Boston Children's Hospital Computational Health Informatics Program

Boston Children's Hospital
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HARVARD
MEDICAL SCHOOL
DEPARTMENT OF
Biomedical Informatics

ITdotHealth 3:
Getting SMARTer

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Executive Summaries

June 11-12, 2015

SMART®

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GETTING SMARTER

The Boston Children's Hospital Computational Health Informatics Program and the new Harvard Medical School Department of Biomedical Informatics held an invitation-only meeting on developing a national *Health Information Technology Platform* supporting *Substitutable Apps* (loosely, an "App Store for Health") on **June 11-12, 2015**.

Renowned surgeon and writer **Atul Gawande** and U.S. Chief Technology Officer, **DJ Patil**, keynoted.

One hundred leaders from across the health care, technology, and government sectors came together to identify barriers to innovation at the point of care; to unlock how to proceed with an apps-based model; to figure out the key antecedents to ensuring that an app written once will run anywhere; and to spark the community of software developers to innovate on the platform that interfaces with the full spectrum of health system data.

We introduced the idea of a health information technology platform in a 2009 paper in the *New England Journal of Medicine*, "No Small Change for the Health Information Economy," suggesting that electronic medical record systems should look a lot more like an iPhone than they currently do. The iPhone and Android platforms separate the system from the functionality provided by the applications. And the applications are substitutable: a consumer can download a calendar reminder system, reject it, and download another one instead. The consumer is committed to the platform, but the applications compete on value and cost. The platform approach to software design, relying on an application programming interface (API), can be used to create and support an extensible ecosystem of applications and to stimulate a market for competition on value and price.

With a grant of $15 million from HHS, we have developed a model for such a system—the open source and open standards SMART Health IT, described in technical detail here, from which we have learned important lessons about the technical, regulatory, and business implications of this transformative and rapidly evolving trend. Recently, with demonstrated successes of SMART and emergence of the FHIR standard to support EMR and HIT APIs, it has become feasible to expect a national-scale infrastructure based on "substitutable" components to drive down health care technology costs, allow flexibility, support standards evolution, accommodate differences in care workflow, foster competition in the market, and accelerate innovation.

The meeting continued the work begun six years ago at the first ITdotHealth meeting. On the tail end of an historic $48 billion dollar federal investment in HIT, we look forward to leveraging that infrastructure to support a flexible, nimble health system in a state of constant learning and improvement. The extraordinary group of participants at ITdotHealth III "Getting SMARTer" continued to drive the national conversation.

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Key Themes from ITdotHealth 3

OVERVIEW

Since ITdotHealth 2 there has been considerable progress in creating an ecosystem for substitutable apps. This includes the development of various standards with significant efforts underway on additional standards, the creation of an API, the development of dozens of apps and an App Gallery, and progress by both garage-level innovators and major vendors in creating apps and integrating them into EHRs. Participants agree with the vision of write once, run everywhere, but believe a more appropriate short-term goal is write once and have an 80% reach.

To accelerate adoption and maturity, further technological development is required, but there is already a good technological foundation to move forward. Policy and market forces are needed to drive further interoperability, open data, and greater innovation.

Even with the barriers that exist, there is optimism and a strong desire to move forward with what exists today, to begin getting even more real-world in-market experience, and to have rapid iteration cycles to quickly improve the platforms, API, and apps that are in the market. Those in attendance sees integrated, substitutable apps as the future of health care, with the ability to transform how care is delivered, leading to improved safety and outcomes, better care decisions, and lower costs.

CONTEXT

Held on June 11 and 12, 2015 at the Countway Library of Medicine at Harvard Medical School, ITdotHealth 3 brought together many of the leading thinkers in the world of health information technology—and early adopters of SMART on FHIR and substitutable apps—to discuss progress and best practices, barriers, and keys to creating a robust ecosystem for substitutable applications that can impact the delivery of health care at the point of care. A few of the key themes are summarized below and summaries of each session follow.

KEY TAKEAWAYS

THE GOAL: SUBSTITUTABLE APPS WITH UPDATED DATA USED AT THE POINT OF CARE.

In kicking off this meeting, Ken Mandl described the tremendous amounts of data in the world, which flow rapidly. He also discussed how in health care information is still not effectively linked or used at the point of care. He offered a goal for the conference of moving forward with the vision of substitutable apps with updated data that are used by clinicians at the point of care.

Josh Mandel explained how progress is being made in making this vision a reality. Extensive work has taken place by the SMART team in making technical decisions, developing an API, building apps, creating an App Gallery, creating standards, and getting broader support within the developer community. This groundwork is now yielding tangible results as a standard is emerging and is currently at the draft publication stage, there are around 25 apps in the App Gallery, and an entire community is coalescing.

HEALTH SYSTEMS SEE SIGNIFICANT ADVANTAGES IN TODAY'S ELECTRONIC HEALTH RECORDS, BUT ALSO BARRIERS TO INNOVATION.

Major innovative health systems like Mayo Clinic, Geisinger, and Partners are using or moving to major commercial EHR systems. These health systems see benefits from EHRs as the system of record, in guiding and automating workflow, and in storing data. However, they see monolithic EHRs as limiting and hindering innovation. These health systems—and clinicians and innovators in them—see innovation taking place through best-of-breed apps. They have interest in finding ways to link the EHRs and the data in them to apps, creating a seamless experience for clinician users. They also have interest in being able to use apps developed by others and share (or commercialize) the apps and IP they have developed. These health systems are early adopters in getting experience integrating apps with their EHR, developing new internal workflows and external business models, and envisioning what the future could look like.

EHR VENDORS WANT TO SUPPORT CUSTOMERS AND ENABLE INNOVATION, WHILE ALSO RETAINING ORDER AND PREVENTING CHAOS.

Vendors are working to strike a balance. They want to work with, support, and satisfy customers—especially important early adopters—who want the ability to customize their EHR, and to integrate innovative, clinically valuable apps. At the same time, the vendors want to have a scalable business model and want to prevent app clutter. Several of the industry's largest, most forward-thinking vendors are big believers in the general idea of extending their EHR products with APIs, and in particular are supporters of SMART and FHIR, making significant investments and devoting significant resources to SMART on FHIR.

THE RECIPE FOR A PUBLIC API INCLUDES STANDARDS, POLICY, AND COMMITMENT.

HL7 and the Argonaut Project are proceeding in developing standards and accelerating FHIR implementation. HL7 released a first draft standard for FHIR a year ago and the second draft standard is being validated. To date 75 organizations—private sector, academic, and others—have committed to using FHIR profiles and FHIR standards.

Also necessary are policies and rules for what constitutes a public API. For example, is agreement needed on authorization profiles on top of FHIR? And, what are the rules for who is allowed to register clients and join the ecosystem? Decisions on rules and where to draw the line are necessary, along with legal aspects. It is also necessary to realize that there are different contexts in which organizations will use APIs.

Some participants view the current maturity level of FHIR as pre-version 1.0, while others see it as at version 1.0. Regardless, participants were in agreement to rapidly move forward with using it to begin gaining experience, and to have fast iteration paths for rapid improvement.

A GOAL OF FULLY SUBSTITUTABLE APPS THAT ARE PLUG AND PLAY IS PROBABLY UNREALISTIC; 80% REACH IS A MORE REALISTIC GOAL.

Having fully substitutable and integrated apps where innovations can write once and run broadly is seen as an aspirational long-term goal. However, for now, writing once and running 80% of the time is seen as a more realistic ambition for certain orchestrations, which will still require slight modifications by providers.

To facilitate adoption of apps, conference participants see the need for some sort of validation or benchmarking or rating process (with a concerted effort to avoid the word "certification"). The importance of validation depends upon the use of the app, with an integrated app that is embedded in the workflow and recommended treatment decisions needing to be rigorously validated, while apps that provide data to clinicians to help inform decisions might require a lower level of validation.

Welcome & Goals

Ken Mandl, Co-Chair

OVERVIEW

There is abundant data in health care, yet even after billions of dollars have been invested, lack of interoperability means that the data that would be most helpful is often not available at the point of care. An idea to get this data used at the point of care is substitutable apps that are linked with EHRs. Once just an idea, this concept is showing progress. If implemented systematically, this concept could have profound implications in improving the precision of care delivered and in decreasing costs.

CONTEXT

Ken Mandl described the context for information in the world and in health care, explained the history and evolution of SMART, and laid out his personal goals for substitutable apps.

As background, this meeting is the latest in a series of meetings on data and apps in health care, which began in 2006. The first meeting introduced the idea that patients should control their own information, and technology luminary Mitch Kapor first applied the term "data liquidity" to health care. These meetings have all been held at Countway Library of Medicine, the country's second largest medical library, and as of July 1, 2015, the home to the new Department of Biomedical Informatics at Harvard Medical School.

KEY TAKEAWAYS

THERE IS A TREMENDOUS AMOUNT OF INFORMATION IN THE WORLD, WHICH FLOWS RAPIDLY.

Since the first health informatics conference at Harvard Medical School less than 10 years ago, the amount of information in the universe and the use of mobile devices have exploded. Consider that in 2011 when an earthquake occurred in Virginia, those outside of the circle shown at the top of the next column learned about the quake via Twitter before they felt the shockwave. This is very different from the situation in medicine, where new evidence is developed but spreads very slowly, through traditional, archaic means.
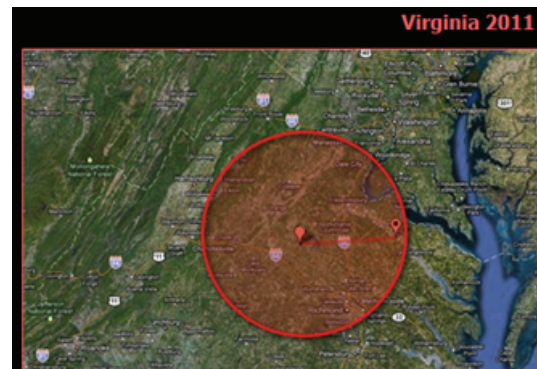
BUT IN HEALTH CARE, INFORMATION IS STILL NOT EFFECTIVELY LINKED OR USED.

