Decision Support Project Team

Engineering the System of Healthcare Delivery

ESD.69, HST.926j, HC.750  MIT Seminar on Health Care Systems Innovation
Fall 2010
Engineering IT for actionable information and better health

Author: Jenny Son
Engineering information technology for actionable information and better health

- American Recovery and Reinvestment Act (ARRA) of 2009
  - Achieve widespread implementation of electronic health records across the land and assure that they achieve sufficient levels of meaningful use to improve care, reduce costs and result in better outcomes

- Most likely government will take a top-down approach to setting standards

- Need for a more skilled workforce capable of using informatics – clinicians, managers and informaticians

- Sufficiently robust infrastructure (computer-based standards, databases, and organizational structures) to accommodate changes over time

- Two sets of content: 1) Information such as facts and treatment guidelines, 2) Communications needed to meet practice standards.
  - Simple exchange of information does not ensure that information was accurately communicated. *How* it is communicated is important
• Role of IT and information systems is to take records and integrate them in a way that a learning organization is created and supported
  – Clinicians and patients determine situations in which a given care protocol is adopted by all providers as the standard
  – Secure web portals that allow patients and clinicians to communicate directly with one another: appointments, the problem list, medications, allergies and/or reactions, test results, demographic and insurance information, and educational materials

• How best to accomplish better care outcomes through the use of such information
  – Measuring performance to improving actual performance through tools such as Clinical Decision Support for both clinicians and patients
  – Translational Bioinformatics – molecular medicine based upon one’s unique biology

• Barriers to rolling out such a comprehensive and integrated system
  – Dysfunctional attitudes and habits, costs, privacy, lack of standard definitions, lack of interconnectivity / interoperability standards, lack of actionable decision support with equal access from clinicians, managers and patients
Electronic Health Records (EHR)

Author: Ralph A. Rodriguez
Electronic Health Records (EHR) as a Foundation

- **Title XIII**
  - $2B to the Office of the National Coordinator for Health IT to develop foundation necessary for broad adoption of EHRs

- **Title IV**
  - $23B in Medicare and Medicaid financial incentives to providers who are Meaningful Users of certified, interoperable EHRs (first payment year FY 2011)

Lots of $$$ but will it work?

Technology Adoption

Transformational Change in Health Care Delivery & Population Health

American Recovery and Reinvestment Act (ARRA)
An Overview of the National Strategy

Adoption ➔ Meaningful Use ➔ Outcomes

- Meaningful Use definition and incentives
- **EHR certification criteria and process**
- Data, exchange, and quality measure standards and process
- Privacy and security standards, practices and policies
- Provider implementation support (extension centers)
- Exchange implementation support (State HIE/NHIN)
- Workforce development
- Beacon Communities
- HIT Research Centers

Source: Ralph A. Rodriguez, Fellow MIT/HMS 922
John P. Glaser, PhD., Vice President and CIO
Partners HealthCare
March 4, 2010
## Examples of Meaningful Use

| Maintain an up-to-date problem list of current and active diagnoses | At least 80% of patients seen or admitted have at least one entry |
| Record smoking status for patients 13 and older | At least 80% of patients seen or admitted have “smoking status” recorded |
| Send reminders to patients per patient preference for preventive/follow-up care | Reminders sent to 50% of all patients seen that are over 50 years old |
| **Provide patients with an electronic copy of their health information** | At least 80% of patients who request an electronic copy are provided it within 48 hours |
| Provide summary of care record for each transition of care or referral | Summary provided for at least 80% of all transitions of care or referrals |
| Capability to provide electronic syndromic surveillance data to public health agencies | Perform at least one test of capacity to provide such data |

Source: Ralph A. Rodriguez, Fellow MIT/HMS 922  
John P. Glaser, PhD., Vice President and CIO  
Partners HealthCare  
March 4, 2010
Levels of Exchange Supporting Meaningful Use

- **Level 0**: Paper/Fax only
- **Level 1**: Simple direct communication of patient data for authorized care among providers who may not have a prior trust relationship
- **Level 2**: Standards-based simple direct communication of patient data between providers and portable patient record
- **Level 3**: Standards-based complex communication, including universal patient data lookup and access across complex networks
- **Level 4+**: Standards-based complex communication, including universal patient data lookup and access across complex networks

Source: Ralph A. Rodriguez, Fellow MIT/HMS 922
John P. Glaser, PhD., Vice President and CIO
Partners HealthCare
March 4, 2010
EHR Adoption in Physician Office Practices

Image by MIT OpenCourseWare. The relatively high use of automation techniques represents an imbalance in the health care information technology portfolio.
A new scale and view of capabilities would solve the imbalance of HIT focus.

Future Integration of EHR

A future framework is needed!

