



STAYING AHEAD OF THE HEALTH CARE IT CURVE: HOW CLOUD COMPUTING AND INTELLIGENT SENSOR ASSISTED DEVICES WILL REVOLUTIONIZE HEALTH CARE

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OVERVIEW. Medicine is going through a powerful convergence of social networking, cloud computing, mobile phones, the Internet, wireless sensors and health care reform. This convergence is what makes this moment in health care extremely exciting, but also challenging. Big change is here, ready or not.

Since the passage of the Affordable Care Act (ACA), hospitals, insurers and physicians are more centered on cost control than ever before. The revolution in health care has already started, and this moment for health care IT is all about skating where the puck is going. As the fee-for-service approach becomes a thing of the past, the focus is turning to higher quality, lower cost interventions delivered in a more collaborative environment. With the added motivation to reduce costs, adoption of more efficient digital medical technologies is increasing, and cloud computing is becoming more important than ever.

This white paper examines the trends that make the present ideal for the adoption of cloud computing by the health care industry. It also discusses the problems facing health care today, and how cloud computing is a part of the solution. Finally, it describes 10 ways that cloud computing is revolutionizing health care, and explains how OrthoSensor™ is harnessing the power of intelligent sensor assisted devices and cloud computing to increase patient satisfaction, improve quality and help lower the costs associated with orthopaedic care.

TRENDS THAT MAKE NOW THE PERFECT TIME FOR CLOUD COMPUTING

AFFORDABLE CARE ACT (ACA)

Part of the ACA is the requirement to adopt electronic health records (EHRs). To contain the massive amount of data involved with imaging, wireless biosensors and even DNA sequencing, adoption of cloud computing for complete EHRs is inevitable.

EHRs aren't the only way that the ACA will drive the adoption of cloud computing in medicine. Accountable Care Organizations (ACOs) are also playing a big role in improving patient care pathway helping to move health care away from the fee-for-service approach.

ACCOUNTABLE CARE ORGANIZATIONS (ACOs)

A major initiative of health care reform, ACOs act as delivery systems for coordinated patient care. ACOs are a network of hospitals and physicians that often develop and test ways to provide more efficient, higher quality care. They may focus on reducing duplications in care or unnecessary interventions, but their major goal is to focus on more effective management of chronic illnesses and the prevention of emergency room visits and hospitalizations. While ACOs are still in their infancy, they'll be a valuable part of health care in the near future. In the process of fulfilling their role to provide more efficient health care, ACOs are insisting on collaboration, further driving the health care IT migration to the cloud.

SMARTPHONES

According to the PewResearch Internet Project in their latest update in January 2014, 90% of adults in America have a mobile phone, and 58% own a smartphone. With such high mobile phone adoption rates, Americans are poised to help make history as health care becomes more collaborative and digitized.

SOCIAL NETWORKING

Americans are quick to adopt new social networking services that prove useful to them. A new study from Edison Research, “The Infinite Dial 2014,” provides some insight: Facebook usage in 2014 is about the same as 2013 at 58%, but Snapchat, an image sharing service, is now a leading social networking service with 46% of Americans ages 12 to 24 using the service and 53% of mobile phone users indicating familiarity with the service. Since Americans increasingly use social media and mobile phones as part of their everyday lives, they may be quick to adopt emerging medical technology that relies on sharing information via mobile phones.

WEARABLE AND IMPLANTABLE MEDICAL DEVICES WITH REMOTE MONITORING

With the accelerating usage and availability of wireless sensors in medical devices with remote monitoring, patients are increasingly receiving care outside of traditional medical settings like hospitals or physicians’ offices. Cloud computing is ideal for managing the information from wireless sensors and providing collaborative care. The Food and Drug Administration has broadly defined Medical Device Data Systems (MDDS) as Class 1 medical devices. This broad definition of MDDS can be interpreted to mean any system that stores data from a Medical device becomes an MDDS. Building MDDSs on reliable, secure cloud infrastructures that support HIPAA compliance greatly reduces the amount of complexity and regulatory overhead when connecting medical devices to Electronic Medical Records (EMR) systems.

PLATFORMS FOR SHARING HEALTH INFORMATION

The accelerating digital revolution in medicine is helping to usher in a keen focus on individual health and prevention of illness. Technological giants like Apple, Google and Samsung are already starting to contribute.

Apple’s HealthKit aims to establish a platform for the integration of information from wearable medical devices or other sensor-generated data. HealthKit allows apps to share health and fitness data with the new Health app, as well as with each other.

Google Fit will act as a hub of connectivity for wearable devices that track fitness. Specifically, Google Fit is a service that will enable wearable devices and apps to compare notes on health data.

Samsung has announced several health care initiatives, which will be available in the future. Samsung is working on SAMI (Samsung Architecture for Multimodal Interactions), a cloud-based data platform. Samsung is also developing Simband, a wearable that looks like a watch, and is expected to have sensor abilities that could outpace other wearable medical devices.