Within health care, huge amounts of data exists which isn't put to good use. This includes research, which continues to be transmitted via papers or pdfs, and disparate patient data, which is often not linked. The slide below shows potentially high-value information sources that could be linked to an individual for use in health care, but that often are not linked. This includes both symptomatic information and information about a patient's social context, geography, and more. All of this information, if linked, could result in far more precise treatments as well as predictive medicine.
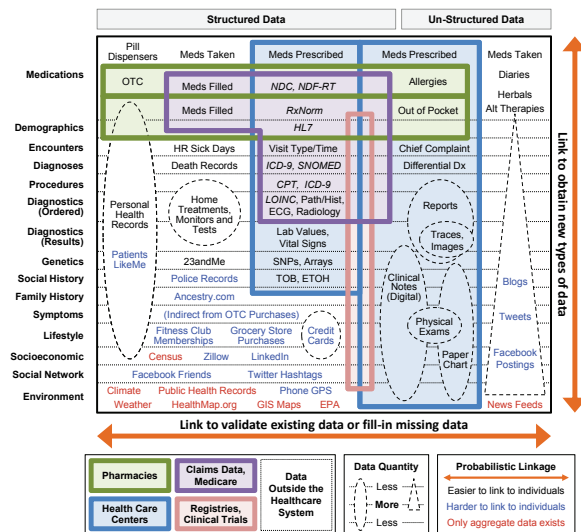
Despite the federal government investing $48 billion in electronic health records and at least another $500 million in private investment, systems are still not interoperable and data doesn't flow.

Needed are systemic changes that enable new evidence to be put into practice immediately at the point of care. Take the situation of Thomas Duncan, the first individual in the United States to be diagnosed with Ebola. Had a different set of information been available to the ER to which Duncan presented at the point of care, with different triage protocols, the situation could have been handled differently. Mandl asked participants to consider:

- What if apps with updated triaged criteria and with integration to the EHR were in use in ERs when patients presented?

- What if apps had informational triggers and geographic knowledge for all high-risk geographies? Since every geography has some risks, apps could be used so that clinicians asked about and checked all significant risks. Since the risks are constantly changing, apps could constantly be updated.

PROGRESS IS BEING MADE IN EMRS BEHAVING LIKE IPHONES, WITH SUBSTITUTABLE APPS.

In December 2009, Ken Mandl and Isaac Kohane wrote No Small Change for the Health Information Ecomony, was published in the *New England Journal of Medicine* in March 2009. At the time the article was written, there were 10,000 iPhone apps; by the time it was published, there were 50,000 apps.

In this article, Mandl and Kohane said that EHRs should behave more like iPhones. They didn't mean that clinicians should use iPhones when delivering care or that EHRs should have mobility. The key feature they envisioned was substitutable applications that would be as easy to add and delete from an EHR as iPhone apps are.

> "The key feature is substitutability of apps, like with an iPhone, that are easy to delete and add."
>
> — KEN MANDL

Following the articulation of that vision much has occurred.

- **API collaboration.** Several organizations (shown at the bottom of the previous column) have committed to working to implement an API at the point of care.

- **Creation of an App Gallery.** This gallery is a place for entities that have developed apps to post them and for others to be exposed to them.

- **Improved design.** Designer Dave McCandless showed how the data from an app can be presented in a far more user friendly way.

- **Creation of a SMART app for three SMART systems.** Showing what is possible, one developer, with one design, in just one week, created a SMART app that is runnable on three SMART platforms.

THE GOAL: SUBSTITUTABLE APPS WITH UPDATED DATA USED AT THE POINT OF CARE.

Ken Mandl stated his personal goals for substitutable apps:

- An app written once will run anywhere in the health care system.

- An innovator can get to the point of care easily. This would mean that in the middle of a crisis, the CDC could develop a new app that could immediately and broadly be used at the point of care.

- An end user can choose from an unrestricted set of (safe and effective) apps.

SMART and Related API Project

Josh Mandel, Co-Chair

OVERVIEW

Extensive work has taken place by the SMART team in making technical decisions, developing an API, building apps, creating an App Gallery, creating standards, and getting broader support within the developer community. This groundwork is now yielding tangible results as a standard is emerging and is currently at the draft publication stage, there are around 25 apps in the App Gallery, and an entire community is coalescing.

CONTEXT

Josh Mandel emphasized that the point of this meeting is not to endorse any particular set of technological decisions but to provide history on the SMART platform and an update on the progress of the App Gallery.

KEY TAKEAWAYS

CREATION OF THE SMART HEALTH IT SPECIFICATIONS, WHICH ARE BASED ENTIRELY ON OPEN STANDARDS, HAS BEEN A MULTI-YEAR COLLABORATIVE JOURNEY.

When Josh was invited to join the SMART team after graduating from medical school in 2010, he knew about building software and had ideas for what health care software could be, but had never heard of HL7 or other industry standards. He had a blank slate and didn't understand what those in the industry viewed as hard problems. He came with the perspective of a developer with thoughts on apps to build and the interface he wished for.

Within about six months, the SMART team had defined an API. It was great and didn't do much, but it exposed enough data so that the team could begin developing some interesting apps itself. Throughout the early development process, the SMART team tried to main a tension between building apps and making sure the APIs were useful. The team was implementing these APIs on top of real health care system. By developing in this way, SMART tried to keep in mind the needs up and down the stack.

At the time, the team looked at specifications and standards in the industry, didn't find them useful, and developed their own in order to make rapid progress. Over time, the SMART team became more confident in its approach and attracted attention from the traditional standards community. In 2011, Josh spoke to an HL7 group explaining why SMART was not using HL7. The key reasons were that the standards weren't open; they cost money; and they were impossible to understand. Surprisingly, this group was receptive to the feedback given.

Based on some of the work that had taken place with SMART and with the evolution of HL7, a spark occurred when HL7 insider Grahame Grieve developed Fast Healthcare Interoperability Resources (FHIR). He understood the pitfalls of working with database systems and took inspiration from consumer-facing APIs. Upon developing FHIR, he offered it back to HL7, requiring that it be free, open, and available in ways that previous standards were not.

The SMART team found FHIR to be very interesting, and started looking at the earliest FHIR specifications. Back in 2012, the SMART team tried building integrations and evaluating them, even though there were very limited resources devoted to FHIR. Dave McCandless advised that to make the developer community care, what is developed for the standards world must be international and community based.

> "We were really encouraged by what we saw in the standards world and in particular when we were looking at one of the earliest pre-release versions of this FHIR specification, we said, 'Here's a bunch of things that work for us.'"
>
> — JOSH MANDEL

The community has been very willing to take feedback, incorporate it, and act on it in a way that has been inspiring. The SMART team has had a great partnership working closely with the FHIR development team inside of HL7.

The outcomes is that the SMART health IT specifications are entirely based on open standards. A standard has been emerging and is currently at a draft publication stage. With these specifications, users will be able to run apps from within their existing EHR and workflow.

AN APP GALLERY HAS BEEN CREATED AND NEW APPS ARE BEING POSTED.

The App Gallery was launched at HIMSS in April. The idea is to open up an environment where anyone who is building a health care app can post it on the web and share it. This includes sharing a screen shot, a video, a description of how the app works, and even a live hosted demo copy that end users can look at and try out. There are currently about 25 apps in the gallery, about half a dozen of which are open sourced apps built by the SMART team.

The growing collection of apps includes a newly posted app called RX Check which involves finding drug prices for patient-facing prescriptions. Another new app calculates eligibility for patients who want to participate in clinical cancer trials. The app figures out automatically which trials a patient might be eligible for based on data in their EHRs.

> "We're seeing a growing set of applications in the gallery. . . . The really exciting thing for me has been to see a growing community of implementers."
>
> — JOSH MANDEL

Going forward, there are many opportunities not just to plug apps into the EHR but to integrate these apps more deeply into the clinical workflow so the apps can make recommendations and help clinicians take clinical action.

Keynote

DJ Patil, U.S. Office of Science & Technology Policy

OVERVIEW

The concept of data science and the emergence of data scientists are permeating society and are coming to health care. Increasingly organizations are becoming data driven, creating data infrastructures and developing processes to acquire, process, and leverage data. Key uses of data are to develop actionable insights and make better decisions.

In health care, a wealth of data exists, but there is a huge gap as data isn't being effectively brought together or acted upon. Needed are open data, system interoperability, and an entire ecosystem that brings people together. The potential is exciting and talented data scientists are being attracting to the field. The opportunity exists to create new data products that transform health care through precision medicine and personalized treatments.

CONTEXT

The country's first ever Chief Data Scientist described the rapid emergence of data science and data scientists, explained the key attributes of data-driven organizations, and discussed the importance of data science in transforming health care.

KEY TAKEAWAYS

WE HAVE ENTERED THE ERA OF THE DATA SCIENTISTS.

This is a remarkable moment. The job title "data scientist" has entered the common lexicon and data scientists are in high demand. There is frequent mention of data scientists in the mainstream and business press, with a *Harvard Business Review* cover story about data science. Data science has received attention surrounding elections, weather forecasts, and sports, and is even featured in movies (i.e. Moneyball). Data science and data scientists have become part of society.

> "Data science is the new black."
>
> — DJ PATIL, QUOTING TIM O'REILLY

FOR ORGANIZATIONS, WHAT MATTERS IS BEING DATA DRIVEN.

While the field of data science is on the rise and hiring data scientists is all the rage, what matters more is becoming a truly data-driven organization. Elements of being a data-driven organization include:

- **Acquiring data.** This involves figuring out where data is and pulling it together. This includes both external data and large amounts of internal data.
- **Processing data.** This is crunching the massive amounts of data to create insights. It is increasingly important to process data quickly and at low cost.
- **Leveraging and using the data.** This is actually putting data to use. It can involve using data to create efficiencies in the business or turning data into new products. The reason to leverage data is to create competitive advantage.

