Health Information Technology

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Lecture Outline

• The Big Picture
  • Major Types of Systems
  • Clinical vs Research Systems

• Drivers of System Functionality & Design
  • Now and in the Future

• Research vs Clinical Data
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Big Picture: Generations of HIT

- **Integrate**
  - Biomedical Equipment with EMRs
  - Patient Data Across Disciplines

- **Connect**
  - Providers with Providers
  - Patients with Patients
  - Phenotype & Genotype

- **Enhance & Enable**
  - Quality of Care
  - Safety
  - Efficiency
  - Compliance
  - Patient & Doctor Satisfaction

1. Collect Data for Review
2. Modular Systems
   - CPOE
   - Data Collection Tools
3. Local Workflow
   - Interfaces
   - Reporting
4. Enterprise Workflow
5. Information Exchange
   - Mobility
   - Portals
   - Research
Translational Informatics

- Patient Encounter
- Clinical Data
- Interfaces
- Knowledge Management
- Knowledge

Shared Semantics (Terminology/Vocabulary/Ontology)

- Expert Systems/CDS
- Clinical Guidelines
- Research

Modified from: Chris Chute, Mayo
Major Types of Systems

- Biomedical Devices
- EHR
- Clinical
  - Instrumentation

Revenue Cycle
- Practice Management/ADT
- Claims Processing
- Clearinghouse

Research
- Corporate Systems/Infrastructure
- Research Devices
- Data Collection

The Patient
Some Drivers of Current System Structure

- Technology: What we can do easily.
- Ownership: Who bought the system.
  - Intent: Why was the system purchased.
- Provider (& Payer) Incentives:
  - How are doctors and hospitals paid.
    - Fee for Service vs Prospective Payment
    - Who gets paid more than whom.
  - What is expensive/valuable.
- Vendor Incentives
  - How can vendor maximize their profit.
- Regulation: What functionality is mandated.
- Legacy: Which systems came first.
Some Drivers of Future System Structure

• Technology: Entering the Exabyte Era
  – Big Data: Volume/Velocity/Variety
  – Medical: Genomics, Imaging, Personal Digital Exhaust
    • Limits in Personnel & Expertise/Cost
  – Non-Medical: Moore’s Law: Storage, Compute, Bandwidth
    • Limited by energy costs/carbon emissions?

• Ownership: Patient/Provider/Payer/Intermediaries

• Provider (& Payer) Incentives:
  – Health Care Reform: ACOs, Medical Home
  – Rewards for Bigness: But is bigger better?

• Vendor Incentives
  – Open Systems vs “Walled Gardens”

• Regulation: Mandates? Incentives? Invisible Hand?

• Legacy: More of it and more complex than ever?
Translational Data Gap

Research Data
- Reliable
  - Collected by protocol
  - Precise
  - Structured
  - Coherent
  - Complete
- Valid
  - Tested
- Hyperspecific

Clinical Data
- Unreliable
  - Quasi Random
    - Patient driven not protocol
  - Inconsistent
    - Detail
    - Structure
    - Completeness
- Impressionistic
- Context Dependent
- Holistic

Modified from: Chris Chute, Mayo
Billing Data: The Center of the Medical Universe

• Reliable?
  – Collected by protocol of sort
  – Structured to a point
  – Relatively Complete

• Valid?
  – Imprecise
  – Biased by third party payment incentives

Modified from: Chris Chute, Mayo
Coming Soon:
Truly Patient Centric Data

- Mobile Devices
- Ubiquitous Wireless
- Physiologic Monitors
- Patient Portals
  - Digital Exhaust
  - Real Time Healthcare Interventions
  - Studies with an N of 1
- Who will aggregate the data?
- Who will analyze the data?
- Who will pay?
EMRs Need Structured Vocabulary

• Interoperability
  – Human <> Computers
  – Computer to Computer
• What we do: Procedures
• Why we do it: Diagnosis
• How we do it: Medications, Results, Orders,…
• Who…
• Where…
Reference Vocabularies Are Necessary but not Sufficient

- Synthesize knowledge from multiple settings and disciplines
- Classify knowledge and define “Truth”
- Require that all system map to that Truth
  - Elegant
  - “Correct”
  - Slow
  - Expensive
  - Impossible
Interface Vocabularies

• Cross-map between terminologies
• Focus on the Point of Care
• Fill gaps in reference terminologies
  – Gaps in content
  – Gaps in usability
  – Gaps in technical implementability
• Usable now - Removable later
Some Important Terminologies and Standards in Medical IT

- ICD-9,10 (International Classification of Diseases)
- SNOMED (Systematized Nomenclature of Medicine)
- AMA CPT (Current Procedural Terminology)
- RxNorm
- LOINC (Logical Observation Identifiers Names and Codes)
- NDC (National Drug Code)
- HL7 (Health Level 7)
- RadLex
Some Important Terminologies and Standards in Clinical Trials

- CDISC: Clinical Data Interchange Standards Consortium
- BRIDG: the Biomedical Research Integrated Domain Group
- OCRe: the Ontology of Clinical Research
- ERGO: the Eligibility Rule Grammar and Ontology
- HSDB: the CTSA Human Studies Database
- LexGRID: a distributed network of terminological resources
  – HL7 Common Terminology Services (HL7 CTS)
EpicCare with Enhanced Diagnosis Master-file Content

— Consider a patient with the following problem list:
  
  • Sclerosing cholangitis
  • Hepatitis C
  • CAD
  • Cluster headaches
  • Dizziness
  • Knee pain
Old ICD-9 Based View

![Old ICD-9 Based View](image)

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New Enhanced Terminology View
The Revenue Cycle

Four Interacting Flows

- **Patient Flow**
  - Identity
  - Location

- **Work Flow**
  - Who does what, where, and when.
  - How does the system support their work.
  - What does the system need from them to help them or others in the flow.

- **Data Flow**
  - Where does data come from, how is it captured, where does it end up, how is it translated (syntax and semantics)

- **Revenue Cycle**
  - How will payment be made and by whom. What data and transactions are needed to ensure payment.