Business success story

Beyond the continuum of care

Technology-enabled innovation in healthcare

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Building a culture of innovation: the healthcare journey

Regulatory changes, consumer demands, cost pressures, emerging technologies—facing challenges and opportunity from multiple directions, the healthcare industry is reinventing itself with new delivery models shifting from the traditional hospital-centric focus to decentralized care emphasizing prevention, population health, and providing individuals with the right care in the right place at the right time. The Affordable Care Act accelerated the pace of change by transforming the cost basis of healthcare from a fee-for-service model to a pre-determined allotment for patient care—in essence paying for results not quantity. Now more than ever, the healthcare industry must find new ways to improve quality and outcomes at lower cost.

Envisioning Healthcare 2025, industry leaders see most care occurring in the home, at ambulatory sites, or in urgent-care clinics rather than at large medical centers. Caregiving teams including health coaches, clinicians, and specialists will use digital technologies to leverage their skills to provide the greatest impact. The continuum of care will be supported by an integrated flow of information, and data itself will be aggregated into actionable intelligence supporting patient empowerment, preventive care for at-risk populations, and optimal clinical interventions when needed.

Emerging trends

Policy
- Value-based Medicine
- Integrated Care
- Patient Engagement

Technology
- Telemedicine
- Mobile access to patient data
- Interoperability

Clinical
- New and improved care delivery models
- Personalized treatments plans
- Patients as Healthcare partners

To get to this future state, however, will take a firm foundation of operational efficiency supporting a culture of innovation. This paper will examine some key ways healthcare providers can act now to establish a technology infrastructure that meets the needs of today while enabling—rather than hindering—future advances. We'll focus on three areas of particular promise that also help satisfy the Meaningful Use criteria: telehealth, healthcare education, and population health analytics. Telehealth technologies are breaking barriers of geography to bring high-value health services where they do the most good at the least cost. Innovations in healthcare education, such as simulation training, enable clinicians to build stronger skills faster and at less risk to both patients and themselves. Population healthcare analytics are transforming Big Data into insights on how to keep people healthier so they'll need less critical care. Examples of leading-edge work in each of these areas are provided by the Jump Trading Simulation & Education Center, an incubator on the campus of OSF Saint Francis Medical Center in Peoria, Ill. Jump is a collaboration between OSF HealthCare—which provides acute care, nursing education, home care, and other health-related services for nearly three million people in Illinois and Michigan—and University of Illinois College of Medicine at Peoria (UICOMP). A $50 million, six-story "innovation engine" facility, Jump maintains three areas of focus: education, research, and innovation.

Between the current state of the healthcare industry and the envisioned future lies a roadmap of actionable steps supported by existing and advancing technologies.

Meaningful Use: EHR evolution aims for seamless, patient-centric care

At the turn of the 21st century, medical records existed mostly on paper, accumulating in patient charts the size of telephone books. Doctors, pharmacies, hospitals, and other care providers could not easily share information because the data was not digitized. Then came the rise of electronic records. The first type of these, according to the Office of the National Coordinator for Health Information Technology (ONC)[1], were "electronic medical record" (EMR) systems. EMRs are digital versions of the paper charts in a clinician's office. They allow caregivers to track data over time; easily identify patients due for checkups; check patient status regarding parameters such as vaccinations; and monitor quality of care within the practice. However, the information in EMRs still does not travel easily out of the practice; patient records might need to be printed out and mailed or delivered by hand, making them, in that respect, little better than paper charts.

The next evolutionary step was "electronic health records" (EHRs). These go beyond the clinical data collected in a single practice to include a broad view of patient information. EHRs are designed to share data among providers and with patients themselves—and to move with the patient wherever he or she goes. The vision for EHR systems is to give all caregivers access to up-to-date information supporting seamless coordination of patient-centered care. Pharmacists, for example, can review information about patient allergies and history for faster, more accurate prescriptions. Specialists view lab results to avoid ordering duplicate tests. Patients are empowered to take charge of their own health, and can move smoothly from one care setting to another. As technology evolves, healthcare consumers and their caregivers will be better able to monitor and manage chronic illnesses using real-time alerts, transmission of health data from home to providers, and communication via virtual visits.

That is the EHR vision. The reality is that the technology is evolving in stages. Meaningful Use is a set of objectives that eligible professionals and hospitals must achieve to qualify for the Centers for Medicare & Medicaid Services (CMS) incentive payments for EHRs.[2] Providers must meet—and demonstrate that they have met—a defined number of standards in each of three stages, although they are allowed to select from the standards listed. Stage 1 of Meaningful Use with a deadline of 2014, addressed Data Capture and Sharing—the baseline capabilities on which further progress can be built. Stage 2 covers Advanced Clinical Processes and Stage 3 targets Improved Outcomes. In 2014, CMS delayed the deadlines for Stages 2 and 3 to 2016 and 2017, respectively, with Stage 3 rules still under development.