The use of massive amounts of data that are acquired and processed in near real time is changing the scientific method. Previously, an organization would develop a hypothesis and then gather data to confirm or refute it. Now, using data, data scientists can form hypotheses first and then start an investigation. The investigation can be done quickly and can be highly iterative.

Data-driven organizations often find that their meaningful insights come from surprises and from outliers at the margins.

DATA SCIENTISTS MUST FOCUS ON DECISIONS AND ACTION, AND TURNING DATA INTO PRODUCTS.

Previously the use analysis of data was commonly termed "business intelligence." But a more apt term is "decision science." That's because the key action of data scientists is not "intelligence" but rather using that intelligence to make decisions and take action. (Thinking of data scientists as focused on decision science instead of business intelligence is analogous to thinking of people in IT as "technologists" as opposed to "in IT.")

Consider the role of Dr. Spock, from the television show Star Trek. Spock was the right hand of the CEO (Captain Kirk). Spock was located on the bridge, right next to the CEO, because he had earned the right to be there. He was involved in making all key decisions.

In focusing on decisions and actions, data scientists need relevant tools. When people think of data-based tools, they most commonly think of dashboards. Dashboards can be pretty, 3D, with lots of data, but they are not actionable and don't say what to do. Data scientists think about what action they want a person to take, what they want a person to think about, and how they want them to feel. This means going beyond the data to digesting the key takeaways from the data.

Also, it is important that data scientists and data-driven organizations not become so focused on data that they follow it blindly and drive off a cliff. Humans have experiences, wisdom, and intuition. The value of data is to refine that intuition to make even better decisions.

> "What we use data for is to develop additional intuition."
>
> — DJ PATIL

Along with making decisions, other important ways to use data are:

- **Fraud security.** Fraud detection and security is an area where data scientists can produce a tremendous lift.

- **Turning data into products.** This is an area where a huge amount of innovation is taking place, particularly in the areas of wearables and sensors embedded in products, ranging from homes to jet engines.

> "A data product is a product that facilitates an end goal through the use of data."
>
> — DJ PATIL

In order to derive value from data, organizations need to have a robust underlying data infrastructure which includes a data warehouse, systems, and tools. There is not just one tool or vendor that addresses all needs; organizations need an entire toolbox and suite of tools. And, organizations need to realize that technologies will change rapidly and have to be replaced.

BETTER USE OF DATA HAS HUGE POTENTIAL FOR HEALTH CARE.

There is tremendous excitement about the potential for data in the health care industry, and many of the most prominent data scientists are flocking to health care. They see that health care is data rich, but there is a huge gap in how data is being put to use. Putting data to use and building data products in health care, as in other industries, must follow "an arc of progression" and a constant evolution. Patil believes that with iteration a major transformation in health care can occur in three years. Key elements of this transformation must include:

- **Data operability.** The data within organizations (companies and the government) must be operable, so it can be accessed

and used. Within the government, there are 130,000 datasets on data.gov and the President has signed an executive order requiring that all government data be open and machine readable. Over 8 million users access this data in a year. Data operability happens because of phenomenal data engineering.

- **System interoperability.** For data to have value in the health care system, it is not enough for one actor to aggregate its data and make it accessible; all parties must be able to exchange and access data. Consumers using Facebook or Twitter or LinkedIn or Amazon can be on one site, click on another application, and go there seamlessly. (Amazon CEO Jeff Bezos famously mandated that all Amazon systems need to be fully interoperable.) Despite huge investment in health care systems, they are far from interoperable and health care is a broken user experience.

- **Ecosystem development.** An entire ecosystem is needed that brings everything together, allowing iteration and producing an interoperable, seamless user experience.

- **Creating products with superpowers.** A superpower is a product attribute that is so compelling that if taken away it is dearly missed. Take for example, the superpower provided through the connectivity of a cell phone. People realize that this is a critical superpower if they lose their cell phone. Health care must take the data that exists and develop data products with superpowers that providers and patients can't do without. When products have superpowers, people love them. Keys to building products that people love are consistency, trust, clarity, and transparency. Great products also have compassion.

In thinking about a Maslow's hierarchy for health care data products and apps, a hierarchy is:

— The site or app is **up and accessible**

— It is **bug free**

— The **functionality** is correct

— The **features** are correct and work as expected

— The site or app provides **user delight**

In particular, the Administration is focused on using data for precision medicine, which will use data in the next generation of research and care.

> "Our mission statement for precision medicine is to enable a new era of medicine through research, technology, and policies that empowers patients, researchers, and providers to work together toward development of individualized treatments."
>
> — DJ PATIL

DISCUSSION

Following DJ Patil's presentation, participants asked questions and offered comments. Highlights include:

- **Emergence of applications.** There are many use cases that apps can address and Patil sees plenty of room for large numbers of health care apps. Producing them will require a community effort.

- **Increasing adoption.** At this meeting, there is tremendous knowledge of and enthusiasm for use of technology and apps. But those in attendance represent a very small percentage of the 750,000 doctors in the country, most of whom know nothing about integrating health care apps with EHRs. Thought needs to be given to how to accelerate dissemination and adoption, as well as exposure to medical school students.

- **Overcoming privacy issues.** The focus on complying with HIPAA is so great that it is difficult to access data, which is a barrier to interoperability. Policy changes are needed.

- **Mandating EHR openness and data portability.** One participant argued that the federal government needs to mandate that EHR vendors make the data inside EHRs available.

- **Meaningful use has insulated legacy technology.** A participant said that the provision of government financing for EHRs, while well intentioned, will result in perpetuating legacy vendors and legacy infrastructures, which hurts innovation and data portability.

- **The patient is missing from the conversation.** A participant said that despite claims of making the health care system more patient centric, patients are missing from most discussions about patient-centered health care or consumer-centered health care. Patients need to be more involved.

- **Interoperability of knowledge.** Beyond just making data interoperable what needs to occur is to make actionable knowledge interoperable so that providers can make better decisions.

- **Innovation at the point of care requires platforms and policies.** In Patil's view, to bring innovations to the point of care requires platforms that make it possible. What these platforms and technologies are is not yet known, but ultimately data is not going to reside in EHRs; it is going to reside somewhere outside of EHRs.

- **Combining and matching data.** With health data being stored in multiple sources, like through wearables, EHRs will represent only a portion of all health data. This magnifies the challenge and importance of combining and matching data.

Innovation: Getting to the Point of Care

Ricky Bloomfield, Duke (Moderator)

Trent Heywood, BCBSA

Tom Krohn, Eli Lilly/Trial Reach

Sims Preston, Polyglot

Mike Pritts, Surescripts

OVERVIEW

Across the health care system technological innovation is taking place. Payers, researchers, and entrepreneurs are developing new applications that use data at the point of care (which is not always the bedside, but may be at a pharmacy or in the community) to improve the health of populations. But a major challenge is implementing and scaling the innovations that are developed. This has been a barrier as each new app has to go through a slow, painful, and expensive integration and implementation process in every situation where it is implemented. SMART on FHIR is helping change this by enabling apps to be integrated with multiple systems quickly and inexpensively.

CONTEXT

The panelists and moderator, representing payers, researchers, providers, and a startup, shared their perspectives and experiences on HIT innovations they have taken into the real world at the point of care. Panelists described how their use of technology works and the value of SMART on FHIR to ease and accelerate the adoption of new applications.

KEY TAKEAWAYS

A GOAL IN HEALTH CARE IS TO ACHIEVE STANDARDS FLUENCY.

Ricky Bloomfield summarized the state of HIT today as being given a standardized language and implementing it, with some issues and inconsistencies. The goal now is to achieve standards fluency, and the best way to do so is to use standards in the real world at the point of care. In Bloomfield's experience, this is what has happened at Duke. Duke implemented SMART FHIR standards on top of its Epic EHR.

INNOVATIONS ARE USING DATA AT THE COMMUNITY LEVEL.

When the Blues, with 106 million members across the country, think of point of care they think not of the bedside, but of care in the community and community health management. The Blues are using technology to look at the number of patients in a particular zip code with a particular disease or condition, such as hypertension. This provides neighborhood-level information that Blues plans can use to better manage the health of populations and to most effectively allocate local resources. This type of data can be used to determine local priorities and decide on the most appropriate community interventions. In addition, patient medical information can be matched with social and behavioral information, such as data on living conditions or data on nutritional behavioral patterns from grocery store bar scan data.

> "When we're looking at point of care we're not necessarily talking about at the bedside. . . . We are focused on innovations outside of the four walls of the clinical setting."
>
> — TRENT HAYWOOD

The Blues are particularly focused on four use cases:

1. **Key accounts.** Several key accounts of Blues plans want to see data about their individual employees across a geographic area to make determinations about resources and allocation of resources.

2. **Targeted populations.** As the Blues make decisions about case managers and disease managers, they want to be able to see more data.

3. **Partnerships.** As the Blues enter into public and private partnerships, they want data to determine the type of infrastructure and programs required.

4. **Community needs assessments.** As part of the ACA, payers must do community needs assessments to understand the role of the health system. This is particularly important since 80% of health outcomes are not related to genetics or clinicians, but are often based on community issues.

TRIAL REACH IS USING TECHNOLOGY TO SIMPLIFY HOW PATIENTS CONNECT TO CLINICAL TRIALS, INCLUDING AT THE POINT OF CARE.

For most patients clinical trials are a last choice at the end of their journey. But for many patients—particularly those with rare diseases or cancer—trials may be their best option. Patients are actively looking for appropriate studies in which to participate, with 112 million page views per month of clinicaltrials.gov, almost half of which are by patients or their caregivers. The challenge is connecting with the right research. Every study expresses itself differently and it is very difficult for patients to find studies that might be right for them.

