Integrating the Healthcare Enterprise

IHE

IHE Radiology
Technical Framework Supplement

Encounter-Based Imaging Workflow
(EBIW)

Revision 1.1 – Trial Implementation

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Foreword

This is a supplement to the IHE Radiology Technical Framework V16.0. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

This supplement is published on June 1, 2018 for trial implementation and may be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the results of testing. Following successful testing it will be incorporated into the Radiology Technical Framework. Comments are invited and may be submitted at http://ihe.net/Radiology_Public_Comments.

This supplement describes changes to the existing technical framework documents.

"Boxed" instructions like the sample below indicate to the Volume Editor how to integrate the relevant section(s) into the relevant Technical Framework volume.

Amend Section X.X by the following:

Where the amendment adds text, make the added text **bold underline**. Where the amendment removes text, make the removed text **bold strikethrough**. When entire new sections are added, introduce with editor's instructions to "add new text" or similar, which for readability are not bolded or underlined.

General information about IHE can be found at www.ihe.net.

Information about the IHE Radiology domain can be found at ihe.net/IHE_Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the process used to create them can be found at http://ihe.net/IHE_Process and http://ihe.net/Profiles.

The current version of the IHE Radiology Technical Framework can be found at http://www.ihe.net/Technical_Frameworks.

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Introduction to this Supplement

This supplement introduces a new Encounter-Based Imaging Workflow Profile to address medical imaging performed outside the context of an ordered procedure.

140 The profile specifies how to integrate the devices to capture appropriate context, populate relevant indexing fields, link to related data, and ensure the images are accessible and well-knit into the medical record.

The focus of this profile is imaging acquired by point-of-care ultrasound devices.

Note: There is a strong interest in addressing image capture devices such as mobile phones,
145 tablets, digital cameras, and specialty imagers like stereoscopic dermatology cameras. Many departments capture clinical photos for documentation, follow-up care, and diagnostics. Those use cases are out-of-scope for this year but for the next IHE RAD cycle a proposal will be re-submitted to document and analyze those use cases and extend the profile to address them.

150 Closed Issues

Q. How are final images encoded? A. in DICOM®1
Q. Store in STOW-RS or C-STORE? A. Expect Both (both transactions already exist) However only C-STORE is included in this draft. STOW-RS will be examined as part of the support for digital cameras. Will likely either clone RAD-131 into a STOW version or re-use 3.108 Store Instances over the Web [RAD-108] depending on suitability to the use cases.
Q10. Should we make any Measurement SR IODs mandatory for the SCP? A: No.
Q. Bias toward older (DICOM/HL7) VS newer (DICOMweb/FHIR®2) technologies? A. Focus on HL7 v2 + DICOM + DICOMweb for this profile
Q. Should images be linked to reports or pasted directly into them? A. Linked by using the shared encounter ID, which is part of the metadata.
Q. Should we use Accession Numbers? A. Yes Creating it and passing to the modality to include in the images means that if the EMR chooses to create an order, it can be linked to the Accession # and everything works like normal. URL linkages use Accession #'s a lot between the PACS and VNA. Patient ID is good but having both Patient and Accession is better. If encounter images are referred for reporting, they will need an accession for billing and report linking.

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1 DICOM is the registered trademark of the National Electrical Manufacturers Association for its standards publications relating to digital communications of medical information.

2 FHIR is the registered trademark of Health Level Seven International.

Billing systems can use the encounter ID or procedure ID since they bill for encounters and procedures but having an accession # wouldn't hurt and some of them would like it. Generally Lab and Imaging procedures have accession #s.

Non-radiology device vendors are notoriously bad at following DICOM (miss study descriptions etc., etc., etc.) but as long as they include that one number, it can tie back to the GOOD metadata in the encounter manager.

Q. How are documents from the same encounter (images, notes, reports) grouped/linked?

A: Accession Number

Accession number mirrors how ordered procedures link the images to the report and link both to the EMR record. Date/time of acquisition (if known to reasonable accuracy) for known patient also helps.

Some sites use both an accession number and an encounter ID (visit id + department id). Others do a query template to match a combination of visit ID & department & doctor. Coded document titles are helpful (e.g., with LOINC codes).

Many EMR/DB products will store relationships internally in proprietary ways. Some EMRs will create an artificial order # after the fact to use for indexing in the record.

Later documents can also point to the encounter imaging procedure using the accession number. Accession number is associated with the Study Instance UID which can be used to invoke a display profile.

(Proprietary EMRs can also do things the hard way: query the VNA whenever a patient is launched in a patient browser and also get order data from the order database and use that to build an index. If no order, it use the DICOM metadata to add an entry to the browser index.)

Q. What is the scope of uniqueness for Encounter/Visit numbers?

A. Uniqueness is handled by qualifying the encounter ID with an assigning authority

For in-patient, encounter ID is unique in the EMR across the enterprise, or unique within the scope of issuing system

For out-patient, encounter ID is unique for each department.

Q. Does Encounter/Visit # link to Accession # for inpatients? Is implicit order required or not?

A. Maintain harmonization for workflow and data management between encounter-driven and order-driven environments, especially for people and devices that operate in both contexts

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Q1. Do we need to profile John Doe cases?

A: Explain how it could be handled but don't profile specific requirements.

Procedure and Pixel metadata should be populated as usual.

Encounter metadata will be mostly as usual, but perhaps a bit sparser due to likely urgent care context. If the John Doe is admitted, they will have a wristband and an Admission ID and the imaging device will still have whatever information it has about the department, operator, location context.

Patient metadata will be sparser and the name/ID will likely be placeholders.

Sites will have local methods for assigning John Doe MRNs etc. and modalities and encounter managers should be prepared to deal with those.

Existing patient-merge/Patient Information Reconciliation methods on the PACS and RIS should work as usual for data stored with placeholder demographics.

Q2. Are Figure 47.4.1.1-1: Encounter-Based Imaging Information Model relationships OK?

A: Basically, yes.

Fixed a few cardinalities. Want to keep the Imaging Procedure entity and keep Studies as a child of the Procedure rather than the Encounter.

Q. Should we create an Encounter Module?

A. Not for now.

We are looking for something that happens 1-n times during a visit.

If we created it, it would contain attributes like:

- Encounter ID
- Issuer of Encounter ID
- Encounter UID
- Reason for Encounter
- Reason for Encounter Code Sequence?
- Encounter Start Datetime
- Encounter End Datetime
- Encounter Location
- Encounter Care Team

HL7 makes Encounter a synonym for Visit so it doesn't really exist in the sense we want. FHIR renames Visit to Encounter but allows nesting so that there can be Encounters within Encounters which would serve our needs. Once FHIR gets there we may want to mirror that in DICOM/IHE. In the meantime, the Accession provides a proxy handle, and managing Imaging Procedures will likely serve most of our other purposes at the sub-encounter level.

PAM covers patient visit and account in great detail and complexity with national variations but doesn't model down to the level we're looking for. The U.S. uses X12 based on HHS definitions of Encounter etc.

Outpatient encounters tend not to have "sub-encounters" so it's a bit simpler.

