RSNA 2010

Sharing Images on CD, DVD & USB: Standards, Tools & IHE PDI, IRWF and BIR Profiles

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Overview

• Media relevance
• Media problems
• Interoperability – standard format DICOM/PDI
• Importation – IRWF
• Viewing – BIR
• Other stuff on media
• Report
• Annotations
• Radiation Dose & other Structured Reports
Primary Use Case

- Images of patient made at source site
  - Hospital
  - Imaging center
  - Doctor’s office
- Need to be used by staff at another site
  - Referring doctor who ordered exam
  - Doctor to whom patient has been referred
  - Specialist hospital (tertiary referral center)
Is Media Still Relevant?

• Everyone dreams of exchanging images via the Internet ... but where is the ...
  – infrastructure & bandwidth
  – access control, provisioning, authorization
  – business-to-business agreements
  – common patient identifiers
  – reimbursement

• Most common interchange remains via CD
Image Sharing Demonstration

- Site provided
- Patient controlled
- IHE XDS-I based
- Transfer via clearing house to PHR
- South Building Booth #2852
Is the Standalone PC Viewer a solution?
Standalone PC Viewer Issues

• CDs burned with Windows auto-run viewer
• Does everyone have a (big/fast enough) PC?
  – in the referring doctor’s examining room?
  – in the out-patient clinics?
• Hospital IT security policy?
  – should IT allow any CD to be loaded on a PC?
  – risk of viruses - how many clinic PCs virus-safe?
• Interference with running applications
  – auto-run may need to be disabled
Standalone PC Viewer Issues

• Quality, training and ease of use for viewers
  – how many viewers does one need to learn?
• Long-term access requirements
  – need images to become part of legal record
  – follow-up visits
  – use during treatment (RT, surgery (OR), etc.)
  – need for distributed access
    • internal referrals, clinical conferences, tumor boards
Extreme End-User Dissatisfaction

- American Academy of Neurological Surgeons
- Rallied many other specialty societies
- American Medical Association

- Fed up with incompatible media and inadequate, unreliable and deviant viewers
- Met with industry (MITA), DICOM & IHE
- Two actions – statement & viewer profile
Statement

• By the AMA Expert Panel on Medical Imaging:

“All medical imaging data distributed should be a complete set of images of diagnostic quality in compliance with IHE-PDI.”

“This standard will engender safe, timely, appropriate, effective, and efficient care; mitigate delayed care and confusion; enhance care coordination and communication across settings of care; decrease waste and costs; and, importantly, improve patient and physician satisfaction with the medical imaging process.”
So what is IHE PDI?

• Portable Data for Imaging
• Initially – uncompressed DICOM CDs
• More recently – additional options
  – DVD and USB media
  – Compression (JPEG & JPEG 2000)
  – Encryption
  – Sending software
Barriers to viewing & import: format, ID reconciliation, viruses
Barriers to viewing & import: DICOM compliance issues
Issues with Format

- Proprietary media (not DICOM at all)
- Not DICOM General Purpose CD-R profile
- DICOM but unsupported compression
- Illegal filenames
  - DICOM says 8 chars, capitals, no extension
  - frequent errors - too long, with .dcm extension
Issues with Format

- DICOMDIR errors especially prevalent
  - DICOMDIR completely missing
  - long filenames
    - illegal DICOMDIR entries
  - missing required attributes
    - e.g. Referenced Transfer Syntax UID
  - violation of identifier attribute types
    - DICOMDIR requires Type 1 Patient ID, Type 2 in image
Issues with Format

• Media creators:
  – should do better & comply with standard
  – no excuse for poor quality software
  – no legitimate reason for deliberate violations (such as file naming)

• Media readers:
  – could be more tolerant
  – installed base of non-compliant creators
  – Installed base of shelved non-compliant media
IHE PDI

- Portable Data for Imaging
- Recapitulated DICOM GP CD Profile
- Avoided compression
- Emphasized common mistakes
- Renewed opportunity to promote compliance
- Opportunity for interoperability testing
- Public demonstration & compliance tool
IHE PDI Connectathon Testing

- Peer-to-Peer vendor testing
- Results checked by RSNA project managers
- 50+ companies tested PDI
IHE PDI – Beyond the Basic

• Too small?
  – DVD options
  – Including compression (JPEG & JPEG 2000)
  – With option, compression permitted on CD

• Too slow?
  – USB (e.g., memory sticks)