Trial Reach is focused on simplifying how patients connect to trials, which includes making the language around trials easier for patients to understand. Trial Reach brings normalization and coding to trials. While clinical practice and EHRs are coded, the world of research has been non-coded. Trial Reach does rich, normalized coding of clinical trial information, therapeutic area by therapeutic area, starting with diabetes (Alzheimer's is next). Trial Reach exposes information to the public in an open API or through widgets or different modalities. By using SMART on FHIR, with consistent codes and representation, there is a possibility for matching.

Clinical Trials to Point-of-Care
Where research participation is a treatment option
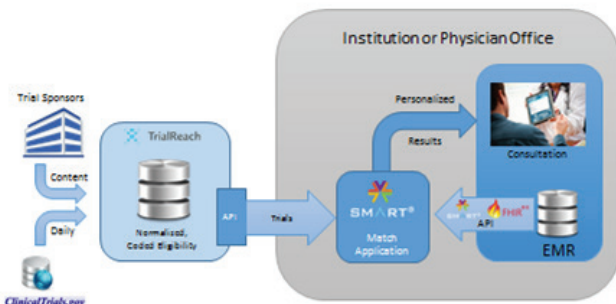
Providers often try to help patients learn about and access appropriate clinical trials. For example, currently, Indiana University Cancer Center has 19 nurses who look through clinical study protocols in PDF form to try to figure out if patients would match; Trial Reach is trying to bring that to scale. One illustration is that

Trial Reach is working with HCA so that as patients with breast cancer flow through the institution, nurse navigators who have access to Trial Reach help patients understand options for treatment, which may include a clinical trial.

Trial Reach's goal is that in one year all clinical studies that are actively recruiting in the United States and the United Kingdom will be structured, available, and normalized through Trial Reach's method.

> "Innovation has helped bridge clinical trials into the point of care as an option for those who may need it."
> — TOM KROHN

MEDUCATION IS AN APP THAT IMPROVES MEDICATION ADHERENCE AND COMPLIANCE BY MAKING MEDICATION INSTRUCTIONS EASIER TO UNDERSTAND.

Polyglot is the poster child for what SMART and FHIR can do for a start-up. Developed based on support from the NIH, Polyglot developed an app called Meducation that makes medication instructions easier to understand. Meducation provides information in multiple formats (written and video), in multiple languages. The content is tailored to the individual patient, based on their unique dosing and instructions.

NIH-funded tech provides
Clear medication instructions in patient's language

The individualization of the instructions is what makes integration with the EMR essential, as Meducation has to process the data in the EMR that is unique to each patient. This issue of integration has been the key challenge for the company over the past few years because each integration is a unique, one-off undertaking which is long, slow, difficult, and not replicable. There is often not an API and Polyglot often lacks access to the database schema.

SMART on FHIR is the opposite. The APIs are fantastic and easy to understand and use because of how well the data is organized. The benefit is rapid integration and rapid deployment, in what is truly plug and play. Once Polyglot integrates with one SMART on

FHIR-enabled system, it can integrate with any other SMART on FHIR-enabled system. In contrast to traditional integrations that take days or weeks, the first SMART on FHIR integration took 16 hours, an integration with Epic took 4 hours, and an integration with Cerner took 30 minutes.

> "The one benefit that is most important is that application developers are going to be able to spend their time on innovation and not integration."
>
> — SIMS PRESTON

SURESCRIPTS WANTS PRESCRIPTION INFORMATION TO EASILY FLOW FROM AND TO ENDPOINTS.

Last year Surescripts processed over 6.5 billion clinical transactions, a massive number. This volume of transactions shows that e-prescribing has become standard, though it took over 10 years to achieve this adoption. Surescripts' success depends upon endpoints having easy access to Surescripts' information. But moving this amount of data can be painful and costly, and getting in every organization's development queue can take considerable time.

> "Our success is really dependent on these endpoints."
>
> — MIKE PRITTS

This is where SMART and SMART on FHIR can come in by enabling Surescripts to work with partners at the points of care to take content, deliver it easily, and provide it in a useful fashion. Surescripts has invested in two applications that deliver important content to endpoints: 1) medication management adherence; and 2) electronic prior authorization approval.

With medication management adherence, content from a patient's medication history is made available at the point of care for medication adherence. With the prior authorization app, the physician is enabled through SMART and is notified that prior authorization is required. Instead of slow manual processes, the physician can say they want to execute prior authorization. Information is transmitted to the insurance carrier and questions are sent to the clinician at the point of care, and the authorization code can be given electronically at that moment, which flows electronically to the pharmacy.

> "We are a really big fan and a supporter of endpoint-enabling components like SMART and FHIR that really make it easy to plug the data into."
>
> — MIKE PRITTS

DISCUSSION

Participants asked questions of the panelists and offered comments about technology at the point of care.

- **Rethinking the point of care.** Maybe the point of care is at home or in the community. By rethinking the point of care, systems can be designed that learn from everybody and every interaction and that better enable patients and caregivers to participate in the care process.

- **Enhance the experience.** Technology often interferes with and detracts from the experience between clinicians and patients. Solutions include building tools and interfaces that facilitate these conversations. The panelists agreed that they are all focused on using technology to enhance the patient experience.

- **SMART on FHIR with Epic at Duke.** Duke previously had a homegrown EHR and decided to replace it with Epic, but wanted to preserve the ability to innovate. So, Duke used existing APIs that were available and built on a FHIR layer on top.

- **No change required for interface at point of care.** Sims Preston explained that the interface for Meducation is consistent across all integrations and is covered as part of the same training for all customers. Mike Pritts said that after providers and endpoints make an investment in infrastructure, apps or data using SMART on FHIR just "ride the existing set of rails."

- **Accessing a patient's true med list.** A question was raised about how close we are to being able to access a patient's true med list. Mike Pritts said, "Not that far." Tremendous progress has been made in sharing information by providers that own this data. Information is widely available on when a prescription was written and whether it was dispensed or not. Another step will be when consumers can have access to this information. The current barrier is privacy, but progress is slowly being made.

- **Listen to the customer.** With clinical trials, there is a tremendous amount of information available, but when Eli Lilly and other pharmaceutical partners listened to customers they heard individuals saying that they couldn't figure out the clinical trial information that was available or if they were eligible. The problem was the sponsors of trials and the system. The trigger for the Trial Reach solution was listening to customers.

Health System Leaders Reshaping the HIT Façade

Ken Mandl, Co-Chair (Moderator)
Alistair Erskine, Geisinger
Jim Jiris, HCA
Shawn Murphy, Partners Healthcare
Christopher Ross, Mayo Clinic

OVERVIEW

Major, innovative health systems are moving from homegrown EHR systems to major commercial systems. In doing so, they see benefits from EHRs in automation, being the system of record, guiding workflow, and storing data. However, they see monolithic EHRs as hindering innovation. These health systems—and the clinicians and innovators in them—see innovation taking place through apps. They have interest in finding ways to link apps with the EHR. They also have interest in being able to use apps developed by others and share (or commercialize) the apps and IP they have developed.

Views differ on whether the long-term result will be big EHRs linked to a series of apps, or whether multiple apps will essentially grow to become a better version of an EHR. In the short term, there is significant interest in FHIR as a way to link apps to the EHR, and there is a desire to create an ecosystem that enables "app madness" with the creation of numerous health care applications that clinicians and researchers can pick and choose from.

CONTEXT

This panel involved representatives from some of the most important, most innovative health systems in the country. They shared their perspectives on the EHRs they are using and discussed how developing and integrating apps fit into their vision and plans.

KEY TAKEAWAYS

PARTNERS HEALTHCARE HAS A COMMON PROBLEM, AND ENVISIONS A FUTURISTIC DISTRIBUTED SYSTEM BASED ON APPS AND MULTIPLE DATA SOURCES.

Shawn Murphy described the situation at Partners, which is similar to that experienced by many other health systems. Partners had a custom-built EMR, but has now adopted Epic. However, the EPIC EMR is not the vision that clinicians and researchers have for what an EMR should be.

Their vision is that clinicians see a patient and use the EMR to collect data. But just the data in the EMR isn't adequate. Clinicians at Massachusetts General Hospital want large amounts of data to perform a precision medicine algorithm to understand the patient—which is not on Epic's roadmap. Clinicians want multiple sources of data, including data from a data warehouse with profiles of similar patients, as well as data from Twitter feeds, personal health devices, data from the EMR, and more. Clinicians also want applications that enable data to be presented and manipulated in certain ways. Clinician innovators want to have control of their intellectual property and want to be part of an ecosystem that allows a free trade of their work. It is difficult to imagine how this will happen in a monolithic EMR.

The SMART system using FHIR interfaces enables serving data out of not just the EMR but also other important data sources. This gives freedom in building applications that can be presented into the workflow of an EMR. This is evolution in action from a monolithic system to one with applications and innovations. If this works as envisioned, data sources will be distributed and applications will come together to essentially make an EMR, which will complement current EMRs with a distributed system based on apps.

MAYO IS EMBARKING UPON MULTIPLE STRATEGIES, INCLUDING CREATION OF AN API LAYER, WITH FHIR PLAYING A KEY ROLE.

Mayo Clinic has had a sustainability problem which has blocked innovation, based on the inability to transverse boundaries between the worlds of automation (where technology is being used to enable physical activities) and digitization (where data is used to create synthetic types of products and services).

Mayo is moving from a series of EHRs to Epic, while also building a large data enterprise, and is creating multiple consumer-facing mobile applications. Mayo's strategy includes:

- **Getting the systems of record right**, which is largely the work of the EHR, which involves managing workflow and transactional data in a consistent, efficient, safe, reliable, scalable way, while also generating data for other kinds of purposes.

- **A unified data platform** which involves building a series of data containers for both big data and transactional data to manage activities across the boundaries of automation and digitization.

- **Creation of an API layer** to reach upwards and outwards. This is where FHIR lives. Mayo is thinking of FHIR as:

  — *Canonical FHIR*. This is the standard form of FHIR to be used at Mayo which generally complies with national standards.

  — *FHIR prime*. This is extensions of FHIR specific to Mayo.