The CMS also explains how healthcare providers can form Accountable Care Organizations (ACOs), defined as groups of doctors, hospitals, and other healthcare providers who come together voluntarily to give coordinated high quality care to their Medicare patients. According to CMS, an ACO that succeeds both in delivering high-quality care and spending health care dollars more wisely will share in the savings it achieves for the Medicare program.[3] Meaningful Use and ACO qualifications are transformative undertakings that must unfold from cultural changes in the healthcare industry supported by a reliable, flexible, and scalable technology foundation.

Stage 1	Stage 2	Stage 3
2011-2012 Data capture and sharing	**2014** Advance clinical processes	**2016** Improved outcomes
Stage 1: Meaningful use criteria focus on:	**Stage 2: Meaningful use criteria focus on:**	**Stage 3: Meaningful use criteria focus on:**
Electronically capturing health information in a standardized format	More rigorous health information exchange (HIE)	Improving quality, safety, and efficiency, leading to improved health outcomes
Using that information to track key clinical conditions	Increased requirements for e-prescribing and incorporating lab results	Decision support for national high-priority conditions
Communicating that information for care coordination processes	Electronic transmission of patient care summaries across multiple settings	Patient access to self-management tools
Initiating the reporting of clinical quality measures and public health information	More patient-controlled data	Access to comprehensive patient data through patient-centered HIE
Using information to engage patients and their families in their care		Improving population health

[1] Source: http://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference/

[2] Source: Center for Connected Health Policy: http://cchpca.org/meaningful-use

[3] Source: http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ACO/index.html?redirect=/aco

Seamless, secure workflows rely on technology backbone

Look inside any modern healthcare setting and you'll see a range of compute devices. The surgeon sitting at her desk reviewing patient images from a Picture Archiving and Communication System (PACS) uses a high-end workstation backed by imaging systems, a secure distribution network, and a storage- and-retrieval archive. At the hospital patient's bedside sits a workstation or thin client giving clinicians fingertip access to the EMR or EHR system. An emergency-response worker uses a mobile workstation to call up patient records and communicate with hospital personnel. Admission and scheduling; EMR and EHR access; PACS access; point-of care and home healthcare; pharmacy and medication management; billing and insurance claims—all these processes require durable, reliable, purpose-matched solutions that enable health-industry workers to do their respective jobs efficiently. The overall compute infrastructure must deliver fast performance, uptime reliability, seamless connectivity, productivity features, and security. At the back end lie data center servers, storage, and networking—with the evolutionary path leading to Big Data and cloud solutions that optimize the value of data and free information technology from its traditional physical constraints. At the front end, in the hands of healthcare workers, client devices must link seamlessly to backend systems and applications while being easy to use for their intended purpose. Two high-value technologies in healthcare settings are workstations and thin clients. Workstations provide the power and performance needed to work with large patient image and data sets, and to support graphics cards that drive high-end, medical-grade displays. Mobile workstations do all this and also move with caregivers as they travel to point-of-care sites throughout the day. Thin clients and virtualization, meanwhile, keep sensitive information in centralized data centers. With no moving parts or fans, thin clients are ideal for bedside and sterile environments.

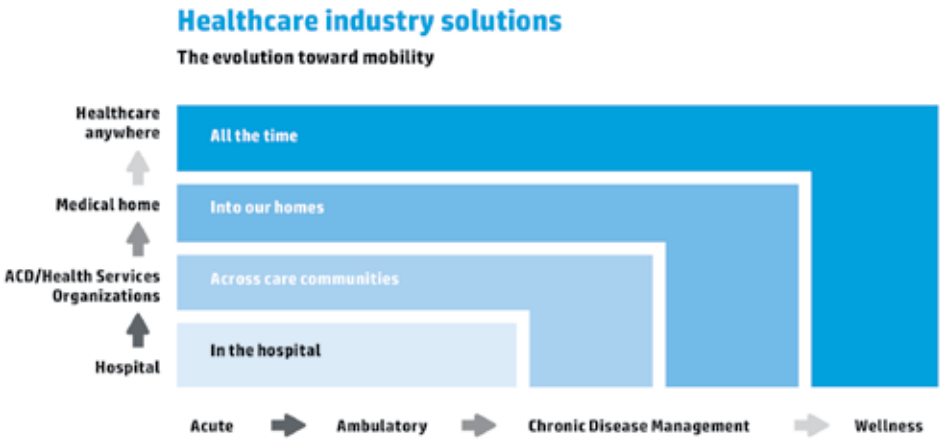
Close-up: HP behind the scenes

At OSF HealthCare, servers and storage from Hewlett Packard Enterprise support an end-to-end infrastructure of secure, reliable operations. In addition, the healthcare system recently replaced approximately 20,000 non-HP devices with HP mobile, desktop, and workstation solutions. Uptime now meets or exceeds the health system's 99.6% requirement, yielding twofold benefits, says Michael Arends, client device services manager for OSF HealthCare: fast patient care and a savings in technical staff time spent supporting the equipment. HP works with OSF HealthCare holistically, he adds, helping with finance and recycling as well as technology. The health system leases all its devices and matches its three-year refresh cycle to the HP three-year warranty.

