Looking at the Future

2017 Annual AMIA Conference
November 5, 2017
Washington DC

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The constant in today’s world

- Technology is the primary driver of change
  - Computational power & size
  - World Wide Web and Internet
  - Smart phones and mobile devices
  - Wearable sensors and the Internet of things
  - Process and work flow
  - People
  - Policy
  - Artificial Intelligence & machine learning
  - Virtual reality and augmented reality
It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.

Charles Darwin
The faster time moves, the faster time moves.
Past to present

- Current EHR systems are built on technologies that date 40 years ago
  - Epic – 1976
  - Cerner – 1983
- Large, expensive mainframes dominated
  - Transitioning to Personal Computers, Portals, Servers
- Clinicians mostly unhappy with EHR systems
- EHR data difficult to access for secondary use
- Medical errors result in preventable deaths > 100,000/yr
- Specialization impossible
The present

- Hospital dominated
- Hospital Information Systems
- Higher revenues with sicker people
- Most care delivered in hospitals and clinics
- Reimbursement drives everything.
- Clinical data largely unstructured, poor quality, incomplete and inconsistent.
- Local terminologies dominant.
Today’s wrong approaches

• We deal with each problem as a single, isolated problem rather than looking at the broader setting.
• We spend most of our time in a work-around rather than solving the problem.
• We address problems with solutions that are already out of date.
• We provide multiple different solutions then spend even more time in trying to harmonize the multiple solutions.
• We start with what we know and have, rather than looking for the best solution.
• We ignore the hard problems.
Current initiatives in health informatics

- Cybersecurity
- Population Health
- Precision Medicine - individual variability
- Big Data for knowledge extraction
- Predictive Analytics
- Artificial Intelligence and Decision Support
- mHealth
- Consumer Involvement
- Pragmatic Clinical Trials replacing RCT
- 3D Printing
Data Sharing becomes the norm

- Federal grants require plan for data sharing.
- Patient-Centric EHRs
- Creation of Big Data
- Creation of national and global data registries
- Health Information Exchanges

- Organizations unable to share patient data will find it very difficult to improve quality and avoid financial penalties under value-based care.
- Unique and universal patient identity becomes mandatory for error-free aggregation of data.
- Success depends on interoperability.
Interoperability is key to the success of population health efforts that support the transition to value-based healthcare and, what’s more, organizations unable to share patient data will find it very difficult to improve quality and avoid financial penalties under value-based care. Interoperability is, in fact, at the root of all healthcare reform initiatives.
What does it require?

• Requires a level of collaboration and cooperation that does not exist today
• Acceptance and acknowledgement of contributions from others; sharing
• Working beyond our inherent competitive nature; moving from a local perspective to a national perspective to a world perspective
• Look for an existing solution; don’t reinvent the wheel
• Requires an answer to what can I do with HIT that I cannot do without HIT.
Enablement

• Aggregated across all sources for each person
  – Accessible across all of health care
  – Interoperable connectivity, usability, understandability
  – Same patient identifiable across all sources
  – Temporal integrity

• High Quality
  – Complete
  – Consistent
  – Trustable

• Challenges
  – Data collection
  – ROI for collecting the required data
Barriers that must be overcome

- Semantic interoperability
- Patient identity across multiple heterogeneous databases
- Resolving privacy issues, yet uniquely identify persons to permit constructive interventions
- Accommodating large and small healthcare settings
- Accommodating a variety of clinical settings – inpatient, outpatient, nursing homes, skilled nursing, …
- Create both public and private partnerships
- Governments at city, county, state and national levels
- Create business case that demonstrate true value to all participants
Value of Technology

• Data and outcomes available for the understanding of the effects of treatment and for the extraction of knowledge
• Through measurement, a better understanding of cause and effect
• Identification of all factors involved in impacting disease and quality of life
• Creating models that will better predict the cost of health care
• More rapid identification of candidates for clinical trials
• Quicker determination of global adverse drug events
• Quicker awareness of disease outbreaks
Nothing is the same …

• Keeping up with technology
  – Recognizing change is continuous
  – Design to accommodate change
  – Define what is required and find appropriate technology to achieve
  – Culture disruptive innovation and vision
  – Never accept “We don’t do it that way.”
  – Never accept “You can’t do that because …”
  – Believe anything is possible. It just may take a little more time.
  – Don’t be bound by the present.
Keeping up …

• Continual discovery of new knowledge through observation, pragmatic clinical trials, analytics, none-hypothesis (self defining) based research
• Immediate use of new knowledge in patient care
• Application of knowledge to data creates information
• Information
Health Indicators

How do we introduce these new kinds of data into the workflow and decision making?

For the first time in generations, life expectancy has plateaued and is declining. Much of this rising mortality is attributable to determinants of health not readily addressed by the health care system.

