Beyond Interoperability: Integrating Patient Care via the Healthcare Cloud

Dr. Mark Diehl
NYSDA Technology Taskforce

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Outline

- Interoperability
- Key Healthcare Changes and Impact
- Whole-Patient Care
- Patient Care Information and the Cloud
- How the Cloud Works
- Standard Healthcare Cloud Architecture
Interoperability

- What is it?
- What is its origin?
- Purpose?
- ONC Roadmap
- Problems
  - Industry Pushback - “Info Blocking”
  - Why?
    - Implementation cost?
    - Competitive marketplace?
Interoperability Problems

- Dan Haley, Athenahealth
  - Problem is the business model
  - Interface cost - $1 million initial
  - Annual maintenance - $500,000
  - Transaction cost - $2 to send a patient record to a different system

- Keith Boone - HL7 RnP project May 27, 2015
  - “What would you do with a 69 page C-CDA?”
  - Provider data overload.

- Is data capable of interchangeable operations?
Security Vulnerabilities

- DHHS OCR since 2009-
  - 1,100 separate breaches
  - PHI of >120 million people

- “...determine the database GUID, admin password and DTXUSER password ... using a wireless connection from a client's parking lot.”
The Real Failing

- A technology solution in search of a use
  - Shannon communication model
  - Does not consider how data are used

- The Systems Analysts’ solution
  - Start with what is being done
  - See the future – disrupt the ecosystem
  - Design and implement change

- Data exchange becomes an engineering problem
  - Benefit depends on best use in clinical and business practices
Key Healthcare Changes

- Aging patient population
- Care delivery patterns
- Technology advances
Key Healthcare Changes

- Aging patient population
  - Chronic disease
  - Multiple inter-related problems
  - Complex cases crossing traditional professional and specialty boundaries
Key Healthcare Changes

Care delivery patterns

- Growing for-profit care industry
- Employees vs. independent practitioners
- Care provider supply vs. demand
- Increasing regulation
- PCMH & Evidence-based Practice
- Increasing patient involvement in care decisions and consumerism
Key Healthcare Changes

- **Technology Advances**
  - Speed greater than our ability to adapt
  - Growth of health and biomedical information
  - Emerging Connected Health Environment
  - Democratization of Information
  - Greater access to Web information sources

[link](http://www.ecnmag.com/news/2014/08/educated-consumers-more-likely-use-potentially-unreliable-online-healthcare-information)
Impact of These Changes

- Increased need for reliable, useable information
  - Trans-profession, trans-specialty, whole-patient care
  - Managing health, not treating problems
  - Continuity of Care over time and location

- by
  - Care providers
  - Care recipients
  - Care administration, regulatory, finance, education and research users
Whole-Patient Care

- Integrating care of multiple specialists and professions

http://www.tedmed.com/greatchallenges/challenge/307

**Problem** - how to manage ongoing care of the total patient among multiple geographically separated care providers?

**Integrated, whole-patient care requires timely access to reliable information by all participants**
Timely Access to Reliable Information

- Example - Health History Information

- Solution – go to the care provider source

I'm allergic to penicillin.
If I came to see you, how soon would you know?
Case: 62 YOWM Petrochem Worker

- Hx - PCN, bee sting allergy; UCHD incl VCV @ <1 yr
- Occupational long term exposure to halogenated hydrocarbons and insecticides
- Type 2 Diabetic controlled w/ Metformin
- AFIB controlled w/ beta blocker and Ca channel blocker
- 2009 Dx - Multiple Myeloma; subsequent hosp - pneumonia
- 2010 stem cell transplant w/ chemo; 5 yr remission
- 2013 Shingles w/ PHN
- Expect job relocation from Newark to West Virginia
- What is the desired outcome?
- Who are the care providers?
- What are their information needs?
## Continuity of Care Maturity Model

<table>
<thead>
<tr>
<th>Stage</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 7</td>
<td>Knowledge driven engagement for a dynamic, multi-vendor, multi-organizational interconnected healthcare delivery model.</td>
</tr>
<tr>
<td>Stage 6</td>
<td>Closed loop care coordination across team members.</td>
</tr>
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<td>Stage 5</td>
<td>Community-wide patient record using applied information with patient engagement focus.</td>
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<td>Stage 4</td>
<td>Care coordination based on actionable data using a semantic interoperable patient record.</td>
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<tr>
<td>Stage 3</td>
<td>Normalized patient record using structural interoperability.</td>
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<tr>
<td>Stage 2</td>
<td>Basic system-to-system exchange of patient-centered clinical data.</td>
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<tr>
<td>Stage 1</td>
<td>Basic peer-to-peer data exchange.</td>
</tr>
<tr>
<td>Stage 0</td>
<td>Limited to no electronic communication.</td>
</tr>
</tbody>
</table>
Its All About Information