"I see technology transforming the continuum of care through the passing of key data from the paramedic, to the trauma team, to the nurse at the bedside that might be caring for that patient."

– Dr. John Vozenilek, chief medical officer, Jump Trading Simulation & Education Center

HP Z Workstations are ideal for 3D viewing and modeling, running simulations, and installing and running healthcare software applications. Select skus of HP Workstations* are widely used in PACS environments around the world, including GE Centricity™ Imaging, Siemens, and Carestream. Embedded as integral components of leading PACS, HP Z Workstations deliver the speed, proven performance, reliability, and expandability required for storage and transmission of CT, MRI, and PET imaging results. Mobile HP Z Workstations, meanwhile, are built tough to travel with caregivers as they see patients, review charts, and update medical records. HP Thin Clients provide front-end access to applications for appointment scheduling, pharmacy, discharge and billing, and other administrative functions. Designed for secure, streamlined access to data and resources, these HP solutions assist with the regulatory requirements of Meaningful Use, HIPAA, and other performance standards. They also set the stage for seamless integration of the continuum of care.



Telehealth and population health: breaking barriers of geography

When suffering from a stroke, time loss equals brain loss. Through the telemedicine provider Specialists on Call, Inc. (SOC), OSF HealthCare provides patients suffering from such neurologic emergencies with immediate 24/7/365 access to board-certified, fellowship-trained neurologists. On arrival at the OSF Saint Anthony's emergency room, stroke patients are paired with emergency neurologists within minutes.

On another front, OSF HealthCare is leveraging telehealth technologies to implement e-visits for patients in remote locations who need to see specialists. Leveraging videoconferencing technology and high-resolution cameras, physicians are able to see, communicate with, and care for patients both in the field and at home.

To push the frontiers of healthcare even further, OSF's Jump Trading Simulation & Education Center recently conducted usability research evaluating telehealth devices related to patient risk factors for falls, potentially minimizing the need for emergency room visits.

Telehealth and telemedicine are emerging as cost-effective delivery models for high quality, on-demand care with improved outcomes. The U.S. Health Resources Services Administration (HRSA) defines telehealth as the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration. Technologies include videoconferencing, the Internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications.[4] Telemedicine traditionally has referred more narrowly to remote clinical services, although the terms and technologies are merging. Considered a cost-effective alternative to more traditional face-to-face ways of providing medical care, telemedicine can streamline the flow of communication and help bring the expertise of medical specialists to rural areas and other distant locations. Access to Meaningful Use funds has been instrumental in securing federal grants for initiatives to advance adoption of telemedicine. The federal government has also structured Medicare and Medicaid to make telemedicine more easily reimbursable. For purposes of Medicaid, telemedicine seeks to improve a patient's health by permitting two-way, real-time interactive communication between the patient and the physician or practitioner at the distant site. Common examples of telemedicine include the offer of direct care between a patient in an underserved region and a healthcare professional in another location; provide remote consults with specialists to assist in diagnosis; afford a second opinion, or recommend and explain treatment options; and monitor and transmit data.

Click on image to view OSF HealthCare Telehealth video:

[4] Sources: http://www.healthit.gov/providers-professionals/faqs/what-telehealth-how-telehealth-different-telemedicine

http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Delivery-Systems/Telemedicine.html

[5] Source: http://www.hp.com/sbso/solutions/healthcare/expertise/whitepaper-telemed-into-practice.pdf

Technology is crucial to driving value in healthcare:

- Optimize spend, increase efficiencies, enhance productivity
- Improve access
- Ensure regulatory compliance
- Succeed in a competitive market
- Drive consumer empowerment
- Draw value from information
- Enhance research and development productivity
- Drive quality outcomes

Click on image to view HP Continuum of Care video:

The latter can include transfer of X-ray, MRI, CT scans, and visible-light images. In addition, devices in patient homes may transfer information regarding blood pressure, glucose levels, electrocardiograms, or pacemaker testing to a monitoring station in a clinic, hospital, or physician's office for tracking and interpretation, thereby reducing the need for office visits.[5]

