The future of health analytics: unlocking clinical and business value
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On February 24, 2015, more than 40 health care senior executives convened at the MIT Media Lab in Boston, MA, for a dialogue on the future of health analytics. The event was co-hosted by MIT Connection Science, Deloitte, and Decision Resources Group. This diverse group was comprised of representatives from health care providers, payers, innovators, life sciences organizations, and government, who discussed challenges, opportunities, and actionable approaches to using health analytics and health data to maximize clinical outcomes and business value. Participating organizations included:

- Activate Networks
- Allergan
- Allscripts
- Amerisource Bergen
- Avalere Health
- Brigham and Women’s Hospital
- Carle Group
- Cerner
- Cigna
- Cogito Corporation
- ConvergeHEALTH by Deloitte
- Covidien
- Decision Resources Group
- Deloitte
- Envariant
- Fresenius Medical Care of North America
- Health Verity
- Indus Growth Partners
- Inovalon
- Kyrrus
- Lahey Health System
- Massachusetts General Hospital
- Massachusetts Institute of Technology
- Massachusetts Veterans Epidemiology Research and Information Center
- Merck
- MIT Center for Biomedical Innovations
- MIT Sloan School of Management
- New Era Venture Partners
- Nuance
- Optum Labs
- Patients Like Me
- Pear Therapeutics, Inc.
- Pfizer, Inc.
- Philips
- Sanofi
- Sanofi / Genzyme
- Sanofi Aventis Groupe
- Smart-CATCH
- Tufts Health Plan
- MIT Sloan Initiative for Health Systems Innovation
- Twine Health
- YOU Technology
- Zephyr Health

Technology advances have provided health care organizations with myriad disparate systems from which to obtain information. From revenue cycle systems and supply chain management to human resource systems and data warehouses, the volume of available data—and the need to capture and process it—has exploded in recent years. Each new wave of innovation claims to simplify or streamline a process that the previous wave had supposedly made efficient or effective. Subsequently, there are so many versions of the truth it’s hard to tell which one is right.

As data volume has grown exponentially, consolidation within the health care industry has exacerbated access and availability problems by creating organizations with multiple clinical, financial, and revenue cycle systems and as many reporting and analytic tools. Concurrently, government compliance and coding requirements have contributed to make this a “perfect storm” for analytics in the health care industry.

360° insights for health care organizations

To weather the storm, health care organizations require analytics to understand the threats and challenges they face and to identify opportunities to improve and expand. Specifically, organizations need to understand four key analytic domains:

1. **Market Domain** - The Market Domain focuses on how organizations understand the communities and populations that they serve and the context of the care provided. Market analytics provide critical insights into decisions ranging from referral patterns and which alliances are most valuable to what populations are generating the most revenue. Key focus areas include:
   - Alliances and Partnership Analytics
   - Network Leakage and Referral Analytics
   - Market Demographics Analytics
   - Population Health Analytics

2. **Clinical Domain** - The Clinical Domain focuses on the acuity, safety, satisfaction, and outcomes necessary to improve care effectiveness and quality. Clinical analytics provide information ranging from readmissions to translational research. Key focus areas include:
   - Research and Development Analytics
   - Quality and Safety Analytics
   - Comparative Effectiveness Analytics
   - Patient Satisfaction Analytics

3. **Operational Domain** - The Operational Domain focuses on an organization’s efficiency in terms of human resources, supply chain, and other resources used in care delivery. Operational analytics help an organization understand how efficiently it is utilizing key resources such as talent, technology, facilities, and supplies. Key focus areas include:
   - Human Resources and Talent Analytics
   - Supply Chain and Procurement Analytics
   - Facility Management Analytics
   - Information Technology Analytics

4. **Financial Domain** - The Financial Domain focuses on the revenue and costs associated with the care provided and the fiduciary stewardship of funds. Financial analytics is more than just financial statements and variance reports; to be most effective it needs to include service-line profitability analytics, information regulatory compliance, and insights for possible mergers or acquisitions. Key focus areas include:
   - Regulatory Compliance Analytics
   - Finance and Accounting Analytics
   - Revenue Cycle Analytics
   - Strategic Positioning Analytics

Each of the specific processes and activities to support analytics within these four domains has distinct requirements but is also interrelated with other upstream or downstream processes and activities. Optimizing how these processes interrelate and integrate analytics will determine the accuracy and effectiveness of the information a health care organization has to make better, faster decisions.

“There are emerging and interesting roles for data to incent positive social interaction with the health care system.”