  — *Un-FHIR*. These are things that Mayo is trying to do where the FHIR standards are not quite there yet.

Mayo is also focused on growing its practice by using distributable knowledge to impact care. Today, Mayo treats about 1.5 million patients per year but impacts patient care for about 40 million patients through relationships with 35 health systems that consume digital products from Mayo. Mayo's goal is to impact care for 200 million patients per year, not through brick-and-mortar acquisitions, but through extension of digital products.

GEISINGER IS USING AN APP IN MULTIPLE EHRS WITHOUT HAVING TO CHANGING THE CODE.

Geisinger was the third Epic client in the country and has used Epic for almost 20 years. Epic has been a great tool for Geisinger, helping this health system reengineer its processes, decrease unjustified variation in care, and deliver great results. At times, Geisinger found it necessary to build its own software around Eric and to configure and customize Epic to meet its needs. However, Geisinger was unable to share its innovations with other Epic clients or other EHR users. Also, apps had to run on their own implemented alongside the EHR.

> "We had all this great stuff that was locked behind our system."
>
> — ALISTAIR ERSKINE

Then, Geisinger learned about SMART and FHIR. By using SMART and FHIR, Geisinger was able to embed its rheumatology app as part of a Cerner EHR, which was seamlessly embedded in the workflow. This integration took place with 800 hours of work, at a cost of $17,000, and was able to work across multiple EHRs.

FROM HCA'S PERSPECTIVE, THE TIME IS NOW.

HCA, with 170 hospitals and surgical clinics, has been on a journey over the last five years in implementing the Meditech EHR in order to comply with meaningful use. It has been an arduous process, resulting in extremely frustrated clinicians. However, the meaningful use goose has laid a golden egg—which is data. From data comes knowledge and wisdom that can be applied, and applied knowledge is the key. The SMART on FHIR platform is a welcome ecosystem about which HCA is excited, in combination with technology for the front end and analytics for the back end. It is HCA's hope that eventually the organization will use apps that others develop, and doctors will find themselves in the position of choosing between the best apps on the market.

DISCUSSION

- **Take over EHRs or coexist?** There was debate regarding whether the general use of multiple apps would take over from the EHR or would coexist with the EHR. Shawn Murphy could see a confederation of apps taking over and essentially becoming the EHR, but others, such as Alistair Erskine, were not so sure. Erskine believes it is unlikely that apps will take over as the system of record or the automated workflow, as this is what EHRs do well. He sees apps coexisting with EHRs and is hopeful of innovation madness to spur rampant app development. Murphy advised not to constrain one's vision by the present reality, because the reality can change tremendously in a very short time.

- **App requirements.** Participants see key needs for apps as authorization (security for who can access an app) and linking patients so that data is shared. Chris Ross believes that health systems will want to provide strong architectural governance so that innovators will turn to the system's API layer instead of trying to do their own thing. Erskine sees some type of rating by users about factors such as safety and ability to integrate. Erskine favors innovation madness with innovation control.

- **Degree of app/EHR integration.** Panelists can envision some apps that are almost completely independent of the EHR, some apps that are dependent on data in the EHR, and other apps that are closely threaded with the EHR.

- **Unique patient identifier.** One participant argued that with health systems wanting to pull together data from multiple sources, the time has come to face the issue of the unique patient identifier.

- **FDA regulation of apps.** The FDA has its hands full regulating food and drugs, and realizes that regulating apps is very, very difficult. The FDA has not abdicated its role in regulating apps, but for now is mainly looking at apps that are devices or apps that control devices, and is taking a step back from regulating other types of apps. One participant commented that when developing an app it is important to make sure the app is not classified as a device.

- **Commercializing the IP.** These health systems believe that the market discipline that comes with a business model that commercializes IP will result in better products than merely giving the IP away. As a result, these organizations all have some interest in commercializing the IP that is developed. A barrier is that Epic prohibits commercializing any program extensions that extend Epic; this is a problem that must be addressed.

HIT Vendors Extending EHR Products with APIs

Josh Mandel, Boston's Children Hospital (Moderator)

Jitin Asnaani, CommonWell

Janet Campbell, Epic

David McCallie, Cerner

Todd Rothenhaus, athenahealth

OVERVIEW

HIT vendors understand the desire of providers to innovate, are partnering with health systems to assist with innovation, and are supporters of FHIR to extend their products and to allow third-party developers to plug in. At this same time, however, these vendors advised caution on multiple topics including the current hype surrounding FHIR, app clutter, certification of apps, governance, and the legal framework.

CONTEXT

This panel consisted of HIT vendors and the director of a not-for-profit focused on data sharing that described the situation vendors face in enabling their EHRs to work with innovative apps.

KEY TAKEAWAYS

EPIC IS NOT A CLOSED SYSTEM, HELPS ENABLE INNOVATION, AND SUPPORTS FHIR.

Janet Campbell said an inaccurate narrative exists that Epic is a closed system. She believes this narrative is perpetuated by those who don't use Epic or by vendors that want their product built into or resold by Epic. In fact, Epic's customers are incredibly innovative and demanding. Many are developing on top of the EHR, and Epic is providing the tools and training to do so—and has been doing so for some time.

Related to FHIR, Campbell shared one thing she is excited about, one thing she is worried about, and one recommendation.

- **Excited about:** The excellent documentation that has been done takes something that many in the industry are doing and does it in a standard way. The result is that efforts to integrate can be done once and should then be much smoother and faster.

- **Worried about:** All the hype around FHIR is putting too many responsibilities onto one standard, believing that FHIR will solve all problems. The industry and players in it need to be careful to direct efforts to those places where FHIR makes the most sense.

- **Recommendation:** There needs to be focus on the "pragmatic glue," which are the things that can help bring FHIR applications to the doctor at the point of care. The keys to this glue aren't about the standards, but are about things such as authentication, performance, and substitutability.

CERNER BELIEVES THAT FHIR APIS CAN TRANSFORM THE INDUSTRY.

Cerner is a big believer in SMART on FHIR. The company has been demoing it for a few years at HIMSS and now has a dedicated development team working on it. In terms of where things are headed, Cerner's David McCallie believes that FHIR, more than SMART, is the big thing.

> "The big thing here is actually FHIR, right? SMART is totally cool and a way to prove the value of FHIR. FHIR is what's going to make our industry different in the long run."
>
> — DAVID MCCALLIE

McCallie believes that the SMART plug-in model is one kind of orchestration for how to use FHIR services and FHIR APIs. The challenge is going to be quickly figuring out additional orchestrations to agree on as a communication so as not to just have synchronous SMART apps. Today's synchronous SMART apps are a good start but are just the tip of the iceberg for what can be done with FHIR APIs. For example, there needs to be an orchestration for asynchronous launching of apps so the rules system

inside the EHR can actually bring the app to the clinician's attention. There needs to be an orchestration that allows the app provider to negotiate silently with the EHR in the background to determine whether the remote app is actually relevant to the physician's workflow, and if not, to just stay out of the way. And, perhaps the most important orchestration that is needed is an orchestration to put smartphone apps in consumers' hands allowing consumers to authenticate against their portal account and fetch data into their smartphone app.

The vendor community—including Cerner, Epic, Allscripts, and athenahealth—are happy to be putting money into the process of speeding up FHIR development through the Argonaut Project.

Two of McCallie's concerns are:

- **App clutter.** With numerous apps being developed, vendors will face a challenge in figuring out which ones to support.

- **Dealing with the 80/20 rule.** FHIR's mantra is a rule where the specification covers 80% of the core services and leaves 20% to extensions. The fear is that no single app will be 100% satisfied with the 80% that is covered by FHIR, which would mean that every app would require some customization, creating complexities for the vendor community.

ATHENAHEALTH IS A PLATFORM, HAS AN OPEN API, AND ENABLES APPS TO OPERATE ON THIS PLATFORM.

athenahealth makes cloud-based software that is used in thousands of practices by about 63,000 providers who care for 40-50 million patients. A few years ago, athena began to think of its software as a platform and has developed sub-specification API layers inside of its software so its modules can talk to one another.

A few years ago the company launched a project called More Disruption Please (MDP), which is an open API. There are now 30-40 companies that have developed apps to run on athena software. If down the road users were using applications tethered to athena but weren't using the core system, athena would still probably view this as a success, as MDP would have provided a platform for innovation. athena has participated in FHIR, is excited by it, and sees it as a great alternative to hand-crafted interfaces.

COMMONWELL IS TRYING TO CREATE A NATIONAL UTILITY TO SHARE DATA AND A SET OF CENTRALIZED SERVICES.

CommonWell Health Alliance is a not-for-profit trade association with about 30 members that are leaders in the acute care, ambulatory care, post-acute care, pharmacy, and lab industries. CommonWell is dedicated to the ideas that data should follow the patient wherever they get care and the data should be available to those who provide care through whatever means and mechanisms they traditionally use for taking care of patients; it should be built into the software and services they usually use.

To achieve that vision, CommonWell is building a national architecture for enabling patient-centered care. In some ways, CommonWell is an orthogonal effort to SMART. Instead of trying to create great utilities that sit on top of data, Common-Well is trying to create a national utility that allows sharing core clinical data that is valuable to providers across the care continuum. Along with sharing data, CommonWell is focused on a set of centralized services that include services for managing patient consent, managing patient ID, record location so that providers know where a patient has been, and the ability to query and retrieve data.

> "I'm thinking about the kinds of data which should be available to providers of all types across the continuum and the value that creates, which is complementary to the types of value we get . . . through applications built on SMART and other types of integrations."
>
> — JITIN ASNAANI

It is likely to see APIs defined that will allow FHIR to access CommonWell services to find documents or data for the same patient. In fact, at HIMSS this year, Cerner demoed a SMART app at the CommonWell booth that was powered by FHIR, meaning it can sit on multiple platforms and can retrieve data from across the spectrum. (Cerner's David McCallie said that this app was to show proof of concept, but with regard to opening FHIR services from CommonWell to non-vendor access, McCallie cautioned about moving slowly).