Q4. Is Department configured on the device or is it needed in the Encounter Context?

A: Both.

The Encounter Manager is permitted but not required to be able to provide a Department based on such things as the device AE Title, or the operator or other clues.

At the same time, Modality devices should include the ability in their setup to configure the Department (along with the name of the Institution). If the modality has a configured value, but receives a different value (rather than no value) in the RAD-130 transaction, it should consider using the RAD-130 value since the Modality might be being used outside its original department. This too could be a configurable behavior.

Large capital devices (MR Scanner) are generally tied to a department. Smaller more mobile modalities (portable ultrasound, x-ray, digital camera) may stay in a single Institution and might be owned by one department but might be used in multiple departments.

Q. Is this a "Radiology" profile?

A. Yes

Historically RAD profiles have provided a basis for other imaging domains. RAD is the closest thing IHE has to a general Medical Imaging domain and we have TC members who understand the solution technologies well.

Q. Do we want to talk about portable X-ray at all during this draft of the profile?

A. Deferred. Keep it short for now. Add later.

There are certainly portable x-ray use cases similar to those described in 47.4.2, however ionizing radiation means it is more often necessary to have an order.

Q. Should the scope include "self-captured" data from patients at home or remote?

A. Deferred, focus on workflow within hospitals.

Q. Who initiates encounter imaging?

A: Usually the imaging device initiates; although we should consider Record Driven Acquisition that is initiated from the EMR/Encounter Manager ("repeat order for current date" since most metadata/context is inherited).

Q. Should the device get the context before starting imaging, or after, or both?

A: Model before, allow for both.

In principle the device gets the metadata, then acquires images, applies metadata, submits to archive. Can also acquire images, get metadata, apply metadata, submit to archive. The later might be handy for ad hoc workflow.

Q3. Are the 130, 131, 132 Requirements adequate to reliably meet the metadata needs in 47.4.1.7

A: Seem to be, yes.

Actually reduced some of the 130 requirements to keep it easy/practical on the Encounter Manager.

Tradeoffs considered include:

- If an attribute/field is made Type 1, might need a defined default or fallback value

- If 131 or 132 requirements are too strict, systems might need to buffer the "bad" images in an exception queue until someone cleans them up. But maybe the clean data benefits outweigh the delay/inconvenience? Beyond the core attributes, this is perhaps a local policy and product design question?

Q8. Do we need to tinker with the RAD TF-2: 2.2 text?

A: No. The semantics are not changed here.

Note specifically, with respect to SCU required return keys, it has the following general policy:

"A key that the Query SCU requests from the Query SCP and receives in the query responses. The definition of *the means offered to the user of the Query SCU to request a return key* (e.g., by default, check a box) *and to make it visible to the user is beyond the scope of IHE*. A

Query SCU shall include as Return Keys in each C-FIND request all attributes specified as R, R+, R*, or R+*. *A Query SCU shall display for the user the returned value of all attributes specified as R or R+ in the normal user interface*."

Q5. How do we want to handle "location" of encounter-based imaging?

A: Not a strong enough need to add an image IOD tag.

The location where the images were acquired can be used to manage encounter images (in the sense of Department or perhaps a specific room), but it seems to be essentially a proxy for the care team/sub-organization/clinical specialty or workflow that generated the images. It might also be used to associate the images with other clinical artifacts. But generally a coarse location (i.e., Department) is more useful than a fine grained location (i.e., a specific room)

CMS has a Place of Service Code Set https://www.cms.gov/Medicare/Coding/place-of-service-codes/Place_of_Service_Code_Set.html

Related DICOM fields and tags considered include:

Current Patient Location (0038,0300) in MWL

Requested Procedure Location (0040,1005) in MWL

Patient's Institution Residence (0038,0400) is "outpatient" or their home room, floor, ward

Scheduled Procedure Step Location (0040,0011) in MWL

Performed Location (0040,0243) in MPPS - Label of the encounter room or (small) facility

Performed Station Geographic Location Code Sequence (0040,4030) in UPS

Related HL7 Segments/Fields considered include:

PV1:3 00133 Assigned Pat. Loc. (See also discussion of ADT^A02 below.)

AIL:3 Location Resource ID contains information about location resources (meeting rooms, operating rooms, examination rooms, or other locations) that can be scheduled.

AIP segment is for scheduled personnel (care team?)

HL7[3] sometimes has fields for <point of care (IS)> ^ <room (IS)> ^ <bed (IS)> ^ <facility (HD)> ^ <location status (IS)> ^ <patient location type (IS)> ^ <building (IS)> ^ <floor (IS)>

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[3] HL7 is the registered trademark of Health Level Seven International.

Q6. How does the mobility of cameras and portable ultrasound affect things?

A: Not in a way that affects profile requirements.

Room and operator are not as easily tied together and not as stable as for stationary equipment. It may also mean that the modality is only intermittently connected to the network, however that has been dealt with in Cardiology, and WiFi usage is becoming more prevalent making network connectivity less of an issue.

For portable modalities, they may remain in a given location, or they may be taken out of a supply rack (and hopefully returned later). They may change rooms/floors. The Facility/department/service is more stable and is more important that the specific room.

Departments will borrow equipment and people also span care teams and departments and take on different roles on different shifts. It would be helpful for the device to show the user what is being assumed, say for the current department, so the operator can confirm or modify from a pulldown or something.

Geotag values available on more and more digital photography devices could he useful, as could network clues and ITI patient tracking which might help populate short picklists of departments.

Mobility might also introduce security issues if the device gets outside the firewall, etc. in terms of attack surface. This may be discussed more in the next work.

Q. Should we require the EM and EMR to support a baseline mechanism for demographics?

A: No.

47.4.1.3 lists the alternatives and leaves it as a deployment issue (like matching up profiles on integration statements usually is).

PAM Encounter Consumer doing Patient Encounter Management [ITI-31]

- 25 different ADT messages over 48 pages. Mostly about reporting what is currently happening, not setting up what will happen (except for pre-admit, pending transfer)

- If a site does not support PAM, doing so for EBIW seems to be a significant load (French National Extension is 57 pages on PAM, German extension is only 6 but it's links to other documents, Patient Encounter Management transaction is 48 pages)

- TF-4: 4.1.2.4 PV1 Segment (prohibits consulting, use ROL)

- ADT^A02^ADT_A02 Transfer = location is PV1-3, was PV1-6, encoded as PL

    o What distinguishes "temporary location" from "permanent location"? E.g., ADT^A10^ADT_A09 and vs movement ADT^Z99^ADT_A01 (ZBE)

- - Permanent location is a bed. Temporary location is a consulting department or room. (Note Leave of Absence where patient leaves the facility without ending the visit)
- ADT^A14^ADT_A05 Pending Admit = arrival expected at PV2-8 (which is X??)
- ADT^A15^ADT_A15 Pending Transfer = location will presumably be PV1-3 at EVN-3
  - Be careful if we need to deal with cancellations etc.
- ADT^A54^ADT_A54 Change Attending Doctor = new doc is PV1-7; Field ROL-4-role begin date/time and ROL-5-role end date/time are used to communicate the begin and end date and time of the attending doctor (or of the admitting, consulting, and/or referring doctor, as appropriate and as designated in ROL-7-role code). When segment ROL is used to communicate this information, field ROL-2-action code should be valued UP.
- Do we want to constrain the PAM Options or just make it a required grouping? Pending Event Management Option (10 messages)
- Who is on the list vs what data elements are populated for that person
  - Might not have to worry about the length of the list if you use type-ahead filtering and/or barcodes. So have ultrasound know about every patient in the hospital.