Salesforce, a customer management software company and cloud pioneer, joined forces with the electronics manufacturer Philips to allow health care providers, makers of medical devices and insurers to link to the Salesforce health cloud. Salesforce has identified health care as one of six industry verticals to pursue. Salesforce could prove to be an ideal cloud platform for payor and provider COOs and CIOs to embrace as a way to implement secure, custom applications and efficiency enhancing workflows around their core EMR systems. At first, using a system known for Customer Relationship Management (CRM) may seem counter intuitive, but patients, after all, are customers of the health care providers and payers. So it is natural that CRM morphs into PRM.

WebMD launched Healthy Target, a portal that uses an application programming interface (API) to allow users to track biometric data from wearable devices, glucose meters and other trackers.

Microsoft offers HealthVault, a platform for gathering, storing and sharing health records. Users can upload data from compatible devices, such as blood glucose monitors or pedometers. Microsoft also provides the Bing Health & Fitness App, which focuses on wellness with medical reference, a symptom checker, trackers for diet and exercise, and videos of workouts and yoga poses.

With so many big corporations investing in health care solutions, platforms and apps, it’s clear that they too sense the changes coming to health care.

CHALLENGES PLAGUING HEALTH CARE TODAY

Streamlining collaboration among physicians and other healthcare providers is one of the biggest challenges within our current health care system, but it's also one of the easiest fixes with the greatest rewards. Collaboration will bring improved patient outcomes and reduced costs. Another major challenge facing health care today is the outdated model of sick care instead of preventative care. Rather than the current fee-for-service model, which rewards providers for treating illnesses, patients need collaborative, personalized care that centers on wellness. With a focus on the prevention of illness, as well as better management of chronic diseases, patients will thrive, and health care costs will become more efficiently managed.

SOLUTION IS IN THE CLOUD

Jonathan Bush, author of *Where Does It Hurt? An Entrepreneur's Guide to Fixing Health Care*, believes that it will be crucial for doctors to have access to each stream of patient information, allowing them to compare results and optimize operations. Bush writes, "In this sense, successful doctors will be running data laboratories that follow patients everywhere they go, even to competing institutions." Cloud computing is the commodity that will allow this predicted future to become a reality.

Not only will doctors become more equipped to improve patient outcomes, they'll be better positioned to provide care in a more economically appropriate setting. Remote monitoring and cloud computing will change how patients receive care. Eric Topol, M.D., author of *The Creative Destruction of Medicine*, predicts in his book that in the coming years, around 50 to 70 percent of office visits will be replaced with virtual house calls, remote monitoring and digital health records.

Ezekiel J. Emanuel, M.D., in his book *Reinventing American Health Care*, forecasts that by 2020, more than 1,000 acute-care hospitals will close their doors as patients are increasingly treated outside of physicians' offices and hospitals. Health care providers will still be employed, but they will provide care in patient homes, senior centers or other settings. According to Emanuel, hospitals of the future will be more efficient, and they'll focus primarily on patients who need implantation of devices, transplants or intensive care. The cost savings will be dramatic. Emanuel, who served as special advisor for health policy to the director of the White House Office of Management and Budget, forecasts that by 2020, we can expect per capita health care spending to grow at GDP +0%.

TEN WAYS CLOUD COMPUTING IS REVOLUTIONIZING HEALTH CARE

1. CLOUD COMPUTING ALLOWS FOR COLLABORATION AND BETTER PATIENT OUTCOMES.

True collaboration among health care providers and patients is only possible with cloud computing. With collaboration, medical errors are reduced, patient compliance is increased, and doctors are better positioned to prevent illness instead of reacting to sick patients.

2. CLOUD COMPUTING HELPS PROVIDERS BECOME MORE PROACTIVE.

Health care providers are working together with ACOs to harness the power of cloud computing for EHRs and collaborative care. This valuable access to information helps providers and ACOs coordinate their efforts to proactively identify patients who will become sick. This early intervention is designed to not only reduce health care costs but also improve the lives of patients.

3. CLOUD COMPUTING BOOSTS MEDICAL RESEARCH.

With the availability of EHRs, researchers are able study large segments of the population like never before. This big data, which is de-identified, helps decrease the costs of conducting research and will ultimately benefit humanity.

4. CLOUD COMPUTING IS AN EQUALIZING FORCE.

With cloud computing, smaller health care companies, such as ACOs, are able to take advantage of an inexpensive way to store, process and maintain medical information. Such power was once only available to larger companies that could afford the more expensive implementation and maintenance of systems like Epic, Cerner or Meditech.

5. CLOUD COMPUTING SIMPLIFIES HEALTH CARE COMMUNICATIONS.

With the rise of cloud computing, health care providers, patients, insurers and ACOs are collaborating for the first time. While health care companies currently use many different software *languages* with ontologies (structural frameworks used in organizing information), the need for a common software *language*, rather than a proprietary one, will be apparent. This new software *language* is more social and collaborative and will greatly simplify health care communications.

6. CLOUD COMPUTING FREES RESOURCES.

A major advantage of using cloud is that software developers no longer need to deploy hardware infrastructure. They can focus on software solutions without the distraction of operating data centers and networks. Another benefit is that cloud provides the ability to scale infinitely (no lack of resources due to excess demand). The cloud infrastructure is run by experts who have the economies of scale to provide the necessary redundancies with no single points of failure, something that not many organizations can afford to do on their own. In short, the simplicity of cloud frees IT resources, and offers a better solution for management of health care information.