DISCUSSION

- **Vendor thanks.** One participant thanked the EMR vendors for FHIR-enabling their systems and demonstrating that apps will work across them.

- **Common vs. unique.** Some products will be developed that can fit with all EMRs in an EMR-agnostic way. An API work group is meeting to figure out the common abstractions that cover a large number of use cases.

- **Certifying an app against EMRs.** A developer asked how newly developed apps will be certified against all EMRs. David McCallie said that Cerner points app developers to open playpens where they can go try their app out to see if it runs in multiple environments or not. If it does not, the developer may want to rethink or redesign their app.

Janet Campbell sees the possibility that ONC will require that all apps be certified by ONC, which is not an ideal path. Chuck Jaffe from HL7 said that part of The Argonaut Project is creation of a utility to certify conformance, but this does not certify the product. To learn about the product, developers can

run it in a sandbox against a variety of open API specifications. Jitin Asnaani said that certifying an app is outside of CommonWell's area of focus and expertise.

- **Governance issues.** In response to a question about what has been learned over the past four to five years related to governance issues and where we need to go with respect to FHIR, Janet Campbell answered: 1) a simple definition of interoperability is needed so that clinical organizations can sign onto it, with a simple use case for exchanging data for the patient at the point of care; 2) a directory to find all end points; and 3) a single certifying body that everyone can trust.

David McCallie said that solving governance generically for everybody without the governance solving system having some kind of authority over the network is just too hard. There must be a network or an arrangement, which is a business deal between parties that agree to work together on common governance or common standards they are going to use, agree on their directory structures, and agree on their contractual relationships. For example, there is accepted governance for e-prescribing among those who participate, which only works for e-prescribing.

- **Legal framework.** Ricky Bloomfield believes that for substitutable apps to become a reality there are technology issues that must be solved, policy issues, and legal issues. When a person purchases an app from Apple's app store they simply click a button, download the app, and begin using it. But for clinicians within a health system to use an app the legal piece is much more complicated. Based on his knowledge of Duke, he imagined that Duke would not allow clinicians to decide upon and download apps. He envisions a process where every app would have to be approved before it could be used.

Janet Campbell sees health systems having local app stores that have approved apps. Over time, if an app is approved by one health system, that may be viewed as good enough for other health systems. David McCallie sees this as a new area and believes that a legal framework will evolve over time that will become simpler and faster.

Also, a potential legal issue is that look and feel differences between an EHR and an app could cause safety issues, which is a subject that has to be addressed.

Open Data and the Point of Care

Andy Palmer, Koa Labs (Moderator)
Niall Brennan, CMS
Joe Corkery, Google
John Mattison, Kaiser
Henry Wei, Aetna

OVERVIEW

Panelists overwhelmingly support open data; the question isn't whether open data is important but how to achieve it. Making Medicare claims data available (through CMS's Blue Button Initiative and in other ways) can help researchers, can help clinicians in health management, and can be used to hold clinicians accountable and identify outliers. Open data is also important to create the huge datasets that are needed for genomics research and to aggregate personal health data. Achieving more open data requires dealing with interoperability, privacy, and security issues including authorization and authentication, and the permission of patients to make their data shareable. Some believe that government intervention is necessary to mandate interoperability, or at least to facilitate the creation of standards and API development.

CONTEXT

Panelists representing public and private payers, and a major technology company, discussed why open data is so important, ways in which open data will be used, and how to achieve it.

KEY TAKEAWAYS

MOST PEOPLE AGREE ON THE PRINCIPLES OF OPEN DATA. WHAT MATTERS NOW IS THE EXECUTION.

In opening the session, Andy Palmer shared several thoughts about open data:

- Everyone understands and subscribes to the idea of "open data," but the issue is no longer the principles; it's the execution.

- Most pharmaceutical companies will say that their information (inclusion/exclusion criteria) about participation in clinical trials is open and available. This may be true, but the actual accessibility of this data to the average provider and institution is very limited.

- The open data versus privacy debate is a red herring. This can be best managed not by focusing on controlling the access to data but by focusing on the use of data.

- Open data at scale does not equal a restful API. Once APIs are working the meaning of the data and the semantics of data need to be matched right.

THE BLUE BUTTON INITIATIVE PROVIDES DATA ON 40 TO 50 MILLION MEDICARE BENEFICIARIES.

Blue Button is an initiative by CMS with an open source framework to provide open Medicare data that can be used by software and app developers ultimately leveraged at the point of care. This initiative is in the very early stages, but there has been focus on the principles, the design guidelines, and the conceptual framework. Medicare claims data matters because with tens of millions of beneficiaries, this is the largest economic footprint on health care spend on the planet. It is exactly the kind of data that any developer would want to use to create an app.

> "We needed a more programmatic way that modern developers could go and actually get at the data and create all sorts of useful apps."
>
> — HENRY WEI

In addition to Blue Button, CMS is using data in other ways. For example, monthly claims data is provided to Medicare ACOs, which can be leveraged now by physicians and ACOs for purposes such as health management and patient interventions. Claims data from CMS also shows the practice patterns of physicians; for example, identifying providers who prescribe or treat far more than other providers in the same geography.

> "We have a lot of data out there. You should go to the CMS Data Navigator. You should find it. You should use it."
>
> — NIALL BRENNAN

Also, CMS recently removed a longstanding prohibition against researchers with commercial intent being able to get access to CMS data. So, analytics companies that are willing to go through the approval process required by HIPAA, sign a waiver, abide by research protocols, etc. can get virtual access to CMS data. Analytics firms can also bring in additional data if they want and merge it at the person level.

In response to a question about the estimated time frame where a patient at the point of care could authorize the use of their CMS data for a clinical application, Niall Brennan would not commit to specific timing but did say, "I think we can get it done on a reasonable timeframe."

GOOGLE SEES A NEED FOR OPEN DATA TO ACCELERATE ITS GENOMICS PRODUCT.

Google's mission is to organize the world's information and make it universally accessible and useful. Health care information plays an important part of that. Recently Google has created rich knowledge panels for health searches with information curated from multiple sources, reviewed by doctors, and validated in collaboration with Mayo Clinic.

Another health care product is Google's genomics products, where Google is making it easy to store genomes and do analysis of them in the cloud. (One person's genomic data is roughly one terabyte of data.) But it requires about one million genomes to have a meaningful dataset, and no such genome dataset of that size exists. There is a big difference between 1 dataset with 1 million genomes and 1,000 silos of 1,000 genomes each. To create one huge dataset, Google is working with the Global Health Alliance for Genetic Health to implement their APIs to provide interoperability of data transfer to make it easier to move genome data around.

> "Our goal is to make it easier for data scientists or physicians to extract useful information to be able to make decisions at the point of care. That's why I'm excited about the open data movement because the more data that's out there the better it is."
>
> — JOE CORKERY

Note: Autism Speaks has funded the sequencing of 10,000 full genomes of autistic children, which Google is hosting and exposing. This data will be opened up to qualified researchers.

AN IMPORTANT USE OF OPEN DATA IS PERSONAL HEALTH DATA.

Some of the biggest wins for open data at the point of care may be using patient-generated data to influence behavior change. Personal sensors can be used by athletes and warriors for real-time tuning, by people with acute illness who require inpatient monitoring, by people with chronic illnesses who require early event detection outside of an acute care setting, and those for whom it is important to help restore wellness through mindfulness. Keys, which involve open data, include helping patients and providers manage personal health data, and filtering the data that goes to providers with the ability to have automated escalation.

DISCUSSION

- **Role of government.** Some believe that interoperability should be solved by the market, while others see a role for government in mandating interoperability. In some markets, like video games, there is lack of interoperability between closed systems. However, video games are not a matter of life and death, and closed systems in health care where a provider is unable to access pertinent patient data could impact outcomes. For this reason, some argued, the government should regulate on behalf of citizens. Others see the government helping to bring the relevant players together to decide on standards.

- **Enabling data sharing.** A work group is working to build specifications that allow consumers to authorize access to their health care data and different kinds of sharing. In one use case, called "Alice to Alice sharing," a user has access to some data and wants to share it with an app. The other use case being considered is "Alice to Bob" sharing where Alice establishes various rules and Bob can come along and access Alice's data. The idea in A to B sharing is that consumers can each set up their own policy and rules, with different consumers setting up rules differently, such as who is allowed access to data.

- **The power of procurement.** Henry Wei pointed out that the government doesn't have to issue regulations to drive changes in behavior among vendors. The government can drive changes through the force of procurement by specifying certain functionality.

- **Letting consumers approve data sharing.** One participant said that research shows that around 9 out of 10 patients would allow access to their data if notified that a researcher was using this data for a particular purpose.

What is the Recipe for a Public API?

Ken Mandl and **Isaac Kohane** (Moderators)
Chuck Jaffe, HL7
Josh Mandel, Boston Children's Hospital
Steve Posnack, ONC

OVERVIEW

This session began with a discussion of key elements for a public API, which include standards, pieces such as authorization and authentication, and policies around who can access the API and the ecosystem.

Beyond the recipe for a public API, the conversation focused on what it will take to be able to write apps once and easily run them on an unlimited number of systems. The general consensus was that goals of a plug and play app or 100% substitutability are not realistic at this time; a goal of 80% reach is more practical and achievable. Most participants see SMART on FHIR as adequate technology with which to begin getting experience. Session participants want to quickly get innovative apps into the market so innovative health systems and vendors can begin using them.

CONTEXT

Chuck Jaffe provided an update around HL7 and Argonaut, and Josh Mandel and Steve Posnack then shared their thoughts on some of the key elements to be considered in creating a public API.

KEY TAKEAWAYS

HL7 AND THE ARGONAUT PROJECT ARE PROCEEDING IN DEVELOPING STANDARDS AND ACCELERATING FHIR IMPLEMENTATION.

Chuck Jaffe provided an update on work within HL7 as well as efforts at the Argonaut project.