B: Appointment Scheduling Management [EYE-16]

- S12 - Notification of New Appointment Booking
- S14 - Notification of Appointment Modification
- S15 - Notification of Appointment Cancellation
- S17 - Notification of Appointment Deletion
- S26 - Notification That Patient Did Not Show Up for Scheduled Appointment

C: Appointment Notification [RAD-48] conversely has the RIS notifying the HIS

- S12 - Notification of New Appointment Booking
- S13 - Notification of appointment rescheduling
- S15 - Notification of Appointment Cancellation

Q7. How can "completed" work be filtered out and just return active and pending encounters?

A: No definitive way. Left to implementations.

It is more convenient if the query from the Acquisition Modality to the Encounter Manager can return a fairly short and relevant list of patients/encounters. For example, it would be good not to return patients/encounters that have already been completed, but that may be hard to determine. If the Encounter Manager monitors ADT discharge messages it can likely omit discharged patients. The Encounter Manager could also monitor RAD-132 notification messages and omit patients with completed imaging procedures, however it might not be unusual for patients to have multiple imaging procedures during a visit or periodically to have to repeat a completed procedure.

Q9. Is the use of "auto-matching" matching keys in RAD-130 OK?

A. Yes.

It is a convenient way for the SCU to communicate potentially relevant details (the Modality and AE Title of the SCU) to the SCP but it does play with the semantics a bit. Doing this also avoids having to tinker with the MWL service attribute requirements to downgrade those.

Q. Should the profile specify creating orders?

A. If the EMR wants an order, it can choose to create one internally.

Orders aren't necessary for the profile to work. If the EMR depends on orders for something (like managing internal data indexing or billing) it is welcome to create orders based on the information provided to it as its choice, not something driven by the modality or the Encounter Manager.

The encounter manager will create an accession number so the images are populated with it, and that accession number is communicated to the Result Aggregator which is assumed to be part of the EMR or a proxy for the EMR. The EMR can then use the accession number to populate an order if it wants to create one and the main linking IDs are aligned just like in ordered images.

Note, sometimes there are other results in a single encounter that need to be linked (not just an image, but an image with other reports or data, progress notes, op note, etc.). If the EMR is creating orders it might create multiple orders for those and thus shoot itself in the foot?

Importantly, PoC docs don't like anything slowing down patient care. They dislike the implication that a physician authorized this in advance. If accession number is not inherently an order, it might be OK.

For radiology, Billing/workflow wise, order is used to gate processing since you don't get paid for orderable studies unless there actually is an order.

Q. How should the EMR/Result Aggregator be notified of new imaging content?

A. ORU-R01 (See also R01 vs R30 question)

EMRs are used to getting this kind of messages about new "results".

N.B. for ordered results, the metadata might often be just enough to match the result to the order and take the rest of the details from that order. Since the encounter case likely doesn't have an initiating order for these results, the message needs to include adequate metadata to properly link into the patient records and for the EMR to construct a proxy order if it needs to.

- – patient, date, SUID, which department, anatomy, procedure name guidelines
- – thumbnails are really nice
- – If the metadata becomes too extensive, might just notify the EMR of the new objects and let it inspect them if it wants extensive metadata rather than try to replicate the full header in the ORU

Rejected Alternatives:

MDM (newer ORU with attachments) not selected because ORU is more widely supported and we don't need to ship the images as attachments. MDM-T01 uses TXA segment.

CARD-14 does this from the Archive to the EMR, sending Study UID, a URI and the Filler/Placer Order # and Universal Service ID (in OBR-4)) but CARD IEO does not mention accession number.

The IRWF.b approach of Automated Order Placement was deemed too heavy-weight and too order centric. That made sense for IRWF where there was generally an ordered read, but that doesn't apply to most encounter-based imaging. Request Filling of Order [RAD-78] was an OMI msg and ORI response from OF.

DICOM Instance Availability Notification service [RAD-49] likely not supported by EMR.

Filler Order Management (New Order) [RAD-3] or Procedure Scheduled [RAD-4] are again too order centric.

Appointment Notification [RAD-48] conversely has the RIS notifying the HIS using SIU S12, S13, S15

Q11. Is it OK for RAD-132 to use an ORU^R30 instead of an ORU^R01?

A: No.

ORU-R30 is titled "Unsolicited Point-Of-Care Observation Message Without Existing Order" which very accurately described our intent, but some systems might not be familiar with ORU-R30 even though it can be structurally the same as the ORU^R01 used by the Results Distribution transaction on which RAD-132 is based.

Andrei notes that the full name of R30 is "Unsolicited Point-Of-Care Observation Message Without Existing Order – Place An Order" and as such, the ORC segment is required. ORU^R01 does NOT require ORC and as such, it is preferable for use (we do NOT want to include ORC – and maybe we should even prohibit its use.

Committee agrees that R01 is the better choice. Teri consulted with Hans at HL7 to make sure we're not overlooking anything and Hans agrees.

Q12. What is the guidance for OBR:48 Medically Necessary Duplicate Procedure Reason

A: None.

The field is typically not populated. There is no need for special guidance from this profile.

For digital photography, will sometimes retake images because of poor quality or need for different views/zoom in on portion (e.g., of a rash). Might also do for PoC US if confirmation images are inconclusive. Might like to bill for encounter image acquisitions so need to avoid double billing.

But this field was for CDS and big bills. Usually, they will take a bunch of photos and then chose the one to upload. It is not take, upload, take, upload, etc.

Q. Which actor should notify the EMR/Result Aggregator of new encounter-based results?

A. Image Manager

The Image Manager could do it automatically when the images are stored. RAD-132 could be populated based on the header of RAD-131.

The operator knows when the encounter is over and could also signal when studies within the encounter or series within the study are over, but don't want to burden them.

The modality knows when data has been captured, the image manager knows when data has been stored, the encounter manager knows when the encounter is over if the operator tells it.

Q13. How should the IM/IA recognize an encounter-based study (so it can send [RAD-132] and how should the Result Aggregator/EMR recognize encounter-based Accessions?

A: Accession Number and Request Attribute Sequence are good clues

See text in 4.Y4.4.1.1 Trigger Events.

If implemented, Issuer of Accession Number might also help to identify those from the Encounter Manager, or if a prefix-suffix-knownrange is used in the Accession Number value. If there are multiple encounter managers, one would need to check a list against issuer.

The presence and content of Procedure Scheduled [RAD-4], MPPS [RAD-7] and Filler Order Management [RAD-2] transactions.

