Understanding the Foundation: How Standards and IHE Profiles Enable Interoperability

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1. Identify the positive impact to both patients and providers when standards and IHE profiles are used.
2. Discuss the difference between intra- and inter-enterprise transactions and role of the Health Information Exchange (HIE).
3. Identify the importance of patient identity reconciliation in the healthcare enterprise.
Agenda:

1. Why are we doing this? i.e. What are the value drivers?
2. Setting the stage: What is true interoperability
3. How is interoperability achieved using IHE
4. Information sharing (inter and intra-enterprise) and role of HIE
5. Role of patient information reconciliation
6. Sample profiles to demonstrate
7. Conclusion
8. Q and A
1. The STEPS™ Framework:
   - Patient Satisfaction
   - Staff Satisfaction
   - Provider Satisfaction
   - Treatment/Clinical
     - Quality of Care
     - Efficiencies
     - Safety
   - Electronic Secure Data
     - Data Reporting
     - Enhanced Communication
     - Evidence-Based Medicine
     - Data Sharing
   - Patient Engagement & Pop. Mgmt.
     - Prevention
     - Patient Education/Engagement
   - Savings
     - Efficiency Savings
     - Financial/Business
     - Operational Savings
HIMSS definition of Interoperability (Approved by HIMSS board 4/13/2013)

• In healthcare, interoperability is the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged. Data exchange schema and standards should permit data to be shared across clinicians, lab, hospital, pharmacy, and patient regardless of the application or application vendor.

• Interoperability means the ability of health information systems to work together within and across organizational boundaries in order to advance the effective delivery of healthcare for individuals and communities.

http://www.himss.org/library/interoperability-standards/what-is-interoperability
There are three levels of Interoperability:

1 - **Foundational**: the receiving IT system does not interpret the data (e.g. a pdf document with lab results).

2 - **Structural**: the structure or format of data exchange is maintained such that the clinical or operational purpose and meaning of the data is preserved and unaltered. It ensures that data exchanges between information technology systems can be interpreted at the data field level. (e.g. the lab results directly information stored in EMR database)

3 - **Semantic**: the ability of two or more systems or elements to exchange information and to use it. This level of interoperability supports the electronic exchange of patient summary information among caregivers and other authorized parties via potentially disparate electronic health record (EHR) systems and other systems to improve quality, safety, efficiency, and efficacy of healthcare delivery. (e.g. take action on an out of bound lab value)
1 - Foundational: exchange CAD results to a workstation.

2 - Structural: interpret CAD result: “micro-calcification at left top corner”

3 - Semantic: display CAD mark on top of image with a visible marker:

The Image Display shall make available for display the following information about each CAD finding, if encoded in the CAD object:

- Manufacturer (0008,0070)
- Algorithm as defined in (111001, DCM, “Algorithm Name”) and (111003, DCM, “Algorithm Version”)
- Operating point as defined in (111071, DCM, “CAD Operating Point”)
- Content Date (0008,0023) and Content Time (0008,0033) of the CAD SR instance, if more than one exists and applies to the displayed image

The Image Display shall indicate when CAD was not attempted or has failed, either entirely, or if some algorithms have succeeded and others failed, as distinct from when CAD has succeeded but there are no findings. This information shall be obtained from the status values of (111064, 4495 DCM, “Summary of Detections”) and (11106 DCM, “Summary of Analyses”).

Radiology Example:
3. How to achieve semantic interoperability using IHE:

Definition of profiles (1):

1. Well defined actors: consistent terminology
2. What is in a HIS, RIS, CIS, LIS, PACS
3. What does a VNA, Broker, Connectivity Manager do?

For example, one VNA might be an image manager, image archive, and support the “store images, documents, reconcile changes, register and query documents, etc…”

Note: doing an “IHE” diagram of your facility makes sense

• Question: Where is the worklist generated?
Eliminate options, for example for change patient info:

- A18 (merge patient information) – deprecated
- A30 (merge person information) – deprecated
- A34 (merge patient information-patient ID only)
- A35 (merge patient information-account number only)
- A36 (merge patient information-patient ID and account number)
- A39 (merge person-external ID)
- A40 (merge person-internal ID)
- A41 (merge account-patient account number)
- A42 (merge visit-visit number)
- A43 (move patient information-internal ID)
- A44 (move account information-patient account number)
- A45 (move visit information-visit number)
- A46 (change external ID) - deprecated
- A47 (change internal ID)
- A48 (change alternate patient ID) - deprecated
- A49 (change patient account number)
- A50 (change visit number)
- A51 (change alternate visit ID)
Profile definition (3):