7. CLOUD COMPUTING IMPROVES EFFICIENCY.

The cloud not only provides a way to collaborate, it also offers an efficient solution for storage of huge data sets. If EHRs are truly complete, they must contain access to data-intensive items, such as patient imaging and genome sequencing. Given the sheer volume of information to be stored for just one individual from birth to death, there's no data storage solution that makes sense other than cloud.

8. CLOUD COMPUTING ACCESS IS SECURE AND CAN BE AUDITED.

Physician's practices and hospitals using cloud computing can share data through Application Programming Interfaces (API) to move information around very quickly on the cloud with robust, role-based access control. Collaborating with cloud eliminates the need to fax medical records, or maintain paper records, which can be accessed without an audit trail. With cloud computing, there's an electronic footprint (audit trail) that tracks where and when medical records have been modified or accessed.

9. CLOUD COMPUTING IS INDISPENSIBLE WITH THE RISING USE OF WEARABLE AND IMPLANTABLE MEDICAL DEVICES.

The data from wireless biosensors must be shared and stored, and health care providers must have an organized way to access and respond to that information. Providers receiving information from wearable medical devices are able to prioritize patient needs with the help of software robots that read data, look for key words and prioritize alerts.

10. CLOUD COMPUTING MOST BENEFITS COMPANIES THAT ARE QUICK TO IMPLEMENT.

Health care companies are currently migrating to cloud computing. While the health care industry's move to cloud computing is inevitable, early adopters are positioned to reap the most rewards, gaining a competitive edge and larger market share.

CLOUD COMPUTING IN ACTION

With the power and efficiency of intelligent sensor assisted orthopaedic devices and cloud computing, OrthoSensor™ Inc. is enabling a new category of medicine called Musculoskeletal Digital Health. Its cloud computing package, **VERASENSE™ iQ**, is already helping orthopaedic providers capture and analyze core information that's important for improved patient outcomes and reduced costs. This comprehensive orthopaedic cloud solution, enabled through "smart devices," provides important data for patients, surgeons and hospitals, and can now be utilized at each stage of care for patients having sensor-assisted knee replacement surgery.

PREOPERATIVE DATA COLLECTION

VERASENSE iQ is a cloud-based solution for collecting relevant clinical data from pre-surgery assessments. This HIPAA compliant secure storage of preoperative data helps to ensure more complete EHRs, and facilitates evidence-based outcomes and clinical studies. **VERASENSE iQ** also provides a data registry mechanism for state and national registries or institution-specific registries.

POSTOPERATIVE TRACKING

Using **VERASENSE iQ**, health care providers have a cloud-based solution for collecting surgical results and Patient Reported Outcome Measures (PROMs). This functionality enables the provider to stay "connected" with its patients facilitating enhanced patient satisfaction and service delivery. **VERASENSE iQ** also coordinates with EHRs to provide accurate, trusted data, and assists hospitals with optimizing internal processes in revenue cycle and supply. In addition, **VERASENSE iQ** enables health care providers to align with payor performance requirements like the Physician Quality Reporting System (PQRS).

INTRAOPERATIVE DATA CAPTURE

VERASENSE iQ helps surgeons and hospitals with streamlined collection and coordination of intraoperative data on knee balance and implant position. Simplifying the capture of sensor-enabled surgical data, **VERASENSE iQ** works with the **VERASENSE Knee System**, which features embedded microelectronics that wirelessly transmit visual intraoperative feedback, allowing for evidence-based decisions during surgery. This access to real-time data provides key information on ligament balance, implant placement and performance through a full range of motion.

CLOUD-BASED RESULTS

Connecting sensor-enabled information to the patient, physician and hospital records, **VERASENSE iQ** not only enhances patient care, but also supports hospitals' efforts to manage costs. With this cloud-based solution, hospitals are better equipped to evaluate utilization patterns, reduce outliers of risk and patient-reported outcome measures. Armed with this data, hospitals can identify opportunities and implement strategies to improve best practices.



CONCLUSION

Cloud computing is and will continue to play an essential role in revolutionizing modern health care. Along with wireless biosensors and other new medical devices, mobile phones, social networking and EHRs, cloud computing will also help promote the prevention of illness, the development of more personalized medicine and a reduction in health care costs. Skating where the health care IT puck is going means adopting cloud computing and embracing new platforms for sharing patient information.

ABOUT ORTHOSENSOR. OrthoSensor™ is at the forefront of the convergence of orthopaedics, technology and cloud computing. A leader in the evolution of musculoskeletal digital health, OrthoSensor offers the **VERASENSE™ Knee System**, which was awarded the Gold Application Award at the 2014 Best of Sensors Expo Awards. OrthoSensor also offers a cloud computing solution, **VERASENSE iQ**, which works with the **VERASENSE Knee System** to streamline the capture and coordination of patient, surgery and implant data. Founded in 2006, OrthoSensor has more than 60 employees and has raised more than \$53 million in capital investment.

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