Conceivably, the IM/IA could have a special AE Title for receiving encounter-based images. That would be permitted but is probably not necessary.

In addition to avoiding extraneous messages, this should also be able to avoid conflict with the SWF.b PIR behaviors which could otherwise trigger duplicate order creation (by EMR from 132 and by DSS/OF from SWF.b PIR)

Image Attribute	EBIW	SWF.b Simple	SWF.b Unsched.	SWF.b Group	Imported
Accession Number	*value*	*value*	*Empty*	*Value or Empty (if diff)*	*Empty or MWL Value*
Issuer of Accession#	EM	RIS	n/a	RIS	RIS or empty
Study Instance UID	Study UID	Study UID	Study UID	Study UID	Study UID
Referenced Study Seq.	<Study UID>	Study UID	Empty	2x Study UID	Copied either
Req. Attrib. Seq.	*Empty*	*1 item*	*Empty*	*2 items*	*1 copied item*
>Requested Proc. ID	n/a	Value (RIS)	n/a	Value (RIS)	
>SPS ID	n/a	Value (RIS)	n/a	Value (RIS)	
Admission ID	Yes	Maybe	No	Maybe	Maybe
Source Device					
RAD-4 Proc Scheduled Msg	*No*	*Yes*	*Later*	*Yes x2*	
RAD-7 MPPS Complete	*No?*	*Yes*	*Yes*	*Yes xN*	
Procurement Type	*ENCOUNTER*	*ORDER*	*UNSCHEDULED*	*ORDER/ GROUP*	*IMPORT*

Operator/Modality knows. Would be nice to indicate explicitly in the header. Probably needs a DICOM CP to either:

- add Identifier Type Code (0040,0035) to Issuer of Accession Number (like exists in the Issuer of Patient ID Qualifier Sequence) and consider encounter accession numbers to be a different "type" of identifier than other accession numbers

- add a Procurement Method attribute to indicate whether this site procured the images by ENCOUNTER, ORDER, IMPORT, or UNSCHEDULED, or something like that

The main flags in the SWF.b unscheduled case for unknown patient are that the modality sends an MPPS to the DSS/OF with the Referenced Study Sequence empty or absent and in the image, the **Accession Number shall be empty/zero length**. The DSS/OF recognizes the

temporary patient ID and waits for the ADT to broadcast a merge after the patient is properly ID'd and registered. The DSS/OF echoes the patient update (merge) to the IM/IA and RM. Then the DSS/OF creates an order with a new requested procedure that matches the completed procedure, the new demographics and details of the completed procedure, and sends it to the OP. Then the DSS/OF sends a Procedure Scheduled with the new requested procedure and order to the IM/IA.

(The Referenced Study Sequence seems more relevant in the MPPS than in the Image IOD).

Q14. What else could we think about in conjunction with the digital camera proposal?

A: Current profile is appropriate to PoC US Devices. The following notes are for next cycle

The current intention for digital cameras next cycle is to introduce a RESTful push of images (WIC/STOW-RS) that is the JPEG with a dozen or so metadata tags, and a RESTful query to send the Admission/Patient ID and get back the handful of metadata tags that will be copied over into the STOW message.

Some other topics that can be revisited include:

- Consider a "push flow" for Record Driven Acquisition (of interest to several participants). The practitioner might interact with the encounter manager or patient record viewer to initiate follow up or supportive imaging which results in some kind of push of associated context (and instructions?) to the modality. Or at least have the matching worklist item cued up to return.

- Consider the model of walking the operator through what they have to do. Maybe body map has the same 25 images and you guide them, e.g., the camera tells you what to shoot rather than you picking what you shoot. It becomes a camera protocol. Consider if there are other workflow changes/use cases needed to support medical photography process.

- What guidance can we provide on how encounter-based studies can/should be divided into Series?

- If a device spawns a new "encounter/procedure/study" for each acquisition, how do you relink those that are really part of the same actual encounter/procedure/study? E.g., photographic multiple body parts on the camera. Could have "bookend" images or signals that are processed by the "modality" (keeping in mind that the profile specifications are targeted at the software not the SLR).

- It's hard to find data that has been put into the patient record. Encounter images are used in more varied ways (in the EMR and beyond the EMR) than radiology perhaps. Launching a different viewer for each different data type and data source raises additional integration questions.

- Consider diagramming Diagnostic Imaging, Procedural Imaging and Evidence Imaging. Delineate EBI vs Enterprise Imaging vs mobile vs consumer vs lightweight vs web APIs vs ...

- Address "deferred completion" patterns. E.g., for a patient in ICU during the day, they acquire and send images and then finish labelling/assigning body parts and procedure metadata posthoc on the encounter manager. Sometimes another patient might be acquired without having closed the prior encounter leading to miss-assigned images that are then (hopefully) corrected too during the posthoc processing. Potential problems of two systems editing the metadata without being fully on the same page.

- While PoC US deployment motivation might be driven/justified/funded by ability to properly track and bill for the procedures, managing cameras might be more about risk mitigation since their use is less diagnostic procedures and more operations and documentation.

- Might require the Modality Actor to populate the Original Attributes Sequence when tinkering with values generated by the digital camera.

- How much do we need to describe the capture device Device Type? Is a value for Modality and Model enough? Do we need modality subtype to hold something like "medical photography" to specialize VL?

- Consider guidance for populating Contributing Equipment Sequence (0018,A001) to describe the camera while allowing the Modality Actor to create the DICOM instance. The sequence includes many details that can then differ for each contributing device:

  o Institution Name

  o Institutional Department Name

  o Station Name

  o Operator's Name

  o Operator's ID

  o Contribution Datetime

  o Contribution Description

Q15. Anything else in the whitepapers we should incorporate?

A: Yes, list these in a concept section

Relevant Whitepapers:

- SIIM-HIMSS Enterprise Imaging Workgroup - White Papers

- A Foundation for Enterprise Imaging - JDI Whitepaper

- Order-based vs Encounter-based Imaging - JDI Whitepaper (Andrei)

- The Workflow Challenges of Enterprise Imaging - JDI Whitepaper (Kevin)

- Technical Challenges of Enterprise Imaging - JDI Whitepaper (Kevin)

- PCD Encounter-based Patient Identification Management whitepaper (Andrei)

http://ihe.net/uploadedFiles/Documents/PCD/IHE_PCD_WP_PCIM_Rev1.1_2017-06-16.pdf

General Introduction

Update the following Appendices to the General Introduction as indicated below. Note that these are not appendices to Volume 1.

Appendix A – Actor Summary Definitions

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Add the following actors to the IHE Technical Frameworks General Introduction list of actors:

Actor	Definition
Encounter Manager	Coordinates encounters (between a care provider and a patient) and associated data. E.g., a practice management system.
Result Aggregator	Aggregates information about clinical results to facilitate practitioners finding and accessing them. Often a component of an EMR.