Image by MIT OpenCourseWare. The personal health record aggregates information from health care entities, and provides patient control of their health data. Source: Rouse, W.B. and D.A. Cortese, eds. Engineering the System of Healthcare Delivery. Institute of Medicine Press, 2009.
END

Supporting Material
Next-Gen Visualization of EHR

In short, the paradigm shifts from thinking of the electronic health record as a by-product of automating practice — to thinking of it as a visualization of signals accumulated across scales of biology, time and geography. Table 1 summarizes this shift.

<table>
<thead>
<tr>
<th>OLD</th>
<th>NEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>One integrated set of data</td>
<td>Sets of data from multiple sources</td>
</tr>
<tr>
<td>Capture data in standardized terminology</td>
<td>Capture raw signal and annotate with</td>
</tr>
<tr>
<td></td>
<td>standard terminology</td>
</tr>
<tr>
<td>Single source of truth</td>
<td>Current interpretation of multiple</td>
</tr>
<tr>
<td></td>
<td>related signals</td>
</tr>
<tr>
<td>Seamless transfer among systems</td>
<td>Visualization of the collective output of</td>
</tr>
<tr>
<td></td>
<td>relevant systems</td>
</tr>
<tr>
<td>Clinician uses the computer to update</td>
<td>Clinician &amp; patient work together with</td>
</tr>
<tr>
<td>the record during the patient visit.</td>
<td>shared records and information</td>
</tr>
<tr>
<td>The system provides transaction-level</td>
<td>The system provides cognitive support</td>
</tr>
<tr>
<td>data</td>
<td></td>
</tr>
<tr>
<td>Work processes are programmed and</td>
<td>People, process and technology work</td>
</tr>
<tr>
<td>adapt through non-systematic work around</td>
<td>together as a system</td>
</tr>
</tbody>
</table>

May 13, 2009
Stead, Electronic Health Records

The Future Direction of EHR/EMR Meaningful Use

2009  2011  2013  2015

- Improved outcomes
- Advanced clinical processes
- Data capture and sharing

Source: Mass Health Data Consortium - Meaningful Use Workgroup Presentation, July 16, 2009
# Quality Measures

| Physicians | - Core quality measures  
|            |   - Smoking status  
|            |   - Blood pressure  
|            |   - Drugs to be avoided by the elderly  
|            |   - Set of 3-5 specialty-specific measures |
| Hospitals  | - Forty-three measures (currently submitting 9) |
EHRs Must Support Standards

<table>
<thead>
<tr>
<th>Problem List (ICD-9-CM or SNOMED)</th>
<th>Patient summary (HL7 CDA R2 CCD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab orders and results (LOINC)</td>
<td>Prescriptions (NCPDP SCRIPT 10.6)</td>
</tr>
<tr>
<td>Units of measure (UCUM)</td>
<td>Quality reporting (CMS PQRI 2008 Registry XML)</td>
</tr>
<tr>
<td>Medication List (RxNorm)</td>
<td>Submission to public health agencies (HL7 2.3.1)</td>
</tr>
</tbody>
</table>
Evidence-based Medicine

Author: J. Michael McGinnis
Background Statistics

- US Infant Mortality = 29\textsuperscript{th} in the world (6.3 deaths/1000 live births); Sweden = 2.8
- Increase in US Obesity, Diabetes, Alzheimer’s cases
- 27\textsuperscript{th} and 30\textsuperscript{th} world ranking in life expectancy for men (75) and women (80), respectively.
- WHO ranks US as 37\textsuperscript{th} in overall healthcare system performance
- US spends $2.5 Trillion/year on Healthcare
  - 16% of US GDP; 50% higher than second place (Switzerland)
  - Avg 6% increase in health prices in 2008-2009 timeframe
  - Increasing cost is burden for households, business, govts
  - Studies show that 30% of services do not improve patient outcome.
  - 50,000 - 98,000 preventable deaths
Some Current Health Care System Failures

– Minimally documented, unjustified, and wasteful variation in practices
– High rates of inappropriate care
– Unacceptable rates of preventable care associated with patient injury and death
– Inability to “do what we know works” practices
– Healthcare delivery inefficiencies leading to substantial waste and increasing costs
Evidence Based Medicine (EBM)

• Focus on improving the effectiveness and efficiency of health care
• Transition from Intuition based to Evidence based practices
• Evidence Based Medicine
  – The use of medical decision rules based on larger knowledge and evidence based data
  – Key advantage is systematic feedback to improve the knowledge base for decisions and practices.
  – Potential application of Engineering practices/ Scientific Method for continuous learning development
Institute of Medicine (IOM)

• Goal is to foster the evolution of a learning healthcare system that delivers the best care every time and improves with each element of the care experience.
  • Apply the best evidence of collaborative health care choices for each patient and provider
  • To drive process of discovery as a natural outgrowth of patient care
  • To ensure innovation, quality, safety and value in healthcare.