OSF HealthCare is working on all these fronts to develop telehealth services providing patients with easier access to appropriate levels of care. For example, with neuroscientists in increasingly short supply in Illinois, OSF TeleHealth Services is implementing televisits to optimize use of scarce resources while enabling patients to avoid unnecessary travel and transfer. The specialists will be able to control high-resolution video cameras connected to back-end networking technology to see and diagnose patients remotely. This will enable physicians to examine, communicate with, and care for patients both in the field and at home, and accurately prioritize when and where patients need to visit a care facility. "It's a way for us to leverage valuable specialists," says Suzanne Hinderliter, OSF executive director of telehealth. "We're breaking barriers of geography."[6]

Telehealth technologies integrate with advancing EHR systems, PACS, and other healthcare applications to help expand the continuum of care beyond institutional walls. To illustrate an example, Jump collaborated with HP to simulate an emerging scenario:[7] an emergency-care worker loads an accident victim into an ambulance. She's already immobilized the patient's spine and taken her vital signs, and now communicates via computer with the hospital emergency room, where an intake nurse speaks with the EMT while viewing onscreen a live feed of the patient's vital signs as well as video images from a camera mounted inside the ambulance. Both healthcare providers can access the patient's medical history through the EHR system. Data and voice communication flow so seamlessly that by the time the ambulance reaches the hospital, a trauma room has already been prepared. "I see technology transforming the continuum of care through the passing of key data from the paramedic, to the trauma team, to the nurse at the bedside that might be caring for that patient," says Dr. John Vozenilek, an emergency medicine physician, and chief medical officer and vice president of simulation at Jump. Quick, reliable, and secure access to patient images and data streamline communication, enable collaboration, and improve the quality of care.

Close-up: HP behind the scenes
Take a close look at OSF HealthCare's TeleHealth Services—as well as the related innovation research occurring at Jump Simulation & Education Center—and you'll see HP Z Workstation, HP Thin Clients, HP Display Monitors, and HP LCD Interactive Digital Signage Displays. Whether it's bringing the expertise of medical specialists to remote areas or streamlining the data flow between trauma centers and emergency transport vehicles, HP brings reliability, processing power, security, and sophisticated visualization capabilities to 24/7 telehealth environments. HP Z Workstations and Thin Clients with webcam offer two-way video conferencing for consults[8]: physicians may pull up live patient video feed along with patient vitals and medical records to collaborate remotely. HP ZBook Mobile Workstations with DreamColor monitors

6 Source: https://www.osfhealthcare.org/services/telehealth/

7 Source: https://www.youtube.com/watch?v=R7EDx_4BXs4

8 Wireless access point and internet service required. Availability of public wireless access points limited. Broadband use requires separately purchased service contract. Check with provider for coverage and availability in your area.

provide advanced IPS panel technology, which greatly enhances the contrast and viewing angle for improved visualization. In addition, the power of HP Z Workstations enables healthcare organizations to work efficiently with EMR, EHR, PAC, point-of-care, and administrative resources—essential to providing high quality care while optimizing the patient flow from admission to discharge. "All of the HP technologies we use make data accessible to make good decisions about patient care," Dr. Vozenilek says.

Education: Simulation training comes of age with advanced technologies

However sophisticated healthcare technology grows, the system ultimately relies on highly trained professionals exercising their experience, skill, and informed judgment. The culture of innovation in healthcare, therefore, also is changing how caregivers learn.

In the traditional apprenticeship model of healthcare education, clinicians build competency by encountering a varied range of opportunities to observe and practice. However, new approaches are supplanting or supplementing this "learn by doing" tradition, in particular for invasive procedures and high-risk care. Three leading tools have emerged to educate and assess medical trainees: Web-based education, virtual reality (VR), and high-fidelity human patient simulators.[9] Web-based education enables anytime, anywhere access to information on demand. New information can be published rapidly, with high-quality digital photos, movies, and audio augmenting text. Webcasts bring interactive distance learning, and instant messaging enables live virtual discussions. VR, meanwhile, creates computer-generated environments that simulate the physical world. VR simulators are available today for laparoscopic surgery, anatomy dissections, and military medic training. Since VR is highly effective at simulating high-stress situations, medical educators recommend further investigation of its potential for training people for emergency departments or even mass-casualty situations. Finally, the use of high-fidelity manikins—life-size representations of the human body designed to look, sound, and feel to the touch like actual patients—is a form of simulation training that provides a physical experience rather than a computer-generated virtual one. Generations of novice clinicians have learned to give injections by practicing on oranges. Today simulation training is coming of age with an innovative range of increasingly sophisticated tools and applications—fully equipped facilities used for education not treatment, where trainees practice procedures on manikins. Advanced simulators even gather data about what the learner is doing, providing performance maps and logs that enable detailed feedback and help instructors target improvements.

John Farmer/OSF HealthCare

[9] Source: John Vozenilek, MD et al, See One, Do One, Teach One: Advanced Technology in Medical Education, ACAD EMERG MED, Vol. 11, No. 11, 1149-1154.