IHE interoperability: ADT^A31
4. How to share information

1. Sneakernet and email:
   - CD profiles (PDI, IRWF, BIR)
   - Secure email (dentistry)

2. Point to point push/pull:
   - Few destinations (specialists, pharmacy, DOD-VA)
3. Centralized or federated “discovery”: use of broker or registry: HIE-private and/or public
   – Many destinations

4. Semi-random discovery: use gateways
How to share information using ITI (IT Infrastructure) profiles

Information Exchange Transport Use Cases

1. Blind Push
2. Known Partners, Pt ID Out-of-Band
3. Known Partners, Pt ID Resolved
4. Community HIE
5. Nation Wide Health Information Network

NWHIN

IHE

IHE XCA (cross-HIE)

IHE XDS (intra-HIE)

IHE XDR (web services)

SMTP + IHE XDM (secure e-mail)

SMTP Only (secure e-mail)

Push

Point-to-Point

Direct

SMTP Bridge

Pull

Publish & Share
1. Patient Identity Management:
   - PIX: Patient Identity Cross referencing
   - PDQ: Patient Demographics Query
   - XCPD: Cross Community Patient Discovery
   - PAM: Patient Administration Management

2. Information Exchange Management:
   - XDS: Cross enterprise Document Sharing
   - XDM: Cross enterprise Document Media Interchange
   - XDR: Cross enterprise Document Reliable Interchange
   - XCA: Cross Community Access
   - XCDR: Cross Community Document Reliable Interchange
   - DSUB: Document metadata Subscription
   - MHD: Mobile Access to Health Documents

Note Imaging variants, e.g. XDS-I, XCA-I, etc.
3. Security and Privacy management:
   - CT: Consistent Time
   - ATNA: Audit Trail and Node Authentication
   - XUA: Cross enterprise User Assertion
   - EUA: Enterprise User Authentication
   - DSG: Document Digital Signatures
   - DEN: Document Encryption
   - BPPC: Basic Patient Privacy Consent

4. Provider and Personnel Management
   - PWP: Personnel White Pages
   - HPD: Health care Provider Directory

5. Workflow Management
   - XDW: Cross Enterprise Document Workflow

6. Content Management
   - CDA: Clinical Document Architecture
Why needed:
  – Lack of universal patient identifier
  – Even if there would be an identifier, still issues (Saudi, Portugal...)
  – Reconciliation needed

So: Problem statement:
  – How can we correctly identify and manage patients across boundaries (with different demographics/identifiers in different systems) to accommodate the exchange of health information using a standards-based approach with a high degree of assurance that the information is about the correct patient?

• Question: who are the highest risk patients with regard to mix-ups?
Because:

– Ordering tests/procedures/medications
– Report results and progress
– Registration, billing, reimbursement
– Retrieve past procedures and results

• Patient ID typically ONLY unique within certain organization (affinity domain), or maybe only even department (RIS-LIS... or campus)
5. Patient Identifier Cross-referencing
Patient ID support:

- HL7: External, internal, alternate, SSN, list
- DICOM: Patient ID, Other Patient ID (list)
- Allows for maintaining multiple patient ID’s in transactions/images
- Use case: admission in hospital A, treatment in hospital B
- Issue: when spanning multiple institutions
IHE has published six profiles designed to solve different aspects of this problem, using existing industry standards

- PIX – Patient Identifier Cross-Referencing
- PIXv3 – Patient Identifier Cross-Referencing HL7 V3
- PDQ – Patient Demographics Query
- PDQv3 – Patient Demographics Query HL7 V3
- XCPD – Cross-Community Patient Discovery
- PAM – Patient Administration Management
IHE Patient ID support (cont):

Service defined in IHE Technical Framework

Higher level services (leveraging base services)

Service out of IHE scope
### 6. IHE ITI and Information exchange

| P | Patient Identity Management | P |  
| A | PIX, PDQ, XCPD | A |  
| M |  | M |  

**Information Exchange Management**
- XDS (-I,-SD), XDM (-I), XDR, XCA(-I), DSUB

<table>
<thead>
<tr>
<th>EUA, DSG, DEN, BPPC</th>
<th>Security and Privacy Management</th>
<th>EUA, DSG, DEN, BPPC</th>
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<tr>
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<td>CT, ATNA, XUA</td>
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**Provider and Personnel Management**
- PWP, HPD