Alex “Sandy” Pentland, MIT Connection Science
A sea-change for health analytics

While the promise of health analytics is considerable, to organizations that have been operating in the world of health analytics and health data for some time, it has often appeared as though the problems around widespread implementation and adoption have been too big, too intractable to surmount. Fortunately, industry stakeholders are starting to see solutions and advancements that may produce a sea-change which should help to unlock health analytics’ full potential for clinical and business value.

Health care today is primarily episodic. A physician takes a symptomatic “snapshot” when someone is sick, gives them medications and instructions, and sends them home to manage their condition largely on their own. Typically, there is little-to-no subsequent physician-patient interaction until the next health episode, which may occur weeks or months later.

The majority of methods physicians use today to evaluate a patient’s condition also are episodic – decades-old, cost- and time-constrained actions to detect changes or abnormalities at a specific point in time, such as evaluating weight, heart rate, blood pressure, and other vital signs; conducting a physical examination; and running blood tests. The clinical application of genetic and behavioral information to improve prevention, diagnosis, treatment, and care management lags advances in those fields.

Health care practice and its measurement need to move from episodic/periodic to pre-symptomatic/frequent. Organizations need to bring data from outside of the medical system into the system, move to real-life and real-time data integration, and monitor the data to make it actionable.

Health analytics, the integration of robust (“big”) data acquired from different scales and sources and analyzed using a broadening array of techniques, can drive positive change in health care innovation and delivery.

Stakeholders discuss challenges and opportunities

Recently, more than 40 senior executives representing health care providers, payers, innovators, life sciences organizations, and government convened at the MIT Media Lab in Boston, MA, for a dialogue on the future of health analytics. The event was co-hosted by MIT Connection Science, Deloitte Consulting LLP, and Decision Resources Group. The diverse group discussed challenges, opportunities, and actionable approaches to using health analytics and health data to improve clinical outcomes and business value. The primary challenges and opportunities can be grouped into the following areas:

• The science and art of health analytics
• Barriers to analytics adoption
• Disruptive developments
• The empowered patient

The science and art of health analytics

The “science” of health analytics enables organizations to generate robust data and clinical and business insights that can help answer questions such as: What are the most important issues facing our organization? How do we develop technologies to keep pace with advances in data? How do we develop consulting/contextual skills? Do we have the appropriate contextual skills? How do we institutionalize our processes? How do we take linked, anonymous data and use it at the front end of research to identify patient cohorts and how to best target them? To unlock health analytics’ full potential clinical and business value, though, science must be applied to everyday practices and processes. Event participants identified numerous areas where generating and leveraging good health data is critically important for providers, health plans, life sciences companies, and other stakeholders:

• Quality – We can use health records data to automatically define quality through objective measures of patient outcomes. Still, we need to determine how to drive quality with data and how to get robust performance reports to doctors (e.g., score carding, patient compliance).
• Care management – If someone is developing kidney disease, we need to figure out how to help them before the disease progresses too far. For example, the patient’s health plan should help the individual understand what they can and should be doing, such as seeing their doctor regularly, changing their diet, etc.
• Cost – The cost of drugs and health care delivery is skyrocketing. Whatever sophisticated algorithms we build to look at costs, we need to collect the right data. For example, health plans need to identify, monitor and influence the behaviors of high-cost members.
• **Disease management to wellness** – Providers and plans can push information out to people about how to maintain their health, but it is very difficult to get them to change behavior. Wellness programs can help those who are already motivated, but others may need to be persuaded using compelling data.

• **Value-based care implementation** – A number of governments have been looking at combining large data sets across different types of services (health care, social services, penal system), combining those data sets and using predictive models to model the total systemic costs over time. This can create a thesis for early intervention.

• **Accountable Care Organization (ACO) integration** – Health care delivery and measurement across an ACO may be siloed and fragmented. Linking data across ACO entities can improve clinical and business processes.

• **Value-chain management** – How do you take all of the scientific data and apply it in drug discovery and throughout the life sciences value chain? How do we take the behavior/genomics/clinical data and stratify patients to come up with better drugs?

The “art” of health analytics must also also be addressed. How can providers, health plans, and life sciences companies use analytics to treat patients individually, not actuarially? How do organizations integrate large-scale data and massively increasing data sets with information that is less structured around what the patient feels and what the patient and clinician want? These qualitative measures should complement scientific measures to improve the patient experience.

**Barriers to analytics adoption**

There are numerous barriers to the rapid adoption and expansion of health analytics use. Among these are gathering, integrating, and processing data from different sources so that analysts and clinicians can understand each other. Hospitals are becoming more interconnected – they have lots of electronic health records (EHRs) – but many hospitals’ data collection systems lack an intelligence layer. EHRs, for example, may not contain all of the necessary clinical data. Organizations need to make data assertions accessible to decision makers and link data insights to actionable change. In addition, they need to do this while working within the oft-changing strictures of government regulations to protect patient privacy.