• Too insecure?
  – Privacy protection – password or PKI based
Use PDI Options with Care

- With flexibility comes risk of incompatibility
- Not all recipients have DVD drives
- Not all recipients will support compression
- Not all recipients will support decryption
- Passwords/certificates lost/unavailable
- Sending software option mitigates concern over unsupported compression or decryption, and permits importation
Import Use Cases

- Media is not just for viewing
- Referring physicians may need to import
- Other facilities may need to import
- More capable viewer or workstation
- Planning, template, measurement software
- Operating room display
- Priors for new study, re-reading
- Studies contracted to outside performer
Two Types of Import

- Import to single workstation, use and discard
  - no need to reconcile identifiers
  - no need to match with local studies
  - no need to automate workflow
  - e.g., advanced viewer, outside consultation

- Import to local “system” (e.g., PACS)
  - reconcile & match identifiers and studies
  - workflow integration (orders, reports)
Import Requirements

- All types of import require standard format
- IHE PDI (DICOM) is the basis for all import
- Proprietary media formats are the antithesis

- Import into the “system” additionally requires
  - reconciliation
  - workflow
IHE Import Reconciliation Workflow (IRWF) Profile

• Convert identifiers
  – Patient ID (local MRN), Name (local spelling)
  – replace/remove Accession Numbers
  – replace codes with local values
  – keep old values in Original Attributes Sequence

• Workflow and source of replacement info
  – Unscheduled – HL7 Patient Demographics Query
  – Scheduled – DICOM Modality Worklist (& MPPS)
Import Policy & Support Issues

• Import to PACS is now the standard of care
  – failure to do so may compromise patient care
• Import does not imply the need for a report
  – some systems may have issues with status flags
• Import may or may not require archival
  – evidence for decision making
  – use as priors in future
  – some systems may not distinguish imports
What about Viewers?

- Viewing remains a key use
- Identified as major source of dissatisfaction
- Inconsistency between
  - different CD viewers
  - CD viewer and PACS viewer
  - PACS viewer and remote/web viewer
- Is there a “basic” set of viewer requirements?
- Could they be satisfied by a common solution?
Implementation or Features?

• First AMA proposal
  – a standard viewer implementation
  – required to be included on all media

• AMA/MITA/IHE compromise
  – a standard set of viewer requirements
  – a standard set of user interface features

➔ IHE Basic Image Review profile
Basic Image Review (BIR)

• Not just for media
• Could be applied to PACS or PHR viewer

• Requirements for:
  – feature set
  – look and feel (standard icons & mouse directions)
  – performance (speed of loading & display)
Basic Image Review (BIR)

- basic grayscale or color rendering of images of any modality
- visual series selection through the use of thumbnails
- side-by-side comparison of at least two sets of images
- synchronized scrolling, panning and zooming
- annotate laterality, orientation, demographics, technique
- spatial localization (localizer lines, cross-hairs)
- simple measurements of linear distance and angle
- cine capability (e.g., for US and XA)
- splitting of dual echo MR, windowing mode for NM
- flip and rotate for non-cross-sectional images
Other Stuff On Media

- **IHE-PDI** allows for optional Web Content
  - browser viewable pre-rendered images
- **Radiologist’s report**
  - DICOM SR, HL-7 CDA, PDF, plain text, ???
- **Key images and annotations**
- **Other DICOM Structured Reports**
  - Radiation Dose
  - Mammo CAD
Key Images & Annotations

• Both are common PACS features
• Older PACS cannot export in a standard form
• Modern PACS import/export GPSS
  — Grayscale Presentation State Storage
  — IHE Consistent Presentation of Images (CPI)
• Need to be able to import/export on media
• Even if CD viewer doesn’t display them
Radiation Dose SR

- IHE Radiation Exposure Monitoring (REM)
- Structured content rather than secondary capture of dose or protocol screen
- RDSRs recorded by the modality
- Stored in the PACS as part of the study
- Used by Dose Information Reporters
- Separate SOP Class from other SRs
- Transport on media for dose-history decision making
Be the solution, not the problem

- Don’t be radiology-centric ...
  - consider the non-radiologist end-user
  - complete set of diagnostic quality images

- Don’t be facility-centric ...
  - consider the receiving importing facility

- Write ONLY compliant IHE PDI media
  - include an IHE BIR profile viewer
  - key images (KIN) annotations (CPI), radiation dose (REM)

- Import external media with IHE IRWF