Appendix B – Transaction Summary Definitions

Add the following transactions to the IHE Technical Frameworks General Introduction list of transactions:

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Transaction	Definition
Get Encounter Imaging Context [RAD-130]	Obtain contextual metadata, such as patient demographics and encounter details, for encounter(s) during which imaging procedure(s) may take place.
Store Encounter Images [RAD-131]	Send images that were acquired in the course of a patient encounter (in contrast to those acquired for an ordered procedure).
Notify of Imaging Results [RAD-132]	Notify a data management system (e.g., EMR) that images (e.g., newly acquired in the course of a patient encounter) are available to the patient record.

Glossary

Add the following glossary terms to the IHE Technical Frameworks General Introduction Glossary:

Glossary Term	Definition
Encounter-based Imaging	The capture of medical images and associated data in the context of a patient encounter, such as an office visit. This is in contrast to Order-Based Imaging where imaging is captured in the context of an ordered procedure. Patient encounters can involve a patient going to a physician location, or a physician going to a patient location. Appointments represent anticipated encounters.

165

Volume 1 – Profiles

3 Scheduled Workflow (SWF) Profile

170 The ***Scheduled Workflow Integration Profile*** establishes the continuity and integrity of basic departmental imaging data. It specifies a number of transactions that maintain the consistency of patient and ordering information as well as providing the scheduling and imaging acquisition procedure steps. This profile also makes it possible to determine whether images and other evidence objects associated with a particular performed procedure step have been stored
175 (archived) and are available to enable subsequent workflow steps, such as reporting. It may also provide central coordination of the completion of processing and reporting steps as well as notification of appointments to the Order Placer.

For imaging workflow performed in the context of a patient encounter, rather than in the context of an ordered procedure, refer to the Encounter-Based Imaging Workflow (EBIW)
180 **Profile.**

47 Encounter-Based Imaging Workflow (EBIW) Profile

Medical imaging is increasingly done outside the context of an ordered procedure. The primary
185 goal of the EBIW Profile is to ensure that images acquired in the context of a patient encounter are combined with the corresponding metadata about the patient, the encounter, and the performed imaging procedure. This facilitates managing the imaging data, linking it into the patient medical record, and accessing it later. This profile introduces these capabilities for encounter-based imaging procedures in ways that are analogous to those of order-based imaging
190 procedures as coordinated by the Scheduled Workflow (SWF.b) Profile.

This Encounter-Based Imaging Workflow Profile specifies how to capture appropriate context, populate relevant indexing fields, link to related data, and ensure the images are accessible and well-knit into the medical record.

When such acquisition solutions are not integrated, complete and consistent, the efficiency and
195 quality of care is negatively affected:

- Time is lost to lack of automation and awkward workflow

- Images are absent from the EMR, or are lumped together on the EMR in a single "container" without easy ways to differentiate and navigate them

- The medical imaging record is "siloed" across many department systems

200
- Images are placed in a paper record or scanned into the EMR without the metadata needed to readily locate and access them again when needed

- Images are not available to the Care Team

- Data sharing with affiliated hospitals is limited or non-existent

The EBIW Profile follows the pattern of SWF.b:

205
- establish encounter/patient/context

- convey metadata

- capture/store image data

- index/archive images

210 Encounter-based imaging should get the same end result (the ability to find, access, analyze and use acquired images) as if the clinician placed the order. This profile does not address display criteria for encounter-based imaging as new criteria relative to existing conventional medical imaging were not identified.

Note: This profile currently addresses the Point-of-Care Ultrasound Use Case (see Section 47.4.2.1). The intention of the committee is to submit a proposal for the next IHE Radiology 215 development cycle to add a lightweight modality actor, a RESTful context transaction, and a RESTful DICOMweb image storage transaction, to support effective but lightweight integration of encounter-based medical photography using digital cameras, tablets and smartphones.

47.1 EBIW Actors, Transactions, and Content Modules

220 This section defines the actors, transactions, and/or content modules in this profile. General definitions of actors are given in the Technical Frameworks General Introduction Appendix A at http://ihe.net/Technical_Frameworks/#GenIntro.

Figure 47.1-1 shows the actors directly involved in the EBIW Profile and the relevant transactions between them. If needed for context, other actors that may be indirectly involved due to their participation in other related profiles are shown in dotted lines. Actors which have a 225 mandatory grouping are shown in conjoined boxes.
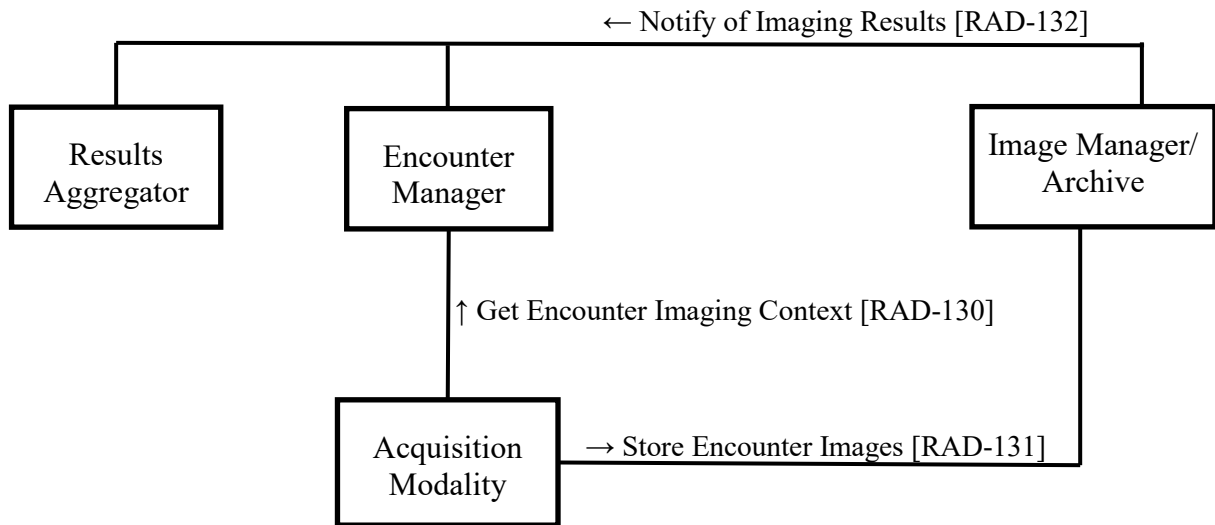
Figure 47.1-1: EBIW Actor Diagram

230 Table 47.1-1 lists the transactions for each actor directly involved in the EBIW Profile. To claim
compliance with this profile, an actor shall support all required transactions (labeled "R") and
may support the optional transactions (labeled "O").

Table 47.1-1: EBIW Profile - Actors and Transactions

Actors	Transactions	Optionality	Reference
Encounter Manager	Get Encounter Imaging Context [RAD-130]	R	RAD TF-3: 4.130
	Notify of Imaging Results [RAD-132]	O	RAD TF-3: 4.132
Acquisition Modality	Get Encounter Imaging Context [RAD-130]	R	RAD TF-3: 4.130
	Store Encounter Images [RAD-131]	R	RAD TF-3: 4.131
Image Manager/ Archive	Store Encounter Images [RAD-131]	R	RAD TF-3: 4.131
	Notify of Imaging Results [RAD-132]	R	RAD TF-3: 4.132
Result Aggregator	Notify of Imaging Results [RAD-132]	R	RAD TF-3: 4.132

47.1.1 Actor Descriptions and Actor Profile Requirements

235 Most requirements are documented in transactions (Volume 2 & 3). This section documents any
additional requirements on profile's actors.

