Developing a Learning Health System

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Agenda

• Introductions
• The Learning Health System Vision
  – Larry Sitka, Founder of the Lexmark Acuo VNA
• Putting the Learning Health System into Action
  – Jim Forrester, University of Rochester Medical Center
• Closing Comments
• Q/A
The Learning Health System Vision
Connecting Health and Care for the Nation
A Shared Nationwide Interoperability Roadmap

FINAL Version 1.0
A Healthcare System

Today the U.S. system has a health care focus

Reactive Healthcare System

- The entire system is procedural-based
- Procedural-based reimbursement model
- Vendors build products based on procedures and not patient outcomes
- Healthcare means the patient is already sick. Are we too late in the process?

Proactive/Suggestive Health System

- Reimbursements based on patient outcomes
- Departments go from revenue generating to capital costs
- Roadblocks to entry are being eroded across localities
- We still have vendor lock and vendor block

A Proactive/Suggestive Health System is a Learning Health System

A Proactive/Suggestive Healthcare Content Management Platform for a Learning Healthcare System must exist

The world is teaching vendors we must focus on a health system
Patient’s Outcome is the Center of the Universe, Not the Product in a Learning Health System
What it is…
• An ONC proposed ecosystem comprised of providers and controlled by the patient.
• Creates new knowledge.
• Is supported by a wide variety of systems.
• Lexmark surrounds a chaotic HIT environment.

Characterized by…
• Continuous learning cycles
• A broad array of stakeholders
• Extends beyond the enterprise to external care contributors
• Supportive LIVE Infrastructure
The Learning Healthcare System maps well to Mature VNAs

**Learning Healthcare System**
- Build upon the existing HIT system
- One size does not fit all
- Empower individuals
- Leverage the market
- Simplify
- Maintain modularity
- Consider the current environment and support multiple levels of advancement
- Focus on value
- Scalability and universal access

**Mature VNAs**
- Can install under/over traditional PACS
- Interoperable now and into the future; Canonical data models
- Reduces complexity, eliminating vendor lock and vendor block
- Consolidates storage and improves its management
- Modular scalability; Adopts new technology and virtualization; Additional benefits emerge
- Savings helps offset investments
- Interoperability through certified standards
A Learning Health System and the Mature VNA

The foundation of a Learning Healthcare System is a Mature VNA

3 Year Agenda | 2015-2017
Send, receive, find and use a common clinical data set to improve health and healthcare quality

| 2015 | 2016 | 2017 |

6 Year Agenda | 2018-2020
Expand interoperable health IT and users to improve health and lower cost

| 2018 | 2019 | 2020 |

10 Year Agenda | 2021-2024
Achieve a nationwide learning health system

| 2021 | 2022 | 2023 | 2024 |

- Ability to acquire, send, find, receive. Canonicalization of content metadata
- Provides a means of perceived centralization of content (both storage and application)
- Data ownership by the healthcare organization. Ownership of the content on behalf of the patient

- Canonical data mapping not just inbound but outbound.
- Interoperability through standards
- Interoperability using secure and authorized Open Image Exchange for sharing
- Leverage the existing HIE and private networks
- All built around this new patient-centered health system
- PIX Manger Services

Today’s Mature VNA

Figure 10. Connecting Health and Care for the Nation: A Shared Nationwide Interoperability Roadmap – Version 1.0

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Industry Driver #1: Unprecedented Demand for Information

- **Analytics**
  - Define outcomes
  - Required by a Learning Health System
  - The next 1000+ concurrent users
    - ALWAYS ONLINE

- **BIG DATA**
  - Patient
  - Oncologist
  - Surgeon
  - Referring Physician
  - Radiologist
  - HIM
  - Physician

- **Scanned Documents**
- **Radiology/Cardiology Imaging**
- **Digital Pathology**
- **Genomics**

- **Zettabytes**
- **Exabytes**
- **Petabytes**
- **Terabytes**
Industry Driver #2: PACS Redefined

The Separation of the PACS Components (IHE Actors) into Enterprise Imaging

Viewing Component
- Diagnostic
- Clinical
- Specialized
  - Multiple sub specialties

Workflow Component
- Modality worklist
- Physicians worklist
- Exam state
- Dictation
- Credentialing
- Physician load balancing

Archiving (Content Manager)
- Secure storage, distribution, routing, canonical data models
- Migrations, PID resolution, SOA access
- Data security, data preservation, data separation
- All content location services (DICOM and other content)
Today’s Environment

Silos of vendor *locked* and *blocked* information

Cardiology/Radiology PACS

Other ‘ologies

ECM PDF, JPG, TIFF, TXT, .RAW

Custom Interfaces

Proprietary File Access

Individual Departmental Storage Silos

Vendor Lock? Vendor Block?