[10] Source: http://www.ssih.org/About-Simulation

[11] Source: http://www.jumpsimulation.org/education/simulation-education.html

Simulation education provides a bridge between classroom learning and real-life clinical experience, according to the Society for Simulation in Healthcare (SSIH).[10] It allows clinicians to build skills and muscle memory without putting patients at risk, and reduces real-world risks to learners from blades, electrical equipment, and infected needles. Education sessions can be scheduled when convenient and repeated as often as necessary. Learners are free to make and learn from mistakes, without the need for expert intervention to prevent patient harm. Training can be customized to include complex procedures or rare ones that do not afford much practice opportunity. Simulations can be followed by videotape-supported debriefings that allow in-depth analysis and visual cues to areas for improvement. Post-simulation reviews allow learners to reflect on their choices and emotions. Simulation education thus offers learners the opportunity to visually see a procedure completed, practice the procedure in a safe environment, acquire a reliable skill set, and then master the skill through consistent practice.[11]

Meet MegaCode Kelly: Advancing clinician education at lower patient risk

Some of the most advanced simulation training in the world is taking place at the Jump Trading Simulation & Education Center. Jump's $50 million facility features seven distinct simulation areas: an ICU; an operating room and trauma lab; a patient care unit; a virtual reality lab; an anatomical skills lab; a regional transport center, complete with an ambulance and apartment-like setup for simulating rescues; and an innovation lab. Jump employs more than a dozen manikins with names like MegaCode Kelly, SimMom, and Newborn Ann. Physicians, nurses, emergency-services personnel, and other first responders use these resources for training to provide high quality care at lower patient risk. An anesthesiologist gains Continuing Education credits working on SimMan in Jump's virtual operating theater. An Emergency Medical Services (EMS) first responder learns at the regional transport center to assess and care for patients during home rescues and vehicle extractions. There's even simulated bad weather and space for a wrecked car.

In addition to delivering immersive hands-on training, Jump also conducts research to improve training methodologies. In one study, the center compares traditional didactic methods for training residents to insert central lines to simulation-based trainings in which the lines are inserted on manikins; the goal is to maximize clinician competency while reducing patient infections and complications. Other projects include a HealthScholars SmartPump App to improve infusion pump training, simulated skin for wound-stitch training, and simulated cardiac resuscitation.

Have a heart: 3D modeling optimizes surgical training, planning

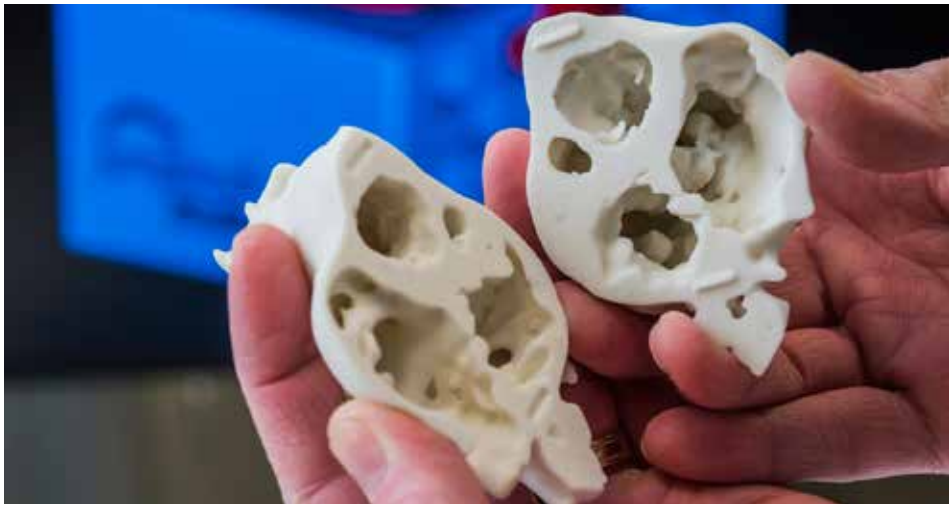
One area of focus is pediatric surgery, where advances in prototyping and modeling are making training simpler and safer. In the past, the first time a surgical resident performed a procedure on an infant or a newborn was often during a real-life surgery. Today, 3D models of the newborn chest and abdomen represent the anatomy of the newborn ribcage so well that trainees can practice suturing and dividing tissues in a very high-fidelity environment.[12] Jump is developing a pediatric surgery training program that will let trainees practice the most common surgeries of newborns on model devices. Jump research also is working to advance the sophistication of these devices, increase access to them, and enhance the data collected by them.