**Workflow Management**
- XDW

**Content Management**
- CDA: XPHR, XDLAB, XDS-MS......

- VNA, HIE
- EMR
Information Exchange Options

**Document Sources**
- XDS(-SD)/XDS-I
  - Publish

**XDS INFRASTRUCTURE**
- Query/Retrieve

**Document Consumers/Recipients**
- Send to Existing Reliable Messaging System
- Receive

**XDR/XDR-I**
- Send to
- Messaging System

**Interchange Media**
- Write

**XDM**
- Including Email

**XCA/XCA-I**
- Query/Retrieve

**Other INFRASTRUCTURE**
Cross-Community Peer-to-Peer Sharing

Community A
- Document Registry
- Practice
- Patient ID services
- Hospital
- Clinic
- Repository

Community B
- Document Registry
- Practice
- Patient ID services
- Hospital
- Clinic
- Repository

Community C
- Non-XDS
- Community based sharing model

Community D
- Document Registry
- Practice
- Patient ID services
- Hospital
- Clinic
- Repository

XCPD, XCA, XDR, XDM transactions

Gateways connect the communities.
Metadata is critical for indexing and searching; contents might be localized

- **typeCode**: Type of document, preferably use LOINC
- **classCode**: details of type, e.g. X-ray report, Discharge summary, etc.
- **eventCodeType**: event, e.g. surgery, consult
- **HealthCareFacilityType**: facility, e.g. hospital
- **practiceSettingCode**: specialty, radiology
Metadata is critical for indexing and searching:

- **authorSpecialty**: subspecialists, e.g. neuro radiology
- **authorRole**: role of author, e.g. physician, nurse...
- **specialtyCode**: code of specialty
- **mimeTypeCode**: text/xml, etc.
- **formatCode**: additional details that are not clear from just the mimetype, e.g. CDA
• **Document Source**
  – A system that submits documents and associated metadata to a Document Recipient

• **Metadata Limited Document Source**
  – A system that submits documents and associated metadata similar to a Document Source but is limited in the quantity of metadata it is able to provide.

• **Document Recipient**
  – A system that receives a set of documents and makes it available to the intended recipient (who can choose to view it or integrated it into the EHR)
Emails, CD’s, flash: common file and DIR

- Assemble the media content and store it on the media to be distributed

- **Portable Media Importer**
  - Read the Document Submission Set content in order to access the document(s) and metadata; and perform import of the documents. This actor may have to create or convert metadata that was not included on the media.
IHE-XCA: Cross Community Access

Initiating Community

Responding Community

Initiating Gateway

Responding Gateway

Cross Gateway Query [ITI-38]

Cross Gateway Retrieve [ITI-39]
• Mobile devices include tablets and smartphones, plus embedded devices like home-health devices.

• This profile is also applicable to larger systems where the needs are simple, such pulling the latest summary for display.

• For devices that are resource constrained, have a simple programming environment (e.g., JSON, javascript), simple network stack (e.g., HTTP), and simple display functionality (e.g., HTML browser).
• The goal is to limit the additional libraries that are necessary to process SOAP, WSSE, MIME-Multipart, MTOM/XOP, ebRIM, and multi-depth XML.

• There is one set of actors and a transaction used to submit or push a new document entry or set of document entries from the mobile device to a receiving system, and one set of actors and transactions is used to get a list of document entries containing metadata, and to retrieve a copy of a specific document.

• The MHD profile does not replace XDS. It enables simplified access by mobile devices to an XDS (or a similar) document management environment containing health information.
IHE-MHD diagram

Document Source

provide Document Resources [III-65] ↓

Document Recipient

Document Consumer

↓ Find Document Manifests [III-66]

↓ Find Document References [III-67]

↓ Retrieve Document [III-68]

Document Responder
True, semantic interoperability cannot be achieved by DICOM, HL7, etc. alone, it requires profiling and actor, transactions specifying which options are used for transactions and data contents such as used in IHE.

There are multiple image sharing architectures and patient reconciliation needs addressed by various profiles so as NOT to prescribe a single architecture using IHE.

IHE provides an important value driver as shown in the following diagram:
Add value acc to the STEPS™ Framework:

Electronic Secure Data
- Data Reporting
- Enhanced Communication
- Evidence-Based Medicine
- Data Sharing

Savings
- Efficiency Savings
- Financial/Business
- Operational Savings

Satisfaction
- Patient Satisfaction
- Staff Satisfaction
- Provider Satisfaction

• Treatment/Clinical
  - Quality of Care
  - Efficiencies
  - Safety
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