Since the Fresh Look Task Force in 2011, HL7 has been investigating opportunities for revising the way it approaches interoperability, and has been working on FHIR. The first draft standard was released a year ago and the second draft standard is being validated. The draft standard is for trial use. Part of the success or failure of the standard is whether it is appropriately evaluated during the draft trial process. Draft standard 2.0 was released in

April and there have been in excess of 1,200 comments. Based on those comments, proposed draft standard 2.1 is under development.

In addition, the joint Policy and Standards Committee met at the end of October 2014, and there was focus on open APIs as one solution for interoperability. In December 2014, HL7 announced the formation of the Argonaut Project, which Cerner and Epic agreed to. In the five months since, there has been a phase 1 of the SMART project, which delivered on the promise of accelerating the development of FHIR up to and including the release of the draft standards. In addition, there was a work stream for authorization and security. As part of the second phase of Argonaut, there is a focus on accelerating implementation.

To date, 75 organizations—academic, private sector, and others—have committed to using FHIR profiles and FHIR standards. And that number is growing. The www.fhir.org website will house a repository, a sandbox, a test bed, some testing tools for conformance, a virtual help desk, and a handful of other enablers.

A KEY QUESTION TO CONSIDER IS WHERE TO DRAW THE LINE FOR A PUBLIC API.

In contemplating the recipe for a public API, Josh Mandel raised key elements to consider. On the one hand, a public API may just need a low-level set of functionality; for example, the ability to make a call through the API. Party 1 gives some inputs and party 2 gives outputs. Party 1 might say, "Get me the medication lists for John," and party 2 responds with medication lists formatted appropriately using the right vocabularies and standards. This might be adequate to be a public API.

The question is, without all the pieces around the API that make it into a platform, like authorization and authentication, without standard rules, is that enough to be a public API?

One way it could be framed is, if the community agrees to use FHIR, is that good enough? Or is agreement needed to use something like authorization profiles on top of FHIR that will allow

developers to consistently connect to a bunch of servers? Or, we could think about broadening that to accessing data in the context of an ecosystem, where we know how to ask for authorization and get permissions. Or we could go further. We could say you have to describe the data and the authorization, but to really be a useful public API, we need a policy that says who is allowed to call this stuff. Who is allowed to register clients? Who can join the ecosystem? What is the bar for membership? The decision could be that a public API needs all those things—a complete ecosystem. An important question is, where do you draw the line?

THE RECIPE FOR A PUBLIC API IS COMPLICATED, WITH MULTIPLE INGREDIENTS.

Steve Posnack sees multiple ingredients in a fully functioning public API. They include:

- Standards, testing, pilots, and the involvement of multiple parties
- Policy
- Guidance to point everyone in the right direction, as opposed to more regulation
- Business practice
- Terms of service
- Non-contradictory legal agreements
- Culture change—a great deal of culture change is required
- Public awareness
- Perceived value, meaning that this public API has to be sold with value to patients, caregivers, providers, and developers
- Commitment

> "You can't underestimate the amount of public awareness that needs to take place."
>
> — STEVE POSNACK

As with any recipe, all of these ingredients are required; without them the final product won't be the same. This includes the technology, the policy, and the legal aspects. Also required is a n adequate amount of time. In addition, it is important to consider the API context, and to realize there may be different ways in which people use APIs. Examples are a patient-centered context, which requires one API recipe; the context of a provider creating an app for their own use; and the context of a provider creating an app for use by other providers. These contexts for the API require different ingredients, such as different policies and parameters.

DISCUSSION

- **Pre-1.0.** Isaac Kohane recollected that in 1994, in the earliest days of medical records, he was using html 1.0, which at the time was a standard. There were several browsers at the time that did not render that html, but did have some shared functionality. He asked if standards for a public API have reached maturity of even 1.0. Josh Mandel believes that the current situation may be even more complicated than with browsers (which Kohane disputed), as there are perhaps 1,000 different EHR systems as opposed to a handful of browsers. But Mandel did say that we are still before 1.0. He went on to say that what is needed are fast iteration paths in order to try out alternatives and make decisions.

- **Making substitutability happen.** Ken Mandl commented that thus far the conference has had little discussion about the ability for an innovator to develop an app that could run throughout the health care system. He asked the panel about a technical approach to getting this done, a regulatory approach, and whether HL7 was committed to this.

  — *Technical approach.* Josh Mandel said that there is already a reasonable API that can be built upon and additional technology can be developed rapidly. There is already some glue around the edges, such as authorization and authentication. The issues he sees for app developers is still the need to get their app certified in 1,000 different app stores (with each EHR vendor having their own app store) and then needing to sell it to 5,000 different hospitals one at a time. The issues are not technology issues; they are practical, market-related, technology adoption issues.

  — *Regulatory approach.* Janet Campbell from Epic doesn't see a regulatory approach to driving substitutable apps.

  — *HL7 commitment.* Chuck Jaffe said that HL7 and leaders in the FHIR community are committed to the idea of "develop once, run everywhere." Once the public API has been agreed upon, it will be up to the business case and policy to make this happen.

  Mandel said there are important steps between write once and run. Those steps are configure and register and certify—and then run.

- **Early adopters.** The two earliest adopters of developing apps using SMART on FHIR are Geisinger and Duke, which are not waiting for HL7 or ONC. Both are fully supporting the idea of a public API that will enable apps to run in multiple places. Both are jumping to be early adopters and are focused on the idea of staying ahead.

  — *Geisinger.* Geisinger saw its problem as having to customize its EHR system, which is expensive and arduous. By adopting SMART on FHIR, Geisinger saw an opportunity to adopt a different model of developing apps for external

use. Geisinger also saw using SMART on FHIR as a way to develop a process of learning, which is important for innovators. It represents a way to move forward in gaining learning without waiting for perfection.

— *Duke*. As with Geisinger, Duke viewed SMART on FHIR as a solution to a problem. The situation is that innovative providers were developing cool apps and wanted to implement them at the point of care, and researchers were developing databases they wanted to access—and these apps and databases were becoming an unmanageable nightmare. SMART on FHIR helps solve this problem. Duke jumped in because it makes people's lives easier and because it is doable now. In Ricky Bloomfield's view, "We're pretty close to 1.0." He said that html 1.0 was far from perfect, as is SMART on FHIR. But the fact that the current version can be implemented and show some clinical utility is good enough to start with.

Mark Braunstein from Georgia Tech stressed that the way to get innovations adopted is to get them out there, let the innovators and early adopters play with them, and then the rest of the market will eventually follow.

A participant commented that in many industries, new products and business models get created based on draft standards, not normative standards. Companies make and sell products that work based on draft standards, which is what Geisinger and Duke are doing.

▪ **80% reach.** Chris Ross asked whether the goal of write once, run everywhere is achievable, or whether a goal of 80% reach would be better. He recounted that when Java came about, the mantra was "write once, run anywhere." But when EJB 2.x came on the scene, things changed. The spirit of write once, run anywhere remained, but the specific implementations varied.

In thinking about the three contexts or domains that Steve Posnack described, Ross thought they all made sense, but it is not clear that an identical API is desired across each of those three domains. And, a challenge back to SMART: the SMART environment doesn't today explicitly deal with what you would need to do to solve the Ebola problem of quickly disseminating information to providers. The solution would be to quickly insert clinical decision support into an EHR-type system. Instead, SMART today is looking at extraction of data, from which one derives insights. Chris' view would be that an 80% reach toward the goal of write once, run everywhere is the right goal, and a slight modification that allows providers and users to particularize solutions to different kinds of domains might be an acceptable variation of the API.

Dan Nigrin of Boston's Children's Hospital agreed with the 80% goal. Boston's Children's was the first institution to put a real-world SMART app pre-dating FHIR. He suggested, "Let's just start using what we've got."

The perspective of David McCallie from Cerner is that the phrase "plug and play" is scary and unrealistic. He agreed with Chris Ross that Java as a desktop generic app delivery model was a failure, but Java as the service tier was a phenomenal success. Like others who commented, he sees 80% as a target to shoot for on specific orchestrations. He sees many positives from SMART on FHIR, including authorization and authentication, but believes that look and feel, usability, color scheme, and safety will vary between vendors, keeping apps from being plug and play. McCallie sees a struggle occurring when app developers have one or two services they need that aren't in the 80% profile.

▪ **Drivers for substitutable apps.** Seth Joseph from Surescripts suggested that with two dominant platforms—the iPhone and Android—developers had incentives to develop apps to reach the massive number of end users. But with 1,000 different EHRs, app developers have less incentive. He wondered if those EHR vendors that open their platforms the most to app developers will become more valuable to clinicians and realize competitive advantage.

Isaac Kohane said that when the iPhone first came out, there were no interesting apps and there was skepticism about whether app developers would create apps to sell for just $0.99 per app. He argued that by making apps easily substitutable and modular, it sparked the development of innovative apps.

▪ **Institutional will.** Janet Campbell was asked how long it will take for a health system that uses Epic to run an app developed by another organization such as Geisinger. Campbell said that all it will take is an organization to decide they want to implement that application at their organization. In Campbell's experience, that lack of organizational commitment is what stops the majority of integrations. The reality is that in many instances the vendor is not the barrier; it is the users themselves.

▪ **Triggering mechanism.** Participants repeatedly discussed the example of an Ebola app that would have updated information from the CDC about how to diagnose and treat Ebola. McCallie said that it is the EHR's responsibility, based on rules, to trigger when it is time for the Ebola app to be in front of the clinician. Then, all questions about Ebola can be guided by the specific app; if more data is needed by the app, FHIR can be used to go get it (a vendor-neutral orchestration needs to be specified that solves that problem; the Ebola app would plug right in). Then, when the clinician-patient conversation is complete, the app needs to summarize what happens and leave a trace in the EHR, which could be a simple document.

