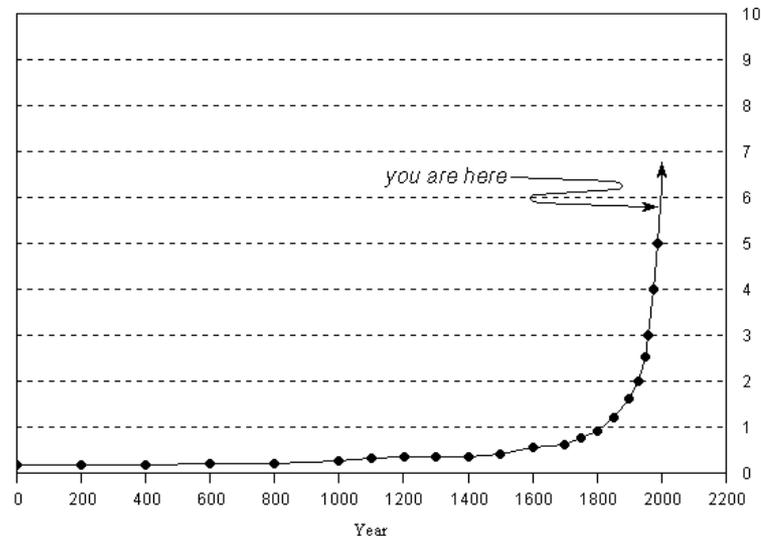


CHANGE ...

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

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- We address problems with solutions that are already out of date.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 start with what we know and have, rather than looking for the best solution.
- We ignore the hard problems.
- We accept “You can't do that” or “it's impossible.”

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

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.

What does this mean for HL7 International?

- Global or international?
- U.S. vs the rest of the world?
- Creating standards vs implementing them
- What about the users? How do we engage?
- What new areas must we consider?
- How do we decide what new standards are needed?
And then, who should do them?
- Do we need new partnerships?
- How do we keep the dialogue going?

Data Sharing

- 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

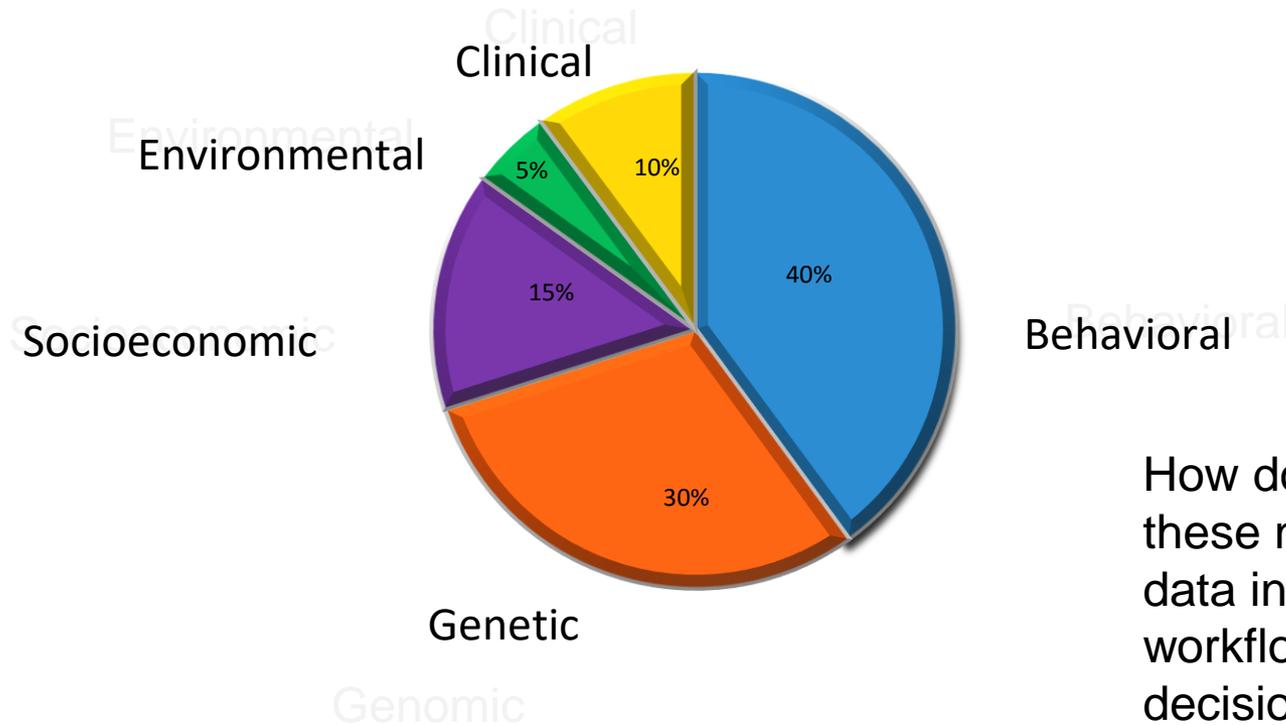
Nothing is the same ...

- 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?

