Integrating the Healthcare Enterprise: IHE…. Background, Overview, and Radiology Status

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Disclosures

- Financial
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- Author
  Essential Physics of Medical Imaging

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Learning Objectives

- Provide an overview of the background, history, and process of Integrating the Healthcare Enterprise (IHE)
- Describe the space in which IHE functions and how stakeholders are involved
- Give examples of radiology profiles, actors, and transactions pertinent to the diagnostic medical physicist

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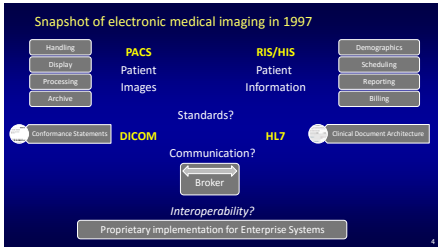

Background

- 1990's: RSNA instrumental in DICOM promotion / adoption; system interoperability required use of the HL7 standard
- 1997: Progress toward producing turnkey devices able to "plug and play" with existing standards– required definition of specific use-cases and specific architectures
- 1998: Engagement with the Healthcare Information and Management Systems Society (HIMSS) to establish momentum and direction for system *interoperability* — ….. the IHE effort was initiated

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Background

- Initially conceived as a 3 – 5 year project with the premise:
  - Annual cycle of proposed technical specifications
  - Testing of implementations occur at "connectathons"
  - Public demonstrations will demonstrate value
- Year 1:
  - Problem of *scheduling radiology workflow* from patient registration / ordering / scheduling … to … image acquisition / transfer / archival / distribution
  - Involved DICOM and HL7, with multiple devices (PACS, RIS, HIS)
  - 47 systems and 24 vendors were present at RSNA 1999

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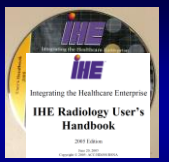
Background

- Year 2, Year 3, ……
- In 2005 there were 7 integration profiles
- In 2016 there are 21 integration profiles & 23 supplements for trial implementation (Radiology only)

Scheduled Workflow
Consistent Presentation of Images
Presentation of Grouped Procedures
Key Image Notes
Evidence Documents
Assisted Protocol Setting Option
Performed Procedure Step



- Project is ongoing and now in 17th year
- IHE is now a global organization spanning multiple domains

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IHE Domain Committees

IHE Integrating the Healthcare Enterprise
IHE International
Enable seamless and secure access to health information whenever and wherever needed.

www.ihe.net

IHE USA

www.iheusa.org

- Anatomic Pathology
- Cardiology
- Dental
- Endoscopy
- Eye Care
- IT Infrastructure
- Laboratory
- Patient Care Coordination
- Patient Care Devices
- Pharmacy
- Quality, Research and Public Health
- Radiation Oncology
- Radiology

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Integrating the Healthcare Enterprise

- Initiative by healthcare professionals and industry to:
  - improve the way computer systems in healthcare share information
  - promote the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs
  - enable care providers to use information more effectively in support of *optimal patient care*

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Integrating the Healthcare Enterprise: What?

- Establishes Technical Framework of Integration Profiles to meet critical interoperability needs
- Guides vendor implementation strategies
- Provides effective shorthand for use in purchase specifications
- Enables providers to use information more effectively from systems developed with IHE integration profiles
- Improves system communication and eases implementation

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Integrating the Healthcare Enterprise: How?

- Identify a set of *use-cases* requiring a common architecture
- Define an *Integration Profile* to support those use-cases
- Define a specific clinical use case
  - Determine clinical information and workflow needs
  - Address needs by set(s) of "actors" and "transactions"

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Integration Profile, Actors, Transactions, Connectathon

- *Integration Profile:* Precise description of how standards are to be implemented to address a specific clinical integration need, definitions of the clinical use case, and set of actors and transactions that address the need
- *Actor:* a system or application responsible for certain information or tasks, which supports a specific set of IHE transactions to communicate with other actors
- *Transaction:* exchange of information between actors, describing how to use an established standard (DICOM, HL7, W3C) to exchange information
- *Connectathon:* process to test implementations at a live, structured, multi-vendor event in a supervised environment

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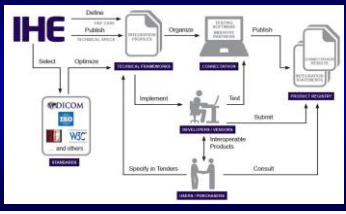
IHE process



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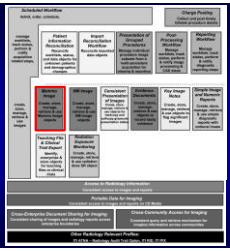
IHE profiles

Mammography Image



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Goal: Build IHE Mammography Image Profile

- Challenges:
  - Two types of image data
  - Different vendor attributes / image data
  - Common use of CAD
  - Importance of prior studies
  - Image size, orientation, layout
  - MQSA requirements (USA)

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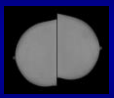
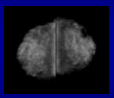
"For Presentation" vs "For Processing"?

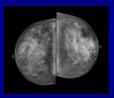
- Which image provides an equalization of the breast skin line?
- Which image is used by CAD in mammo?