Developing a Robust Ecosystem

Ken Mandl and **Isaac Kohane** (Moderators)

OVERVIEW

In developing a robust ecosystem for substitutable apps, important considerations include ensuring that apps can be integrated with the EHR and can access patient data, which differentiates connected health care apps from the thousands of existing consumer apps in app stores; having a way to validate apps and their content; and viewing patient safety as a key benefit of best-of-breed apps. The importance of integration of apps with EHRs requires the combination of a platform, an API, and standards.

CONTEXT

Ken Mandl and Isaac Kohane led a discussion recapping highlights and observations from the conference. The discussion focused on thinking of best-of-breed apps as a patient safety tool and the process by which apps and their content are validated.

KEY DISCUSSION POINTS

- **Apps that are connected to the health system.** Chris Ross of Mayo Clinic said he thought the most useful part of this conference was the focus on Smart on FHIR. It is not merely the creation of innovative health care apps that has value; it is the use of shared data and the embedding of apps and data into the workflow and ecosystem. Ken Mandl agreed, noting that there are tens of thousands of health care apps today, which are largely ignored in the delivery of care because they are disconnected from the health system. It is the creation of apps that are connected and integrated with the health system that has the greatest value.

- **Seeing best-of-breed apps as part of patient safety.** Isaac Kohane said that EHRs sell themselves as a patient safety feature in having all of a patient's data in one location. He said that best-of-breed apps can also be positioned as improving patient safety. He gave the example of the Growth Chart app, which could use existing data from a child's EHR and plot a child's height and weight over time, using standards and comparisons. Use of this app can lead to earlier identification of children with pituitary gland tumors and other deficiencies.

For this app to be accepted and widely used it has to have the right standards, the right reference populations, and proper noise characteristics so that alarms are not constantly going off. No EHR vendor or hospital could be expected to get this right; this is a place for a focused innovator.

> "Perhaps we should start framing this apps initiative in terms of patient safety and using the best of our collective intelligence."
>
> — ISAAC KOHANE

- **Balancing order and innovation.** Ken Mandl sees a dichotomy between (1) the rigorous processes that EHR vendors go through to ensure data integrity, data consistency, and the integration of data across multiple systems that is translated into orders that take place with integrity to ensure a patient gets the right treatment at the right time, and (2) the less-than-orderly creation and implementation of innovative apps. The implementation of innovation apps has the potential to threaten or disrupt the orderly process of the EHR vendors.

- **Validating, certifying, or benchmarking apps.** Andy Palmer noted that while there has been discussion about validating or certifying apps, there is no entity taking responsibility for this. Several participants responded:

  — There was agreement that "certifying" is probably not the best term. Perhaps validation or benchmarking or steward are better terms.

  — The AMA is considering playing some role in a benchmarking or validation process, possibly in organizing a group of the right partners.

  — There are possibilities that various clinical specialty societies will act as sponsors or experts that validate the content of a particular app. (David McCallie suggested that because in some cases apps may disrupt the status quo, incumbent specialty societies may not be the most appropriate sources to validate apps. Even if they provide input in some way, these incumbent societies shouldn't necessarily be the only groups providing input.)

- **Basing the degree of validation on the nature of use.** A participant commented that if an app is part of automated workflow and is used to make binary decisions to do or not do a certain clinical thing, it is essential that the content and calculation in the app be very certain. But if an app is used to provide information to a doctor who will have a great deal of freedom in making a decision, then the degree of certainty required is not as high since the intended use is different.

  Similarly, Atul Gawande said that surgical innovations and other types of therapeutic innovations happen all the time, without regulation. As a surgeon, there is no regulation over what Gawande can do when undertaking a procedure. There are guidelines and endorsements by specialty societies, but on occasion an innovator will say, "Try this." Perhaps apps should be viewed similarly to other types of therapeutic innovations with recognition that some are high risk, which require clinical trials, and other innovations are lower risk, make sense, and can be adopted with lower levels of evidence.

  An example was shared about a medical calculator app developed by Pascal Pfiffner that has been downloaded 1.2 million times. This app, which is used mostly by physicians, has no certification. The evidence used to create it has been verified by the development team, but it has gone through no formal process for verification or re-verification when changes were made—and it is being broadly used. Another participant pointed out that this freestanding app does not benefit from being tied to an institutional EHR, but is not limited by an institutional development cycle.

- **Verifying the content of apps.** One participant argued that the content in apps—the evidence that is delivered—needs to be objectively scored. The eLibrary is a project at Harvard Medical School to create a repository of medical evidence that can be used for scoring the evidence in apps. Another individual said that AppScript, created by IMS Health, attempts to do some rating of apps. Of some concern is that the next generation of algorithms will be "black box" using machine learning. As such, the evidence will be testable and can be validated, but it isn't reviewable and can't be explained.

- **Different APIs for different situations.** Josh Mandel pointed out that the APIs used to access evidence and patient data at the point of care are likely to be different from the APIs used to access huge amounts of data to build the black boxes.

Keynote
Atul Gawande

OVERVIEW

Innovations spread fastest in health care when there are immediate and visible benefits—as opposed to pain now for uncertain benefits later—and when there are benefits for both patients and physicians. Thus, transforming health care with health information technology innovations can happen fastest by showing immediate, visible, and significant benefits.

Two important areas where transformation is required are in how care is delivered and in how end of life is addressed. The delivery of care needs to shift from solo practitioners acting autonomously to care by coordinated teams. And end of life care needs to shift from care delivered reactively and intensively with a goal of prolonging life, to care based on each individual patient's preferences, which are known in advance based on proactive conversations.

CONTEXT

Surgeon, researcher, and best-selling author Atul Gawande discussed why some innovations spread faster than others and answered questions about transformative innovations.

KEY TAKEAWAYS

IT IS IMPORTANT TO UNDERSTAND WHY SOME HEALTH CARE INNOVATIONS SPREAD FASTER THAN OTHERS.

For health care transformation to occur, innovations must spread throughout health care. Looking back at the diffusion of innovations, lessons can be learned about why some innovations spread rapidly and other don't. Consider that anesthesia, discovered in 1846, was used in all major institutions within six years. In contrast, antiseptics, which were discovered in 1867, took many more years to spread.

Some believe that the reasons why anesthesia spread quickly while antiseptics did not were incentives and complexity.

- **Incentives.** There was definitely an incentive to use anesthesia so that surgery would be painless, giving surgeons more time to work without having to subdue patients. But there was also incentive to use antiseptics as infections were the leading cause of death after surgery and when patients died they didn't pay in a cash-based system. Incentives don't explain the differences in rate of dissemination.

- **Complexities.** Antiseptics did have some complexity, but anesthesia is far more complex and still spread more quickly. Anesthesia requires another doctor in the operating room, yet still scaled rapidly.

The key reasons why these two important innovations spread at different rates were:

- **Immediacy.** Anesthesia brought immediate and visible pain relief during surgery. Antiseptics, on the other hand, killed germs and prevented infections, but germs were invisible and infections didn't occur for several days. Thus, the benefits of antiseptics were delayed and invisible.

- **Beneficiaries.** With antiseptics, patients benefitted by not experiencing an infection, but there was no benefit for physicians. With anesthesia, the patients benefitted through pain relief and physicians benefitted by having more time to perform surgery.

Other health care innovations that have immediate and visible benefits and that benefit patients and physicians have spread quickly (like Viagra), while innovations spread much more slowly if they require investment up front without immediate or visible benefits (like medications for hypertension) and without benefits for physicians.

TRANSFORMING THE DELIVERY OF CARE REQUIRES CHANGING THE CULTURE AND COMMUNICATION WITHIN HEALTH CARE.

Historically health care has been practiced by solo practitioners who acted autonomously ("cowboys"). This model no longer works. Health care is moving to teams of coordinated people with specialized areas of knowledge ("pit crews"). This requires culture change, more of a process orientation (such as using checklists), training, and different systems, such as EHRs.

THE CARE AND SERVICES DELIVERED AT THE END OF LIFE NEED GREATER ATTENTION.

There is significant waste and suffering in end of life care, as a great deal of harmful and non-beneficial care is delivered. Much of the problem is based on a failure to recognize that people have priorities other than just living longer. Many care about how they live—including quality of life and pain. The key to discerning patients' priorities is just asking them. When asked, many patients

will state tradeoffs which may include being at home versus being hospitalized, and being conscious. However, fewer than one third of patients nearing the end of life are asked about their goals and wishes; it is impossible to align care with someone's wishes if those wishes aren't known.

When there are conversations with patients about their palliative care preferences, research shows a decreased use of chemotherapy, decreased hospitalization, and increased use of hospice care. When there are conversations with patients about end of life care, costs go down by 33% and amazingly, patients live longer.

> "If a drug going through the approval process showed these results [the results of conversations about palliative care plans], it would be fast tracked for expedited approval."
>
> — ATUL GAWANDE

What is needed is a systematic solution to this systematic problem. For example, a triggering system could be part of an EHR where physicians were asked, "Would you be surprised if this patient died in the next year?" For all patients where the physician would not be surprised, the physician would be encouraged to have a conversation about end of life treatment preferences. In initial research, when such a trigger occurs, the rate of conversations increases from less than 33% to more than 90%. The key is not technology, which plays a very small role, but changes in systems, processes, and the culture.

DISCUSSION

- **West Coast vs. East Coast.** The West Coast view of innovation in health care is about disruption and disintermediation. The East Coast view is institutional innovation. In reality, innovating in health care is not about disintermediating the entire system. The greatest value is in smoothing the system and making it work better.

- **The future of doctors.** While technology will provide more information to make better decisions, humans will still be able to understand the context, assess how the patient is doing, and make the ultimate decision. The health care system will be a human system for years to come.

- **The focus of investors.** In general, investors are looking at companies that: 1) give consumers data to improve their lives; these innovations can be marketed directly to consumers, have the least friction, and are generating a great deal of attention; 2) provide innovations for clinicians; these innovations have more friction and slower iteration cycles; and 3) interlink the health care system; these innovations are receiving the least attention but are incredibly valuable.