Data integrity issues can also be a barrier to widespread analytics adoption. Health care data is often “dirty” and hard to work with – for instance, one dataset erroneously listed 2,000 pregnant males in Florida. Data is constantly changing, so systems need to make sense of that dynamic and add content to the overall database in a logical and methodological way. The industry needs greater data literacy and tools to clean up data integrity problems. Building incentives around this area may help drive more sound practices so that data sets and databases can be merged for productive use.

Changing the innovation mindset is an important step towards encouraging the adoption of health analytics and overcoming many organizations’ reluctance to move from closed to flexible innovation models. Yet, implementing change management to drive innovation can be quite difficult. Case in point: Analytics can support clinical change programs around patient care, but there is a lack of aligned incentives across health care segments to encourage such innovation, be it incremental or truly disruptive. Additionally, analytics’ disconnect from being part of an end-to-end organizational and process design can inhibit its use as a driver and tool of innovation.

Often, the people who understand process design are not experts in analytics, and the people who understand data are unfamiliar with organizational design, making it difficult to leverage the power of analytics. How do you make “fancy math” accessible to the people who need to use its output, but don’t know the math or don’t trust it? To make something accessible, the value has to be apparent, and stakeholders often define value differently. If you’re a patient, a family member, or a physician, your value levers may not be the same. Designing around these levers is a huge driver for getting data analytics in the door. Who are the middlemen trying to pull all of the pieces together? What are stakeholders’ roles in creating a middleware layer and a standards body that makes point-to-point relationships easy to identify and low-cost to solve? External, multi-stakeholder collaborations can be a productive approach for driving innovation – they tend to shake off conservative thinkers and help individuals from different backgrounds to work together.
Disruptive developments

A number of recent and emerging developments may drive more widespread use of health analytics, thereby disrupting and improving traditional health care delivery and business processes.

• Integrated, real-time data landscape
  – A lot of the analytics used now are retrospective—someone needed to log something in using unstructured/structured data, but isn’t using real-time signals (e.g., how that patient stratifies versus other patients that resources could be allocated to). How do you create the signal environment to handle zero fail mission environments (cloud data)? What does the implementation and signal deployment need to look like?
  – Hospital systems are fragmented across different EMR environments. We need to create a dynamic relationship between workflow environment and the patients from whom we’re collecting data.

• Technology advances
  – Creative interfaces are being developed to improve patient interactions with their medicines (e.g., smart glucometer that keeps track of blood, asthma inhaler that tracks how well patients are utilizing their medicine).
  – Analytics-supported apparel (smart business clothes) is becoming more mainstream.
  – Wearables are popping up everywhere. For the first time we have sensors on people’s bodies for extended periods, collecting measurements of behavior that are relevant to one’s health. Many basic functions can be measured using simple sensors.
  – New statistical models and analytic methods are increasingly useful: With innovation in data science, we are able to make predictive inferences about health and attempt to prompt behavior changes at greater scale and with greater persistence.
  – Recent pinnacles of understanding in cognitive psychology and neuroscience allow for greater impact on human health behaviors. Coupling these with human-centric design and gamification has allowed health innovators to engage consumers via mobile devices in highly effective management of chronic conditions.

“Analyzing a holistic view of a patient’s data over several years gives tremendous insight into not only disease conditions, progression, and the various impacts of care modalities, but also enables insights into which points-of-care and care providers hold greatest influence and relationship with the patient. In the effort to have analytics impact costs, quality, and outcomes, significant dollars can be wasted in sending patients to the wrong [not influential] point-of-care or doctor. Bringing together what needs to be done with where and with whom it can be achieved is all part of the myriads of calculations needed in determining not only the what, where, when, and how of achieving success, but also the probabilistic calculations needed to address the important questions of financial costs and benefits of large scale applications of advanced data-driven care”

Dr. Keith Dunleavy, CEO and Chairman, Inovalon Holdings
Disruption may also come from the measurement of change and outcomes through patient self-managing and reporting. In the next five years we could see the transformation of behavioral measurements from measuring fundamental steps to clinical-level symptomology. Already the health care industry has the ability to take information about a patient’s voice and movement and transform it into clinically relevant measures such as physical isolation or requirement for additional movement.

The empowered patient

The most untapped resource in health care today is the patient. How can providers use analytics to treat patients individually, not actuarially? To strengthen their relationship with patients? To better understand the roots of behavior and drive change from that understanding? Every point of contact between a provider and patient should be a learning opportunity, and health analytics can enrich those interactions. Analytics can help to unify the relationship between physicians and patients so that patients are actively engaged in the interaction of medicine and behavioral change.