47.1.1.1 Encounter Manager

The Encounter Manager manages and provides encounter metadata and marshaled patient
demographics (e.g., see Section 47.4.1.4).

240   The Encounter Manager shall be able to generate Study Instance UIDs and Accession Numbers.

The Issuer of Accession Number value shall be configurable on the Encounter Manager. Some sites may find it useful to configure the Encounter Manager to list itself as the issuer as a way to identify encounter-based accession numbers.

The Encounter Manager shall be configurable to assure that the generated accession numbers
245   avoid collisions with those generated by other systems.

> Note: This is particularly important on networks where some systems do not observe the Issuer of Accession Number and may include configuring a prefix or suffix string on the Accession Number value.

The Encounter Manager shall not return different accession numbers for the same admission to the same device unless it can determine that there has been an additional encounter. The profile
250   does not constrain how the Encounter Manager achieves this, but it will likely involve keeping a record of the accession numbers that have been provided in recent queries.

The Encounter Manager shall be capable of populating required fields in Get Encounter Imaging Context [RAD-130] with appropriate values for "John Doe" (unidentified) patients. How such behavior is triggered by the query from the modality is up to the Encounter Manager (e.g.,
255   querying with a first name of "Unidentified", or a patient id of 0, or using an id from a list of temporary ids) and the modality operators will need to be trained accordingly. See also Section 47.4.1.9 Unidentified Patients.

An Encounter Manager that implements, or is integrated with, systems for encounter appointment scheduling, practice management, or staff scheduling, would likely be able to have
260   more sophisticated business logic and be better able to populate fields of the Get Encounter Imaging Context [RAD-130] transaction. This profile does not require such capabilities beyond being able to populate the required fields.

47.1.1.2 Acquisition Modality

The Acquisition Modality assembles acquired pixels with associated metadata and perhaps
265   operator input and then stores the resulting image IODs. The Acquisition Modality may acquire/construct the pixels itself (e.g., a point of care ultrasound device) or it may import pixels and device metadata from a separate image capture device (e.g., a digital camera). Details of such separate image capture devices and mechanisms for import are the responsibility of the Acquisition Modality product and are outside the scope of this profile.

270   A major responsibility of the Acquisition Modality is to ensure that key procedure metadata (such as the body part examined and the imaging procedure performed) are included in the stored image. Populating these details may require interacting with the operator. Without this information, encounter images cannot be properly managed, located, and accessed when they are needed. The full requirements for stored images are documented in the Store Encounter Images
275   [RAD-131] transaction. See also Section 47.4.1.6 Recording Encounter and Procedure Metadata.

The Acquisition Modality may also store non-image DICOM IODs. Such evidence documents (like accompanying measurements) will share an Accession Number with associated images and

be stored in the same DICOM Study. Some Acquisition Modalities might also store non-DICOM clinical documents, such as HL7 CDA.

280 The Acquisition Modality user interface, e.g., where it takes input from the operator or shows the operator the metadata that will be associated with the stored images, is left to product design and is outside the scope of profile requirements. It is recommended that the Acquisition Modality be able to show the operator what values are being assumed and permit adjustment for metadata values like the department, operator, patient, procedure, etc.

285 **47.1.1.3 Image Manager/Archive**

The Image Manager/Archive is required to send notifications to the Result Aggregator. Optionally, the Image Manager/Archive may be configurable to also send notifications to the Encounter Manager.

47.1.1.4 Result Aggregator

290 The Result Aggregator receives notifications about newly acquired and stored images from encounter-based procedures. Typically this actor will be a component of, or a proxy for, an electronic medical record (EMR) system.

47.2 EBIW Actor Options

Options that may be selected for each actor in this profile, if any, are listed in the Table 47.2-1.
295 Dependencies between options when applicable are specified in notes.

Table 47.2-1: Encounter-Based Imaging Workflow - Actors and Options

Actor	Option Name	Reference
Encounter Manager	No options defined	--
Acquisition Modality	No options defined	--
Image Manager/Archive	No options defined	--
Result Aggregator	No options defined	--

47.3 EBIW Required Actor Groupings

An actor from this profile (Column 1) shall implement all of the required transactions and/or content modules in this profile *in addition to* all of the transactions required for the grouped
300 actor (Column 2).

If this is a content profile, and actors from this profile are grouped with actors from a workflow or transport profile, the Content Bindings Reference column references any specifications for mapping data from the content module into data elements from the workflow or transport transactions.

305   In some cases, required groupings are defined as at least one of an enumerated set of possible actors; this is designated by merging column one into a single cell spanning multiple potential grouped actors. Notes are used to highlight this situation.

Section 47.5 describes some optional groupings that may be of interest for security considerations and Section 47.6 describes some optional groupings in other related profiles.

310   **Table 47.3-1: Encounter-Based Imaging Workflow - Required Actor Groupings**

EBIW Actor	Actor to be grouped with	Reference	Content Bindings Reference
Encounter Manager	ITI CT / Time Client	ITI TF-1: 7	--
Acquisition Modality	ITI CT / Time Client	ITI TF-1: 7	--
Image Manager/Archive	None	--	--
Result Aggregator	ITI CT / Time Client	ITI TF-1: 7	--

47.4 EBIW Overview

47.4.1 Concepts

The primary goal of the EBIW Profile is to ensure that images acquired in the context of a patient encounter are combined and stored with the corresponding metadata about the patient, the
315   encounter, and the performed imaging procedure. This facilitates managing the imaging data, linking it into the patient medical record, and accessing it later in ways analogous to those for order-based imaging as coordinated by the Scheduled Workflow (SWF.b) Profile.

Many of the concepts in this profile were influenced by a set of whitepapers on Enterprise Imaging done by members of a joint working group of the Society for Imaging Informatics in
320   Medicine (www.siim.org) and the Healthcare Information and Management Systems Society (www.himss.org). The whitepapers (available from http://siim.org/page/himss_siim_white_pap) include:

- A Foundation for Enterprise Imaging

- Order-based vs Encounter-based Image Capture

325   - Workflow Challenges of Enterprise Imaging

- Technical Challenges of Enterprise Imaging

Readers may also find useful the whitepaper from the IHE Patient Care Device Domain entitled Point-of-Care Identity Management (PCIM) which is available here: http://ihe.net/uploadedFiles/Documents/PCD/IHE_PCD_WP_PCIM_Rev1.1_2017-06-16.pdf

330 **47.4.1.1 Encounter Information Model**

The information model diagram (See Figure 47.4.1.1-1) relates operational entities (a Patient has
Visits to a facility which may include Encounters with clinicians which may result in performed
Imaging Procedures) to DICOM entities (a Patient has Studies which contain Series which
contain image Instances) and to other documents.