- Susannah Fox named CTO at HHS
  - Data focus - *Data Liberación*
  - Spotlight citizen initiatives
  - Nurture the entrepreneurial spirit

- "**Best use of information to improve and maintain the health and well-being of individuals and populations.**"
  - Definition of Health Informatics
Information Requirements

- Information used in whole-patient care must be:
  1. complete and accurate,
  2. relevant to the case at hand,
  3. available at the time and place it is to be used, and
  4. presented in a form best used by the individual decision maker.

Source: American Dental Association, Council on Dental Practice. COHR Concept Model v.1.0. Feb 1996.
Benefits of Accessible Information

- Medicare Emergency Care Costs
- South Carolina HIE
- February 2012 – January 2013
- 11 geographically separate emergency care depts
- 532 patients
- 231 care providers made 7,525 HIE log-ons
- Cost saving $1,947 per patient
- Hospital admission savings
  - 56 patients
  - Total = $551,282
  - Per patient = $9,844
An Analyst's Perspective

System Architecture Principle #1

“Form follows function”

Changes in healthcare drive changes in how we use information.

Data Form Follows Function

- How is data used in clinical care?

Process = diagnostic therapeutic process
Structure = people + technology + data

Donabedian
How Process and Structure Fit

- Donabedian Model is an IPO Model
- Structure elements are enablers and controllers

Understanding Function

- **Becomes a process hierarchy**
  
- **Process defines software actions**
  
- **Information is a control** - identifies what information is used to manage the process
  
- **Information is also an output produced by the process**
First Define What Not How

- What information is needed by any care provider, care recipient, other authorized user?
  - Depends on care delivery parameters
- Describe this information - size & structure, when & where it occurs
- Who/what is the source?
- What is the best approach to make needed information available?
Information Access Approaches

- Stand-alone
- Client-server
  - Workgroup/department/enterprise
  - Thin Client / Fat Client
- Application service provider
- Cloud Computing
What is Cloud Computing?

“A model for enabling convenient on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”


In English – Making information available anytime and anywhere you are connected to the Internet
Why Cloud Computing

- Cloud Services Provider delivers both applications and data

- **24/7 SUPPORT**
- **PAY PER USE**
- **LOW TCO**
- **DEVICE INDEPENDENT**
- **LOWER CAPITAL INVESTMENT**
- **ECONOMICAL**
- **SCALABILITY**
- **INCREASED RELIABILITY**
- **SECURE DATA STORAGE**
- **DATA + APPLICATIONS**
NIST Cloud Deployment Models

- **Private Cloud** - operated for and within a single organization, managed internally or outsourced

- **Community Cloud** - shared by several independent organizations; operated by a *Cloud Services Provider*

- **Public Cloud** - available to the general public or a large industry group; owned and operated by a *Cloud Services Provider*

- **Hybrid Cloud** - a combination of two or more of the Public, Private, and Community Clouds; organizations share a uniform technology for program and data portability
Healthcare Cloud Stats

- HIMSS ANALYTICS - 2014 Survey
  - 83% of healthcare organizations use cloud services
  - 67% use SaaS-based applications
- 55% of 2014 survey respondents use some form of cloud computing – KLAS Research
- 59% of practices use a cloud EMR – CDC National Center for Health Statistics, Jul 2012
- Global healthcare cloud – Markets & Markets
  - 2011 $1.7 Billion
  - grow to 2017 $5.4 Billion
Healthcare Cloud Typical Uses 2014

- Hosting Clinical Applications and Data - 44%
- Health Information Exchange - 39%
- Business Continuity / Disaster Recovery - 35%
- Host HR Applications and Data - 33%
- Host Operational Applications and Data - 28%
- Back Office Applications - 22%
- Managed Services - 22%
- Communications Services - 20%

“After decades of ignoring the cloud, Epic Systems Corp. reverses course by announcing the release of a massive cloud data center.”

Vendors
- Athenahealth - 50,000 customers
- EMC - hybrid cloud, EHR storage
- AMAZON - NetApp - **Data Fabric Architecture**
- GNAX Cloud - vCloud - private cloud
- ClearDATA, CareCloud, CECity, Medidata, Others …
How is all this relevant to patient care?