• Learning-driven care
• Care-driven learning
• Best practices every time
• Clinician as steward
• Patient at the center

• Seamless cycle feedback
• IT based knowledge engine
• Clinical data as a public trust
• Trusted scientific intermediary
• Networked leadership
Examples of Engineering and Scientific Concept Applications to Healthcare

- Systems approach: Predictive modeling, Operations Research, Lean practices to reduce waste
- Engineering data management systems to generate new and quicker perspectives to inform decisions
- System design using the 80/20 rule
- Design for Safety
- Mass Customization
- Continuous Flow
- Production Planning
Introduce Cultural Changes

• Emphasize continual learning process on the grander scale
• Addressing clinical complexity across the entire context
• Changes in decision making process, payment mechanisms and care planning
• Management of clinical data systems
• Transition from “silo” to “systems” thinking and treatment approach.
• Developing more robust capacity of knowledge management in learning system
• Improving systems for care delivery via team versus individual practitioners
Reform Examples in Healthcare

• Veteran’s Health Affairs
  – Historical issues with fragmented, expensive care with accessibility and unfocused on individual patient needs
  – Reforms include
    • Accountable structure
    • Integration and coordination of services across domains
    • Improve and standardize quality of care
    • Modernize information management
    • Align system’s finances with desired outcomes

• Ascension Health
  – Health care that works
  – Health care that is safe
  – Health care that leaves no one behind
IOM Factors for EBM

- Patient Experience
- Delivery of established best practices
- Allowance for tailored adjustments
- Non linear learning process
- Systems Thinking mentality
- Focus on Team work rather than individual practitioner
- Performance transparency and feedback used as improvement drivers
- Expect individual performance errors, perfection in systems performance
- Align awards on continuous improvement
- Facilitate the partnership between engineering and healthcare
- Foster a leadership culture, and style that reinforces teamwork and results.
Transforming healthcare through patient empowerment
Need for patient-centric healthcare system

- **Problem:** Buying poor value in current healthcare system
- **Cause:**
  - misaligned incentives due to fee-for-service (FFS) payment system for physicians with insurance-based financing care
  - knowledge imbalance between physicians and patients is linked to how a physician earns income in a FFS environment
- **Solution:** patient-centric healthcare can control cost while improving quality
  - more is **not** better: physicians should aim to use care most efficiently
  - patient-centric approach to both decision making and to movement of information for care management
  - patients should be empowered to make decisions, acting in their own self interest
  - shift away from financial reimbursement and provider business process management to patient care management
  - can do this through stepwise models
Basic, Patient-Centric Model

Patient's Outcome

Patient's Post Treatment State

Diagnostic Testing

Choice of treatment

physiology & pathology

Patient's Values

Demography, Symptoms, Heredity, Environment
Patient + Physician + Payer Model

- **Payers Outcome**
- **Patient's Outcome**
- **Physician's Outcome**

**Payers Costs**

**Testing**

- **Patient's Post Treatment State**
- **Physician's Post Treatment State**

- **Payer Policies and Controls**
- **Demography, Symptoms, Heredity, Environment**

- **physiology & pathology**

- **Choice of treatment**

- **Physician's Perceptions of Patient Values**
- **Patient's Values**
Aligning Physician and Payer Interests

- Payers Outcome
- Patient's Outcome
- Physician's Outcome

- Payers Costs
- Patient's Post Treatment State
- Physician's Post Treatment State

- Testing
- Choice of treatment

- Physiology & pathology
- Demography, Symptoms, Heredity, Environment

- Patient's Values
- Physician's Perceptions of Patient Values
Consumer Driven Healthcare System

Payers Outcome

Payers Costs

Testing

Patient's Outcome

Patient's Post Treatment State

Family Unit Outcome

Family Unit Post Treatment State

Choice of treatment

Family's Values

Family Education by Physician and others

Family Knowledge about Medical Options

Demography, Symptoms, Heredity, Environment

Physiology & pathology

Testing

Payers Costs

Patient's Outcome

Patient's Post Treatment State

Family Unit Outcome

Family Unit Post Treatment State

Choice of treatment

Family's Values

Family Education by Physician and others

Family Knowledge about Medical Options

Demography, Symptoms, Heredity, Environment

Physiology & pathology
Objectives for the Future

- Diagnostic tests and treatments chosen must capture a patient’s physiology and values so that expected utility is maximized.
- Best choice for individual must be represented.
- Conflicting objectives of other parties (payers, physicians, etc) impact the choice of treatment and reduce patient-centeredness of decision making --> reducing quality of medical decisions.
- Therefore, strategies to control costs should do minimal harm to patient centeredness.
- I.E. Difference between the expected utility under a patient centric model and the policy implemented.
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