How do industry stakeholders make the products of analytics accessible to patients so they are empowered to change behaviors and make informed health care decisions? One way is to use them as a coaching tool. Sometimes a patient needs a coach who can help manage their care and guide them through the lifestyle changes necessary to treat a chronic illness. If a patient doesn’t take a necessary drug as prescribed, the medication’s efficacy level falls off. But if a patient sees through an analytics-enabled simulation that lack of adherence produces a vulnerability, the simulation can serve as a tool to increase self-care as well as interactions between the patient and health care provider.

However, instituting long-term behavioral change is a very challenging goal. Patients need guidance and coaching but generally prefer passive, non-intrusive assistance. Also, expectations from patients and the communities that are caring for them are not currently aligned; doing so can help drive uptake of analytics-based patient tools.

The health care industry is still learning how to use big data to influence consumer/patient behavior. There are emerging and interesting roles for data to incent positive interaction with the health care system; however, for consumers to engage with data collectors, the collection mechanism needs to be easy to use, the collected data needs to be safeguarded, and consumers have to be properly incented. Using graphics/informatics/cartoons that are intuitive can help patients develop new kinds of self-efficacy by reformatting measures patients don’t necessarily understand to show the link with their health.

“When we look for near term low hanging fruit to improve the cost and quality of care, perhaps instead of only new drugs, we need software and algorithms for intervening with patients to better utilize the pharmacopeia we have. The potential for disruption is when behavioral interventions can garner measurably competitor incentive value with devices, procedures, and drugs.”

Brigham Hyde, Chief Data Officer, Decision Resources Group

“You can’t cross your fingers and hope the patient will just follow your directions and improve chronic illness. Engaging the patient [in the care process] makes them part of a collaborative team to improve quality and drive down costs.”

John Moore, Co-founder and CEO, Twine Health
Privacy regulations may help to ease concerns about data security. And while monetary incentives do not appear to be strong incentives, consumers may respond to premium, personalized service, and positive reinforcement via social media and community relationships.

**Conclusion**

Current optimism in the health analytics industry is being driven by increasing and substantial investment in data capture, integration, and interpretation by health care providers, health plans, life sciences companies, and governments. To unlock health analytics’ full potential clinical and business value, however, stakeholders need to make data actionable to help unify the relationship between physicians and patients so that patients are actively engaged in the progress of medicine. With its members working collaboratively, the health care industry may soon see solutions and advancements that can help to make this vision a reality.

“We’re looking for the right intervention at the right time – the biggest trend we’re seeing is the patient turning into a consumer and driver of their own health care. It’s creating interesting pressure on the system to drive their personalized analytics.”

Dan Housman, CTO, ConvergeHEALTH by Deloitte
In his keynote presentation,\(^1\) Dr. Dennis Ausiello, Physician-in-Chief Emeritus of Medicine at Massachusetts General Hospital, Jackson Distinguished Professor of Clinical Medicine at the Harvard Medical School, and Director and Co-founder of the Center for Assessment Technology and Continuous Health (CATCH), a joint MGH-MIT initiative aimed at finding new ways of measuring the human condition,\(^2\) discussed how quantitative human phenotyping is one way to close the health care measurement gap.

According to Dr. Ausiello, we currently can diagnose disease but can’t diagnose wellness – we are aware of the underlying mechanisms and disease indicators but generally are not good at making sense of the different disease pathologies driving disease and turning that into actionable results. How do we get a sense of wellness’s progression to disease? Applying human phenotyping (genotype + behavior + environment) and health analytics can help to close the health care measurement gap. CATCH is investigating several such new types of phenotype measurements and studies:

- **Continuous measurements** from implanted cardiac devices, continuous glucose monitors, etc.
- **Behavioral measurements** via wearable devices that monitor exercise, diet, and medication adherence
- **Environment-responsive measurements** including diet and inhaled or ingested toxins
- **Pathway-inspired measurements** of inflammatory cells and pathways in autoinflammatory disease as well as common diseases such as Type 2 diabetes and cardiovascular disease
- **Integrative analyses** to reveal, for example, how various genetic and environmental factors can shape which types of human microbes are present and their aggregate influence on metabolism and immunity.\(^3\)

The health care industry will need to continue to monitor behavior to assess it and to change it; the digital revolution enables us to measure those factors.\(^4\)

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3. Ibid
4. Ibid
Contact us

We sincerely hope that this publication provides information and insights that you can take back to your organizations. If you have any questions or want to explore the important topic of health analytics in greater detail, please contact us.

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