335 Each entity has a primary identifier (shown in regular text) for instances of that entity, and
sometimes references (shown in italics) to other identifiers that provide links to related entities.
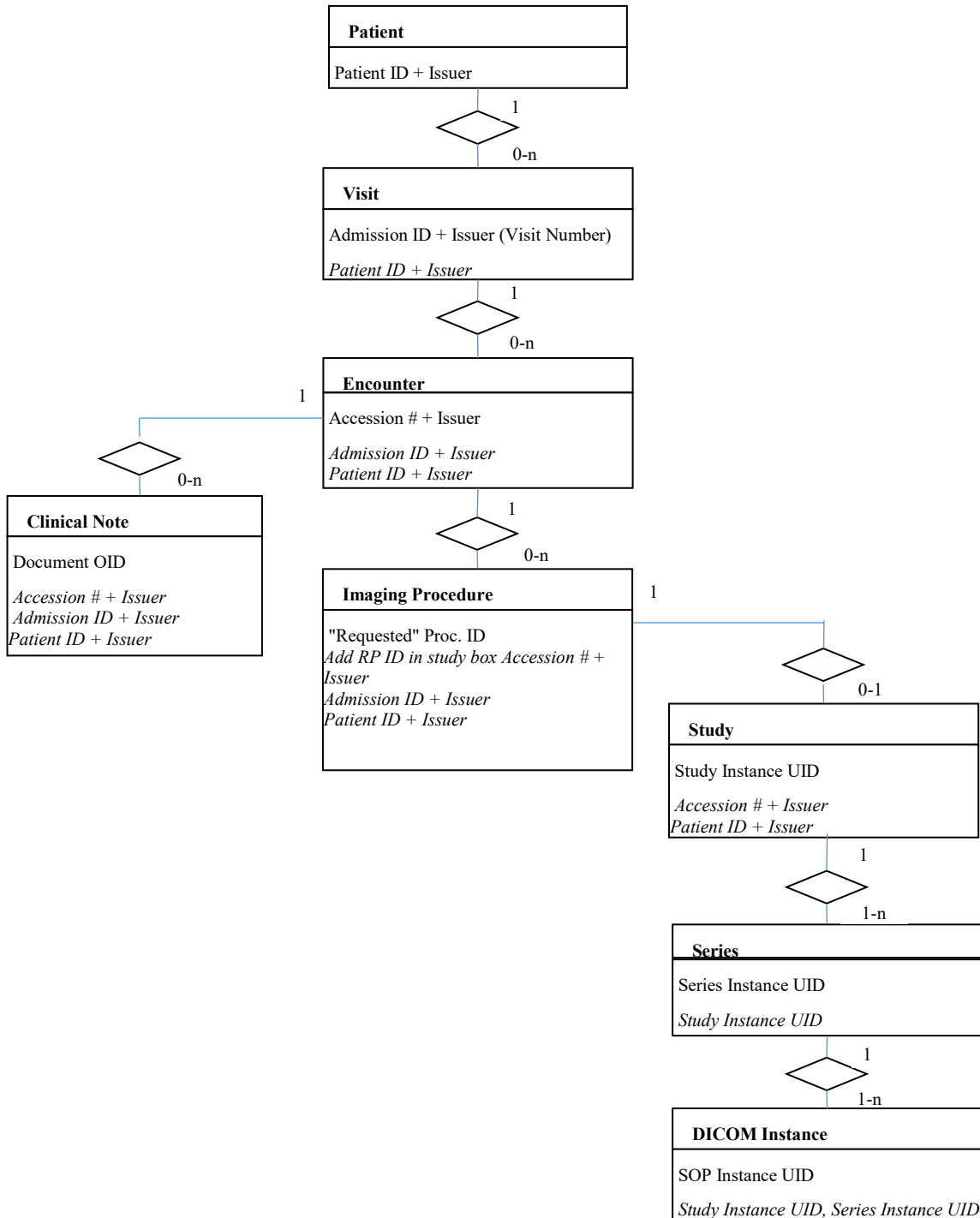
Figure 47.4.1.1-1: Encounter-Based Imaging Information Model

340   An Encounter is part of a Visit associated with a particular department or practitioner.

An Encounter may have multiple Imaging Procedures and thus there may be multiple Studies associated with an encounter, although typically it will only be one, possibly with multiple Series. Current encounter-based imaging devices are sometimes prolific about spawning multiple Studies when they could be a single Study with multiple Series. Some PACS compensate for

345   such behavior by auto-merging Studies with the same Accession Number.

Per the DICOM data model, a Series does not contain images belonging to more than one performed Imaging Procedure.

In principle, a Study could span multiple encounters; however this is uncommon and this profile does not address coordinating the Study Instance UID and Accession Number for re-use during

350   subsequent imaging.

It is often left to the acquisition modality operator to control when to make a new Study within an encounter. The DICOM header includes attributes for the Body Part Examined and the Modality of each Series. For Encounters that image multiple body parts, imaging of each body part should be in separate Series to allow proper population of the Body Part Examined attribute

355   in the DICOM header. Similarly, if images are produced from multiple modalities during the same encounter, they must at least be put in different Series. It is also acceptable to consider the Encounter as having multiple Imaging Procedures, which each have a Study and one or more Series.

Note that some or all of the images acquired during an Encounter might not be persistently stored

360   (i.e., to PACS) if the acquiring physician judges them to be not clinically significant/relevant. There is often a selection step between acquisition and storage.

Figure 4.1.1-1 shows a Clinical Note to represent other Encounter documentation with which images might be associated such as visit notes, operative procedure notes, office notes, nursing notes, treatment reports, procedure reports, or discharge notes. It is expected that notes will

365   always have an OID (a unique Object Identifier) allowing them to be uniquely identified. If such notes also include the Accession # and Issuer, the note could be unambiguously linked to the Encounter and thus to the other artifacts generated in the encounter. Clinical notes might be encoded as HL7[®4] CDA[®5] documents.

For many encounter-based images, there will not necessarily be an associated diagnostic report.

370   If diagnostic findings are recorded, they might be put into a procedure note as described in the previous paragraph. It is also possible that a formal diagnostic report will be made about the imaging procedure, similar to that produced for a radiology procedure. Such reports are associated with the Accession # and the Study Instance UID. Reports may refer to images acquired over multiple encounters (e.g., priors).

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[4] HL7 is the registered trademark of Health Level Seven International.

[5] CDA is the registered trademark of Health Level Seven International.

375 The Service Episode, and corresponding Service Episode ID in the DICOM Visit Identification Sequence, are not included in the information model. A Service Episode encompasses multiple Visits and as such is "larger" than a Visit, not "smaller" so it does not correspond to the Encounter entity in this profile. Service Episodes were intended to model the illness onset/treatment cycle which is not significantly relevant to the finer grained encounter-based

380 imaging workflow.

47.4.1.2 Accession Numbers

The accession number has become the primary index for managing an imaging study in the electronic medical record. It also serves a key role in linking images with associated reports and other documents. This profile preserves this role of accession number in the context of

385 encounter-based imaging.