Source: McGinnis JM, Williams-Russo P, Knickman JR. The case for more active policy attention to health promotion. Health Aff. (Millwood) 2002;21: 78-93

Patients become empowered

- Patients, consumers, citizens or what ever we wish to call them are having an influence in health and health care.
- 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.

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

The Age of the Patient

- Patient reported outcome
- Wearable sensors
- Mobile devices



A screenshot of a mobile application interface showing heart rate data. The title is "Heart Rate All Recorded Data Edit". The data is presented in a list with a heart icon, the heart rate value in bpm, and the date and time. The bottom navigation bar includes icons for Dashboard, Health Data, Sources, and Medical ID.

bpm	Date/Time
65	May 19, 07:28
66	May 7, 08:20
70	May 6, 20:41
66	May 5, 20:32
64	May 3, 08:40
59	Apr 30, 19:51
61	Apr 28, 21:12
62	Apr 27, 20:40
51	Apr 25, 17:56

A screenshot of a mobile application interface showing blood pressure data. The title is "All Recorded Data Edit". The data is presented in a list with a heart icon, the blood pressure reading in mmHg, and the date and time. The bottom navigation bar includes icons for Dashboard, Health Data, Sources, and Medical ID.

mmHg	Date/Time
120/55	May 19, 07:28
103/53	May 7, 08:20
111/67	May 6, 20:41
108/54	May 5, 20:32
121/68	Apr 30, 19:51
121/69	Apr 28, 21:12
125/65	Apr 27, 20:40
120/77	Apr 25, 17:55
122/66	Apr 11, 20:01

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

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

Overwhelmed?

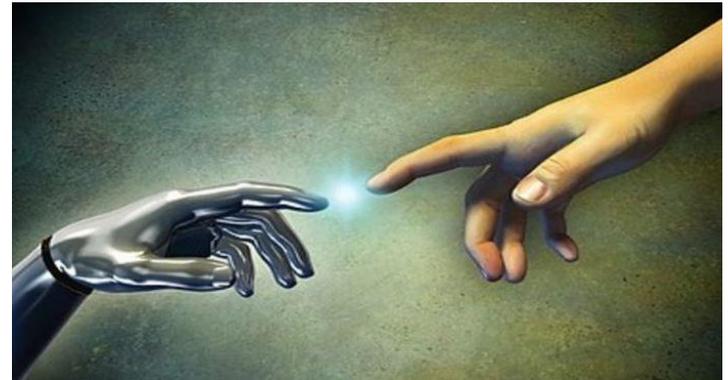
- Clinicians make informed decisions about 10% of the time. Missing data, dirty data, confusing knowledge, changing knowledge, conflicting literature, past teachings, personal experiences all contribute.
- The amount of data now available for decision making far exceed the ability of a human to make those informed decisions.
- Humans repeat errors

The Second Machine Age

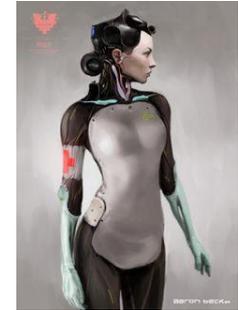
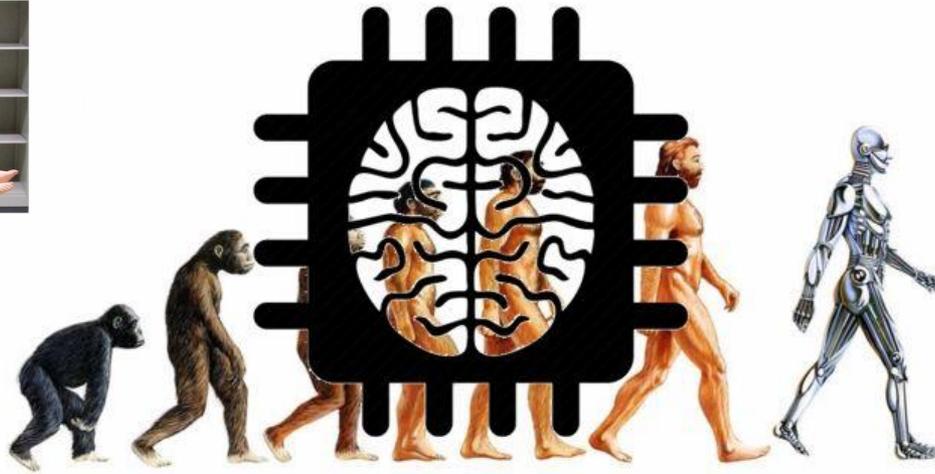
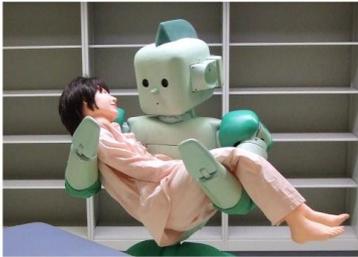
- Machine Learning
- Artificial Intelligence
- Cognitive Computing
- Deep Learning

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 co-morbidities from start to finish will overpower the ability of humans to make informed decision 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!