Multiple if any DR plan? PHI Exposure? $$$?
What’s Next for Interoperability in Healthcare

“21st Century Cures Act”

• Data Locking and Data blocking
• What are the consequences?
  – Lost MU certifications for the Vendor
  – Provider will have reduced reimbursements and ultimately complete loss.

SMART on FHIR as the platform to link apps to the EMR

“SMART HealthIT is the interface between healthcare data and innovation. The goal of SMART is audacious and can be expressed concisely: an innovative app developer can write an app once, and expect that it will run anywhere in the health care system. Further, that one app should be readily substitutable for another. When apps are substitutable, they compete with each other which drives up quality and down price. SMART and the “App Store for Health” model….\n
SMART®

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Open Content Exchange

Leverage Healthcare Content Management Apps to enable health information exchange between facilities

Secure Open Image/Content Exchange

Healthcare DURSA Governance Agreement
(Data Use Reciprocal Support Agreement)

- Media Writer
- PACS Scan
- Content Upload Service
- Content Download Service
- HCO A
- (Un)Affiliated HCO B
- VNA + ECM

- Content Upload Service
- Content Download Service
- HCO A
- (Un)Affiliated HCO B
- Enterprise Viewing
- Image Sharing

- Content Upload Service
- Content Download Service
- HCO A
- (Un)Affiliated HCO B
- Multifunction products (MFP)

Sending PACS
Receiving PACS

Enterprise Image Connectivity

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The Learning Health System

Implementation at the University of Rochester Medical Center
Monthly Image Volume

• Provides a metric that is understandable by C-Suite execs
• Useful for monitoring and trending –
  – Used to trend average images per study as compared to patient outcomes. As average image count per study increases, does diagnostic accuracy increase? Does turn around time of diagnostic read improve?
Monthly Image Volume

Total Images in Archive (VNA)
Image Access from EMR

• Provides a metric that is understandable by C-Suite execs
• Useful for understanding clinical workflow (referring provider)
• Useful for capacity planning
Foreign Image Ingestion

• Useful for understanding confirmation of “gatekeeper” functionality
• Useful for understanding trends and resulting implications
  • Such as consult load on radiologist for foreign studies
Foreign Image Ingestion

Foreign Film Studies

- Received
- Push to PACS
- Linear (Received)
- Linear (Push to PACS)
Foreign Image Ingestion

Enterprise Imaging Studies

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VNA Image Study “Prefetch”

- Useful for understanding customer\end user experience
- Useful for finding anomalous usage patterns
VNA Image Study “Prefetch”

Images “ Retrieved” from Archive (VNA) to Viewer Cache

- Ad Hoc Retrieval
- Prefetch Ortho
- Prefetch Rad
- Linear (Ad Hoc Retrieval)
- Linear (Prefetch Ortho)
- Linear (Prefetch Rad)
VNA Image Study “Prefetch”

Images Retrieved from Archive (VNA) to Viewer Cache
Create Historic Imaging Order Set
Create historic order load from VNA image study archive meta data
• Imaging studies migrated into UR Medicine VNA from foreign or internal archive
• Studies are modified for demographic information upon migration to match UR Medicine Epic demographics
• Upon migration a data extract is queried from UR Medicine VNA SQL database which includes study information such as modality type, exam code, exam date.
• This extract is converted to HL7 and fed into imaging downstream systems so that they can now readily access the imaging studies from VNA. Can also be fed into EMR as reportable order.
• This is a powerful tool for imaging study migration and consolidation
Image Study Viewed by Hour of Day

• Image study views in viewer
  • Grouped by hour of day and day of week
  • Average over 52 weeks
  • Diagnostic and enterprise combined data set
• Useful for understanding image study viewing patterns
  • Used to plan scheduled downtimes
  • Used to understand impact of unscheduled downtimes
Image Study Viewed by Hour of Day

Image Study Views By Hour

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Study Completed

- Imaging studies tech complete timestamp
  - Grouped by hour of day and day of week
  - Average over 52 weeks
- Useful for understanding imaging study acquisition patterns
Study Completed

Completed Studies By Hour
ED CT Data

- Similar to prior dataset but specific to trauma center ED CT acquisition
- Useful for understanding implications of planned and unplanned downtimes for ED trauma center
  - Demonstrates\confirms known ED encounter and usage patterns
- Useful to plan staffing for 3D\advanced visualization processing lab
ED CT Data

SMH ED CT Studies 2014 by Begin Time
ED CT Data

Total EDCT Volume 2014  Grouped by Hour of Day

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Questions

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