Karen DeSalvo
Patients become empowered

- Patients, consumers, citizens or whatever we wish to call them are having an influence in health and healthcare.
- Patients have access to their data.
- Patients are more sophisticated.
- Patients better understand their diseases and want to play a role in their treatment.
- Life is lived outside the healthcare environment.
- Data collected and analyzed in real time becomes more responsive.
- Patients want to push this data back into their EHR.
New Voices ...

- Forty percent of health care executives and clinicians said that in five years, patient-generated data will become a top health data source and genomic data will be one of the most useful sources of data, according to a survey from NEJM Catalyst.
- “Googling” has opened the knowledge and understanding of disease for the non-professional to change the communication between physician and patient.
- Social media and such groups as “Patients like me” have the power to change the system.
The Age of the Patient

- Patient reported outcome
- Wearable sensors
- Mobile devices
From sick care to health

- Reimbursement focus shifts from fee-for-service to accountable care.
- Healthier patients bring highest returns.
- Hospitalization cost money. Keep people out of hospital.
- Focus on behavioral health – good health habits - nutrition, exercise, no smoking, responsible drinking, safe driving, etc.
Consequences

• It will cost more to be sick.
• Patients will seek care outside of hospital and clinics.
• Technology will enable interactions with persons in their home.
• Except for a few major academic health centers, most hospitals will become much smaller or disappear. They will be replaced by small Emergency Centers.
Value Proposition

• More complete data about a patient
• Pragmatic clinical trials with millions of patients and less cost
• Rare diseases become less rare.
• Better understanding of outcomes

• Requires common data element set
• Requires high quality data
• Requires interoperability
Wearable devices

• Collecting data with high quality and consistency is one of the biggest challenges we face.
  – Solution – automate the process
  – Initial steps – wearable sensors

• My Duke EHR has data about me only once or twice a year. But I generate data constantly outside the system. First indications of change in my health status will happen in and on my body.

• Rather than “Give Me My Data” – I want “Take My Data and Intervene When Appropriate.”
Mobile Devices

• The ubiquity of smart phones has changed communications between and among groups. A virtual visit is becoming competitive with an office visit.

• Smart phone apps can be used for data collection by text, check boxes, and photographs with sufficient resolution to make clinical diagnoses in many areas such as dermatology.

• Smart phones can be used for education.

• Smart phones can be used for behavior modification.
Mobile Health

• The increasing motivation for consumer engagement and service-oriented applications is giving rise to new initiatives carrying the label of iApps.
• SMART on FHIR is providing the standards, the publicity, and the examples.
• Apple, Google, and Microsoft along with many others are entering this field and are creating both a market and repository for iApps.
• 21st Century Cures Act is about the development of iApps
The scope changes

As movement to ubiquitous EHRs becomes the norm, data sharing became goal.
  - Interoperability became the Holy Grail
    - Data interchange standards
    - Common data representation
  - Patient-centric EHRs
  - Health Information Exchanges

Predictive analytics should guide business decisions

Major impact on workflow
  - Making decisions on data from elsewhere?
Changing to the new

• How do we keep up with changing technology?
  – New concept and role for the EHR
    • EHR’s sole function is data in, data out
    • EHR data structure optimized to find the value of any data element as well as to know immediately if that data element has never been collected.
    • All other functionality is external to the EHR but must be interoperable with content
  – Functionality supports a changing technology and accommodates domain preferences.
  – Access to data, as appropriate, is enhanced.
  – Movement to the cloud

Duke Center for Health Informatics
Overwhelmed?

• Clinicians make informed decisions about 10% of the time. Missing data, dirty data, confusing knowledge, changing knowledge, conflicting literature, past teachings, personal experiences all contribute.

• The amount of data now available for decision making far exceed the ability of a human to make those informed decisions.

• Humans repeat errors
The Second Machine Age

- Machine Learning
- Artificial Intelligence
- Cognitive Computing
- Deep Learning

Everybody's doing it
- Google
- Apple
- Amazon
- IBM
- Microsoft
- Many Others
Robots
The art of the future possible

• The volume of data, the variety of data types, the increasing wealth of knowledge, and the ability to track disease and comorbidities from start to finish will overpower the ability of humans to make informed decisions about health and health care.
• Computers will not only become the decision makers but will carry out the decisions directly.
• The role of the human clinician will change to being an interface between computers and patients, and that may only be a temporary step.
• Humans will be replaced.
• The future deserves the best of health and healthcare that we, technology, policy, innovation, and disruption can provide. That is our goal, and that is our strategy.
• What ever the future, it is constantly changing. We must change as well.
• The future is closer than ever before, and we must plan accordingly.
• Modularity, technology neutrality, and sharing thoughts and ideas may be keys to survival.
• The world is changing and we must change with it.
• Resistance is futile.
Thank you!