Detector corrections, gain map corrections, no enhancement, ***"For Processing"***



Simple linear contrast & brightness corrections, *no advanced processing*



Skin equalization processing and non-linear enhancement ***"For Presentation"***

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Types of Image Data

- "For Presentation" image data
- "For Processing" image data
- Mammo CAD structured report

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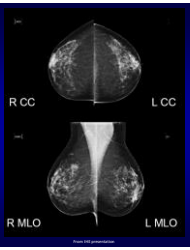
Hanging Protocols

- Determined by
  - View type (CC vs. MLO)
  - Specialty view type
  - Laterality
  - Patient orientation

Preferred layout



From DR presentation

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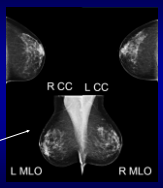
Hanging Protocols

- Generic image display
  - Series based
  - Image order as acquired
  - Image orientation as acquired

"PACS" layout

Stacked series



Carolyn Reynolds, IHE presentation

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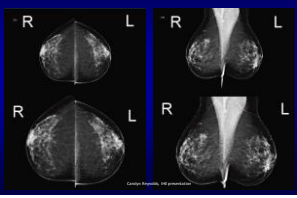
Variances in image size

- Typical "Fit to Viewport" effect



Carolyn Reynolds, IHE presentation

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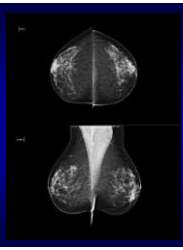
Recognizing tissue vs air

- Window / Level adjustments
  - Recognize skin line
  - Pad outside data to pre-determined value
- Maintain black air gap during window / level operations and inverted pixel data



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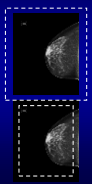
True size film printing

- Film size vs. detector size
- Precision with <2% error

24 x 30 cm

18 x 24 cm



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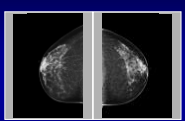
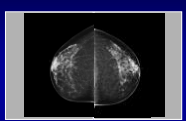
Printing: minimal borders at chest wall



Centered images



Images offset on chest wall side: Minimal borders

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Mammography Image: Integration via IHE

- Meets desire to have multiple FFDM vendors, and use any vendor's workstation for diagnosis
- Ensures FFDM modalities provide adequate information for downstream applications
- Ensures systems support required data objects for interoperability
- Defines image display and printing operations for effective and efficient diagnosis

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IHE profiles

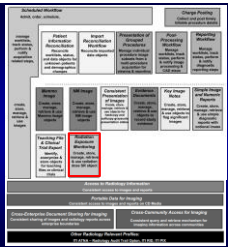
Radiation
Exposure
Monitoring

Integrating the Healthcare Enterprise

IHE

IHE Radiology (RAD)
Technical Framework

Volume 1
IHE RAD TF-1
Integration Profiles



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Radiation Exposure Monitoring

- Create, store, manage, retrieve, and use the DICOM Radiation Dose Structured Report object

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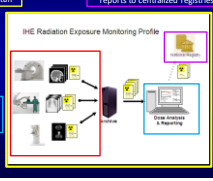
Radiation Exposure Monitoring (REM) – 2012

The profile allows dose information to be collected and evaluated without imposing a significant administrative burden on staff

The profile describes how radiation reporting systems can submit dose reports to centralized registries

The REM Profile requires imaging modalities to **export radiation exposure details in a standard format**

The radiation reporting system is expected to **perform relevant dose QA** analysis



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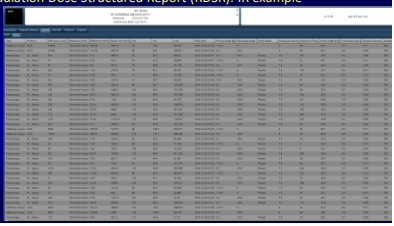
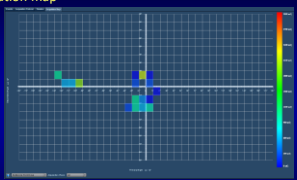
Radiation Dose Structured Report (RDSR): IR example



Angulation map



- Reference point: 11007 mGy
- Largest dose by position: 2200 mGy

Radiation Dose *metrics*

- Modalities:
  - **Computed Tomography**
    - CTDIvol & DLP
  - **Interventional Radiology, Cardiology & Fluoroscopy**
    - DAP, RP AK, kV – mAs, geometry tracking
  - **Radiography**
    - Exposure index, Deviation Index: IEC 62494-1
  - **Mammography**
    - Average Glandular Dose, Incident dose, Compression

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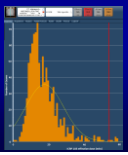
Increased radiation dose awareness

- Access to radiation dose software
- Identification of high-dose studies (why?)
- Provision of patient-specific dose metrics



The IHE REM profile

- Addresses the efficient collection and distribution of dose information, but is *just a tool*.....
- Profile removes data collection and management burdens
- ..... But it is up to the site to put the information to use

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IHE Radiology: expanding applications and implemenations

Current technical framework

Supplements for Trial Implementation

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IHE-RO

- Radiation Oncology implementations
- Uniquely applied to interoperability challenges in management of RO operations and workflow
- Detailed overview in the subsequent presentations

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Summary

- From limited expectations & planned extinction, IHE is expanding and evolving to solve critical clinical interoperability needs
- IHE defines Integration Profiles that use standards to solve interoperability problems
- The Technical Framework contains the Integration Profiles that have gone through the validation (connectathon) process
- Specifying IHE Integration Profiles in RFPs ensures compatibility and functionality for given tasks and interoperability

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