On a related front, Jump teamed up with Dr. Matthew Bramlet to create replica models of children's hearts. Dr. Bramlet is a specialist in congenital cardiac MRI and an assistant professor of pediatrics at the University of Illinois College of Medicine at Peoria. "The beauty of the whole project is that children with complex heart disease may have only half of a heart to work with, so when you're trying to figure out the optimal operation, there's no better way to do so than to actually see the heart and hold it in your hands before attempting the surgery," he writes.[13] Dr. Bramlet also sees opportunities for sharing this information with the world in a library of anatomic models depicting common heart conditions previously viewable only in 2D. "For example, take something as simple as an Atrial Septal Defect (ASD) – something I've read about in textbook after textbook and have seen in thousands of echoes. When we printed out an ASD, and I was able to hold it in my hand, I learned something new."

Close-up: HP behind the scenes

How does Jump create its 3D models? HP Z Workstations are integral to the process. First, MRI imaging is taken of a live human—with an HP Z Workstation embedded into the equipment. The data is then sent to a computer-aided design (CAD) system on HP Z Workstations for 3D rendering. HP Z Workstations combine high performance with maximum reliability, secure data integrity, and easy serviceability. Jump relies on them for the processing and visualization power to view, turn, and manipulate heart images in detail onscreen. Then the CAD data is sent to 3D printers, and when the process is finished one holds in one's hand an exact replica of a human heart.

HP solutions are integral to Jump education activities at every level. Believing in Jump's mission, HP donated everything from workstations and notebook PCs to the high-definition monitors Jump uses to work with CAD files, review simulation videos, and more. In the future, Jump plans to open additional collaborative workspaces bringing currently siloed groups together on its innovation platform powered by HP. Jump classrooms can offer live video feeds from outside experts, such as from the Mayo Clinic Care Network of which OSF HealthCare is a part. A world of possibility opens leveraging HP interactive displays, visualization technologies, and compute power. "HP donated large flat panel touchscreen displays and very robust HP Z Workstations to



Jim Carlson/OSF Saint Francis Medical Center

[12] Source: http://www.jumpsimulation.org/research/current/pediatric-surgery-training.html

[13] Source:http://www.jumpsimulation.org/blog/building-3d-heart-library/

power them with," says Matthew Warrens, executive director of operations at OSF HealthCare Systems/Jump Trading Simulation & Education Center. "It gave us tablet PCs and other equipment that enables us to test new ideas and build the future." HP also offers HP Specialty Z Displays with options including curved screens or interactive virtual-holographic 3D displays.

Evolution of Big Data forges path to predictive and prescriptive analytics

As care models transition from a hospital-centric focus to population health, Big Data analytics becomes a key resource for improving preventive care. A report delivered to the U.S. Congress in August 2012 defines Big Data as "large volumes of high velocity, complex, and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management and analysis of the information." Data analytics, as it grows in maturity, brings the potential to support earlier disease detection; easier and more-effective treatment; better management of individual health; fraud detection; and population-health management. It can help keep people healthier at home so they don't need as much critical care.

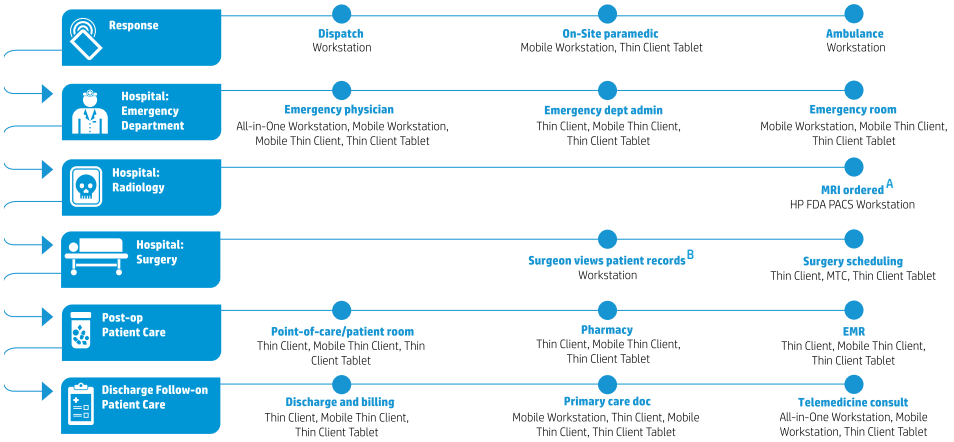
Both Meaningful Use and ACO requirements recognize that harnessing the power of Big Data is an evolutionary process. The Healthcare Information and Management Systems Society (HIMSS) posits a seven-stage electronic medical record (EMR) Adoption Model that scores providers' EMR capabilities from Stage 0 (zero clinical automation; laboratory, pharmacy, and radiology ancillary systems not installed) to Stage 7 (medical records fully electronic and clinical information readily shared with all entities within a clinical network).[14] Few U.S. hospitals have arrived at advanced stages of this journey. Even the most robust electronic health record (EHR) systems do not yet aggregate all the data that is relevant to an individual's health and the potential to improve it through care. According to industry experts speaking at the HIMSS15 conference, EHRs do not necessarily integrate with all the applications within a single hospital, much less with systems used by external providers or applications used by individuals, such as wearable devices. Yet interoperability is imperative to realizing the potential of healthcare analytics. Furthermore, EHR records will provide just of a fraction of the data healthcare providers will want to collect and analyze in real time. Information from socio-economic, environmental, and behavioral health determinants, along with genomic and individual microbiota data, will play a big role.[15]