- How does data access and presentation impact the way care providers perform services?
- Provider resistance -
  - Not resisting the EMR concept but the implementation
  - Single EMR forces change in the way they practice
- Should we force all providers to use same data presentation and interaction?
- Is data privacy, confidentiality, security a data structure or a data use issue?
How To Architect The Solution

- Form follows function = Structure depends on use.
  1. Model the Processes - What Not How
  2. Model Information - People’s Use of Data
  3. Select an Infrastructure

- Questions -
  - Who needs access to what data?
  - When and where do they need access?
  - In what form do they need this data?
  - What constraints should limit their access?

- Removing roadblocks - give users choice of application and presentation
Removing Roadblocks

- Provide Flexible Application Mix
- Single standard EHR
Proposed Standard Healthcare Cloud Architecture

- Provides universal connectivity with user choice
Standard Cloud Components

- Application Delivery - secure HTML
- Data communication - Cloud Services Provider
  - HL7 FHIR
- Standard EHR
  - EHR Definition - “Body of data …”
  - ANSI/ADA 1000 structure
  - Identifiable + de-identified data
- Cloud Services Broker
### Standard EHR LDM Subject Areas

| 01 INDIVIDUAL                  | 17 ORGANIZATION HEALTHCARE MATERIEL ITEM |
| 02 INDIVIDUAL CHARACTERISTICS  | 18 PROVIDER HEALTHCARE MATERIEL          |
| 03 POPULATION                  | 19 PATIENT HEALTH FACTS                  |
| 04 POPULATION CHARACTERISTICS  | 20 PATIENT SPECIMEN                      |
| 05 ORGANIZATION                | 21 PATIENT OBJECT                        |
| 06 LOCATION                    | 22 POPULATION HEALTH FACTS               |
| 07 LOCATION ASSOCIATIONS       | 23 PATIENT DIAGNOSIS                     |
| 08 LOCATION CHARACTERISTICS    | 24 POPULATION DIAGNOSIS                  |
| 09 COMMUNICATION               | 25 PATIENT TREATMENT PLAN                |
| 10 HEALTHCARE EVENT            | 26 TX PLAN EXPECTED OUTCOME              |
| 11 HEALTH SERVICES PROVIDER    | 27 POPULATION OUTCOME REFERENCE          |
| 12 PROVIDER CREDENTIALS AND PRIVILEGES | 28 PATIENT HEALTH SERVICE     |
| 13 HEALTHCARE SERVICES         | 29 CLINICAL INVESTIGATION                |
| 14 HEALTH SERVICES OBJECTS     | 30 CLINICAL INVESTIGATION DESIGN         |
| 15 HEALTHCARE MATERIEL         | 31 CODES AND NOMENCLATURE                |
| 16 HEALTHCARE MATERIEL ITEM    | 32 REFERENCE TABLES                      |
Application – Accountable Care

- **Admin features include** -
  - Unique Person ID
  - Structurally de-identified PHI
  - Person characteristics

- **Clinical features include** -
  - Clinical facts, diagnoses, TxPlan, services provided
  - CPOE, CDS, EBP data support

- **Additional features** -
  - Materials management
  - Education, Research, Public Health data support
Application - Claim-Free Reimbursement
Additional Info

- Google – NIST, Cloud, PDF
- ANSI/ADA 1000 Source – Email standards@ada.org
- Vendor white papers
- Provider Guide to Cloud Computing Email markdata@aol.com
QUESTIONS

CLOUD COMPUTING
Interoperability?

THINK
DIEFFERENT
Dr. Mark Diehl is a licensed clinician with over 30 years experience in health informatics, IT management, and the architecture and development of HIT. His career included biomedical research in computer applications, HIT project and program management, executive roles, education and consulting. Dr. Diehl has a masters degree in Health Services Management and Computer Data Management, and an MPH in Health Services Administration. He is a nationally recognized leader in the health informatics standards community, was the principal author of seven American National Standards in health informatics, and has over 40 publications spanning areas of data analysis and architecture, system design, and automated biomedical technology.
Abstract

Among the changes shaping the future of healthcare are an aging patient population, evolving care delivery modalities, and technology advances. Whole-patient care for aging patients often involves coordinating complex and interdependent services among multiple care professions and specialties. Successful care coordination achieves benefits in improved care outcomes and increased efficiency of care delivery. Information interoperability was envisioned as facilitating this coordination, and with the advent of cloud computing interoperability is transforming into making information available to those who need it, on demand, any time, any place. A proposed standard architecture for the healthcare cloud has the potential to optimize performance and timeliness of information delivery, enabling improvements in both patient care outcomes and efficiency of care delivery.