Lecture 26 April 2005

Data Integration and Analysis I: Medical Information Systems
DATA INTEGRATION AND ANALYSIS I

- Integration in the hospital environment
  - Imaging and information flow
  - Use of DICOM standard
  - The personal healthcare record
  - HL-7: the hospital standard for data interchange
  - IHE: Integrated Healthcare Environment
- The importance of use cases: York Hospital
- Adding metadata to medical records
  - DICOM Structured Reporting (SR)
  - Snomed
Information flow in health care delivery
Here’s a diagram of what is there today . . . .

- Admissions
- Primary Care
- Hospital Administration
- Radiology
- Laboratories

Semi-automated
Paper and film

Biomedical
Information
Technology
Integrating the hospital information entities

Devices
- MRI
- X-Ray
- CAT-Scan
- Ultrasound
- Electrocard.

DICOM Data

DICOM Data Repository

Services
- Radiology
- Pathology
- Cardiology
- Intensive Care
- Others

Biomedical Information Technology

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The personal **Electronic Medical Record (EMR)**

- Electronic Medical Record
- DICOM Data Repository
- Patient Treatment
- Patient Information
- Diagnostic Protocols
- Pharmacy and Other

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The enterprise healthcare system
Integrating Medical Imaging with a Person-Centric EMR

William “Buddy” Gillespie
Chief Information Officer

www.yorkhealth.org
1998

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Integrated Delivery Network

York Hospital

York Medical Group

South Central Preferred

Employers

Remote Clinics and Facilities

Home Healthcare Facilities

Electronic Medical Record

YHS NETWORK

Physician 1

Physician 2

Physician 3

Affiliated Physician Offices (PHO, MSO, HMO)

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Regional Affiliations

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York Health System Information Flows

Hospital
- EMR
- Medical Imaging
- Registration

Physicians
- EMR
- Pat Mgmt

Managed Care
- Tracking

Data Warehouse
- General Ledger
- Billing
- Registration
- EMPI

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Generation and storage of metadata

- **Diagnostic analysis**
  - Track and record changes to the image
  - Store results (see MS image segmentation)
  - Coding systems
    - HL-7
    - Snomed
    - ICD 9/10
    - UMLS

- **Structured Reporting**
  - Originated with DICOM
  - Is broader than DICOM
Diagnostic coding systems

- Long history of nomenclature attempts
  - ICD
  - DRG
  - Read Codes
  - Unified Medical Language System (NLM)

- SNOMED is the current most accepted standard

  “SNOMED Clinical Terms provides a common language that makes health care information accessible and usable, whenever and wherever it is needed, to improve health care across primary and specialty medicine settings internationally. Government entities and healthcare organizations in 28 countries have adopted SNOMED CT since its release in January 2002.” www.snomed.org

Hospital information coding systems

- **HL-7**
  - Started as simple set of transaction codes
  - Grew to some 3,000 tags with definitions
    - Current version 2.08, March 2005
  - Tags are a cumbersome way to enforce ontologies

- **HL-7 Version 3 is an object model**
  - Object model
  - Strangely silent since 2002
  - Had major effort and use cases; see handout

www.HL7.org
Metadata: viewing medical images

Diagram removed for copyright reasons.
Depiction of different views and functions on a given image: magnifying glass, window/level, zoom, pan, flip vertical/horizontal, invert, annotate.
A complex case at BWH, Harvard Med. School

- **Multiple sclerosis**

- **Design**
  - 100 patients
  - 20 time points/patient
  - Four 3-D MR images/time point
  - 60 GB raw data

- **Analysis**
  - Segmentation of 3-D images for lesions
  - Time course of lesions (another 40 GB)
  - Associated patient genetic database

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Advanced image processing architecture

- Component Sharing & Interoperability

Efficient Architectural Model:

- Image Database
- Memory Database

- Image Stream / Pipeline Processing

Efficient Execution Model:

= Edge (Gray (Sharpen ( )))

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Integration of metadata: An example of a Structured Report (SR)

Chest X-ray Report:
Observer: Clunie^David^A^Dr.
History: malignant melanoma excised 1Y
Findings:
- finding: multiple masses in both lung fields
- best illustration of findings:
Conclusions:
- conclusion: cannon-ball metastases
- conclusion: recurrent malignant melanoma
Diagnosis Codes:
- diagnosis: 172.9/ICD9
- diagnosis: 197.0/ICD9

Ref: David A. Clunie, DICOM Structured Reporting, PixelMed Publishing, 2000, p 30

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