Healthcare analytics over the next five years will incorporate an expanding ecosystem of data content, from billing and lab data all the way up to real-time, 7x24 biometric monitoring. Health Catalyst, a healthcare data warehousing and analytics company based in Utah, has developed an eight-level Healthcare Analytics Adoption Model that begins with fragmented point solutions at Level 0 and progresses all the way up to Clinical Risk Intervention & Predictive Analytics at Level 7 and Personalized Medicine & Prescriptive Analytics at Level 8.[16] At the forefront of these advances, Jump Trading Simulation & Education Center is developing applications for predictability analytics using population health modeling.

[14] Source: https://app.himssanalytics.org/stagesGraph.asp

[15] Source: John McDaniel, speaker at the 2015 HIMSS Oregon Annual Spring Conference. Keynote address: "Healthcare 2015—Transformation to a New Model of Care." McDaniel is vice president of innovation and technology solutions for The HCI Group, a global health IT firm.

[16] https://www.healthcatalyst.com/healthcare-analytics-adoption-model/
The Healthcare Analytics Adoption Model: A Framework and Roadmap, Health Catalyst, 2013



This diagram depicts the typical HP products that may be utilized during care. From emergency dispatch, to emergency response, triage and admission, to the radiology and surgical departments and finally discharge, billling and follow-on care.

Jump Mission Central creates population health predictability models

In a technology-outfitted meeting room of the Jump Center, researchers stand at a wall of three touchscreen displays. On one, a map shows demographic data of the Illinois region under study. The middle screen displays graphics on population results. The third shows outcomes. The application Jump has created is interactive and animated. Users can touch the interactive display screens to select their desired views. How would a different treatment approach impact outcomes over time? Up pops a 3D graphic that visualizes changing results as the years roll by. How does the scenario change if you drill down into different age groups or geographic regions? The application allows users to manipulate and display data in myriad ways.

This is Jump Mission Central, a collaborative project with HP to create predictability models for population health.[17] As the healthcare industry evolves to personalized medicine and predictive analytics, accurate analysis must incorporate data from community research, pharmacies, genomics, EMR and Health Information Exchange (HIE) systems, real-time 24/7 monitoring, and other sources such as geographical information systems mapping, government reports, and even social networking. These large data sets have to be collected, processed, and transformed into meaningful information that guides decision making. At stake is the quality of care, as well as its cost and outcomes.

Diagram
[A] Workstations for PACS storage and transmission of images.
[B] Surgery records storage.

The disease state Jump chose to study first at Mission Central was diabetes, since it is a big problem for at-risk populations in OSF's area. However, the same approach could apply to other health concerns such as smoking, obesity, heart disease, or environmental factors—all applicable to Meaningful Use criteria. Bringing together clinicians and engineers, Jump Mission Control is processing large data sets and converting them into interactive charts, graphics and displays. That takes massive local processing power and visualization capabilities, which Jump gains from its HP Z Workstations paired with HP large-format interactive signage displays.

"We collect a ton of data on every patient. We know every time they've come for treatment, and every treatment they've had. We know how much it has cost. And then we can write predictability analytics that tell us how much it's going to cost take care of you in the future if no change occurs," Warrens says. "We use census and other data to drill down into geographic locations and look at population sizes—and then view our locations and facilities in relation to the population size. You can slice and dice the data any way you want. To do this, we use HP Z Workstations for processing power, speed, and sophisticated graphics."

[17] http://h20621.www2.hp.com/video-gallery/us/en/products/workstations/4171139130001/osf-population-health-management/video/

The Mission Central diabetes project demonstrated the power of predictive analytics so definitively that Jump showed it to board members to make the business case to invest in more research.

Jump also is working at the data-collection end of the telemedicine spectrum, and developing ways to strengthen communication between patients and healthcare providers. "I never thought my mom would own a tablet and know how to use it; she's 70," Warrens says. "How likely is it that a person at home who's 70 will use a device? We conduct usability studies, human-factor engineering. How well does the technology work? How easy is it? The home monitoring market will be a big piece of keeping people healthy and out of the hospital in the future."

Close-up: HP behind the scenes
The HP Z Workstations coupled with HP interactive signage displays bring local visualization and processing power to Jump researcher fingertips. Not every analytics program requires a massive data center effort. HP Z Workstations powered by Intel® Xeon® or Core™ i7 processors deliver the performance and reliability required for fast-turnaround, iterative queries at a cost-effective and locally empowering distributed level. Public-health officials, data scientists, and informatics professionals can effectively identify critical population cohorts to target for intervention.

In addition, HP brings a full range of Big Data software, services, and hardware enabling organizations to analyze 100% of relevant human information, machine data, and business data to radically improve their processes, interactions and business outcomes. Haven, the HP Big Data platform, is available on-premise or on-demand to transform any type of data—structured and unstructured—into strategic insights. On the personal-device end of the spectrum, HP brings a full range of full-featured, reliable PC and tablet devices that are increasingly becoming part of the healthcare communication scenario even beyond traditional care facilities. A recent survey by Accenture found a growing demand among tech-savvy seniors for access to healthcare information and services from home. HP has been at the forefront of providing enabling technologies. After data analytics has identified populations most in need of preventive care, for example, HP solutions such as tablet PCs can support follow-through patient engagement.

HP advantages in healthcare

- Simplify data security and access
- Simplify access to systems
- Make patient and medical data more accessible
- Assist with HIPAA and other regulatory mandates
- Avoid application abuses
- Improve efficiency
- Simplify life for users
- Improve system-wide workflow
- Compile larger patient data sets
- Reduce total cost of ownership
- Reduce installation costs
- Get secure remote access
- Centralize IT Systems management

HP and healthcare: a history of innovation

For close to half a century, HP has been delivering industry-leading innovations in healthcare information technology. The HP approach to healthcare encompasses three critical areas: care delivery, patient engagement, and population health management. Care-delivery solutions provide transparent, personalized, technology focused at the point of care, wherever that might be, built for the way providers work. Patient-engagement solutions actively engage patients in their healthcare journey with the right tools, at the right point in time, with the right experience, wherever they are. Population health management provides solutions that improve social and economic outcomes.

A broad solution portfolio
With these three critical areas in mind. HP combines expertise in healthcare information technology with an extensive portfolio of products, services, and relationships with certified solution partners.

- **HP Z Workstations**, complemented by **HP digital signage and monitor**s, bring advanced security features, extreme processing power, advanced graphics capabilities, and built-in reliability to run healthcare and analytics applications. In both desktop and mobile systems, HP Z Workstations are designed to reduce overall acoustic output levels, provide extremely efficient heat removal from processors, and simplify servicing and upgrades. HP is an OEM supplier to leading imaging systems from Siemens, GE, and Carestream.
- **HP mobile** devices with advanced security, extended battery life, and touchscreens enable healthcare professionals on the go to access healthcare applications, patient files, and the Internet. And as consumers take more and more charge of their own well-being, HP mobile devices such as tablets combine power with ease of use.

- **HP Thin Clients** enable healthcare professionals to simply log on to a virtual desktop and securely access their user applications. HP single sign-on capabilities—offered in collaboration with HP Partners Caradigm™, HealthCast, and Imprivata OneSign®—provide secure roaming and contact-less smartcard user authentication for fast, flexible access needed to improve system-wide workflow efficiency.
- **HP printing and imaging** products make it easy to scan, copy, print, send and display medical records, prescriptions, and other documents. They also align with security and digital document management solutions to streamline document workflows.
- **HP data storage and retrieval** solutions simplify handling EMR and EHR systems, and support HIPAA regulatory requirements. HP Converged Infrastructure combines storage, servers, and networking to provide an always-on solution critical to healthcare systems. **HP Software as a Service (SaaS) and cloud solutions** help attain the interoperability essential to healthcare of the future.
- **HP software** solutions include HP Exstream, which handles all aspects of document creation and multichannel delivery to consolidate a high-volume explanation of benefit communications and deliver personalized wellness messaging. HP Haven Predictive Analytics dramatically improves performance and enables users to analyze much larger data sets than was previously possible.
- **HP Health & Life Sciences** provide health plan organizations, healthcare providers, public health and human service agencies, local, state, and federal governments, and pharmaceutical firms with products and services, collaborative partner solutions, and consulting. For example, HP has supported the U.S. Centers for Medicare & Medicaid Services since the program's inception more than 40 years ago.
- **HP Labs** drive innovation in analytics, clinical informatics, EHR systems, and decision support systems to improve patient safety, operational efficiency, and the patient and staff experience.
- **HP Support and Services** offer easy financing, free online classes, enhanced service options, and more to all HP customers.

HP solutions can make the EHR transition more affordable by leveraging the American Recovery and Reinvestment Act and the HITECH Act. EHR solutions powered by HP products enable healthcare organizations to enhance patient care, streamline administration, and potentially qualify for reimbursements—all great reasons for making the transition during the funding window.

For more information on HP healthcare solutions, go to:
hp.com/go/healthcare
hp.com/go/wshealthcare
hp.com/go/thin/healthcare
hp.com/go/zworkstations

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