Accession numbers are generated by departmental information systems, such as the RIS, for use by the modalities, PACS, reporting systems, HIS and EMR systems, and cross-enterprise image sharing infrastructure. For order-based imaging, the accession number is associated with the order that provided the context for, and often initiated, the order-based imaging procedure. For

390 encounter-based imaging, the accession number is associated with the encounter that provided the context for, and initiated, the imaging procedure.

In both order-based and encounter-based imaging, an accession number may span multiple imaging procedures related to the same order or encounter. Sites may choose to use procedures that are "fine-grained" (several procedures sharing an accession number) or "coarse-grained"

395 (one procedure per accession number) in orders and encounters.

47.4.1.3 Orders

Placing an order for an encounter-based imaging procedure is generally not necessary and in some cases would be disruptive to clinical care activities. That being said, some EMRs are dependent on having an order with which to associate imaging procedures.

400 The profile does not require the Result Aggregator (likely implemented as a component of an EMR) to create an order and the profile is not dependent on such an order. The profile does try to ensure that the necessary details have been provided via the Notify of Imaging Results [RAD-132] transaction so that the EMR can create such an order if it wishes. Some EMRs use such orders as a substitute tracker for an encounter and/or for billing purposes.

405 ### 47.4.1.4 Obtaining Patient Metadata

The Encounter Manager is responsible for obtaining relevant patient metadata which it provides to the encounter-based imaging modality. A variety of HL7 v2.5.1 message segments and fields contain relevant patient details. This profile does not mandate support for any specific set of HL7 messages containing those segments, but several IHE profiles are worth considering.

410   The Encounter Manager could group with a Patient Demographics Consumer in the Patient Administration Management (PAM) Profile to receive a feed of patient demographics for all patients in the facility. The Patient Identity Management [ITI-30] profiles 6 HL7 ADT messages, although depending on the option selected the actor only needs to implement 4 or 5 of them. Implementers of the PAM Profile are advised to pay close attention to the additional regional

415   requirements described in ITI TF-4 for National Extensions. Note that the Encounter Manager could alternatively group with a Patient Encounter Consumer (see Section 47.4.1.4) since [ITI-31] also contains patient demographics.

    The Encounter Manager could group with a Patient Demographics Consumer in the Patient Demographics Query (PDQ) Profile to get patient demographics on demand. The Patient

420   Demographics Query [ITI-21] transaction provides at least basic name, MRN, sex, DOB and address information. The Patient Demographics and Visit Query [ITI-22] transaction additionally provides a variety of PV1 fields identifying the visit number, care team members, hospital service, patient location and admission type.

    The Encounter Manager could group with a Patient Demographics Consumer in the Patient

425   Demographics Query v3 (PDQv3) Profile to get patient demographics on demand. The Patient Demographics Query HL7 v3 [ITI-47] transaction provides a few more details and handles MRN assigning authorities (Issuer of Patient ID).

    The Encounter Manager could group with a Patient Demographics Consumer in the Patient Demographics Query for Mobile (PDQm) Profile to get patient demographics on demand. The

430   Mobile Patient Demographics Query [ITI-78] transaction provides the same details as PDQv3 using RESTful services.

    If the Encounter Manager is grouped with the active Patient Demographics Supplier in any of the above profiles that would give it access to the information internally.

    It is also possible that an Encounter Manager exists as a component of the EMR and thus has

435   direct internal access to the required patient records even if the EMR has not implemented any demographics related profiles.

47.4.1.5 Obtaining Encounter Metadata

    The Encounter Manager is also responsible for obtaining relevant encounter metadata which it provides to the encounter-based imaging modality. A variety of HL7 v2.5.1 message segments

440   and fields contain relevant encounter details. This profile does not mandate support for any specific set of HL7 messages containing those segments, but several IHE profiles are worth considering.

    The Encounter Manager could group with a Patient Encounter Consumer in the Patient Administration Management (PAM) Profile to receive a feed of encounter details for all patients

445   in the facility. The Patient Encounter Management [ITI-31] transaction profiles 25 HL7 ADT messages, although an implementation that only needs admit/discharge information only needs to implement 5 of them, while an implementation that needs notification of pending changes to the

patient location, visit status and care team would implement 17 of them. Note that [ITI-31] provides patient data in addition to encounter data.

450   The Encounter Manager could group with a Patient Demographics Consumer in the Patient Demographics Query (PDQ) Profile to get some encounter details on demand. The Patient Demographics and Visit Query [ITI-22] transaction provides a variety of PV1 fields identifying the visit number, care team members, hospital service, patient location and admission type (in addition to patient demographics information).

455   If the Encounter Manager is grouped with the patient information supplier in any of the above profiles that would give it access to the information internally.

It is also possible that an Encounter Manager exists as a component of the EMR and thus has direct internal access to the required visit and encounter records.

The Encounter Manager could be a recipient of HL7 SIU messages (such as those profiled for
460   eye care appointments in the Appointment Scheduling Management [EYECARE-16] transaction) to get appointment details for encounters and associated metadata.

Finally, it is possible that the Encounter Manager manages encounter scheduling independent of the EMR and can create appropriate values for the required fields itself.

47.4.1.6 Recording Encounter and Procedure Metadata

465   The ability to properly manage, locate, access, and use encounter-based images depends on key encounter and procedure metadata being properly captured and recorded with the images. In particular, information about the imaging procedure (such as the body part examined, and the reason the image was captured) are best known at the moment the image is captured. The further away in time and space this information is recorded, the less available and accurate it will be.

470   The Acquisition Modality is responsible for meeting the full requirements for stored images as documented in the Store Encounter Images [RAD-131] transaction. Some of the information will be available in the response received in the Get Encounter Imaging Context [RAD-130] transaction. Populating the rest of these details will likely require some interaction with the operator. This profile does not dictate how this takes place but advises that it should be as
475   automated and convenient as possible. This might include picklists for the operator to avoid manual entry. Those picklists might be configurable or filtered based on details of the encounter to keep them as short and manageable as possible.

The Acquisition Modality may also supplement the encounter metadata. For example, based on who is logged into the modality, or from scanning a care provider badge, the modality may know
480   more accurately which care provider the patient is having an encounter with, or which department or specialty is currently using the device. Again, configurable picklists might be a useful feature.

47.4.1.7 Consumption of Encounter-Based Images

Encounter-based images that have been stored may be sought out and accessed for a variety of reasons including:

- To view images referenced in an encounter note or report

- To compare current images to the corresponding priors when a physician is evaluating a condition such as a mole, wound, or burn.

- To access encounter-based images as relevant priors or clinical context when reading order-based images to generate a report

- To explain clinical progress/situation to a patient

- To consult with a specialist

- To support medico-legal proceedings

- To support billing

Key metadata for finding relevant images, considering the above reasons, includes:

- Accession Number

- Admission ID

- Acquisition Datetime (Study datetime, Series datetime)

- Body Part Examined, Anatomical Region, Primary Anatomical Structure

- Clinical Specialty (dermatology, burn care, wound care)

- Location of Acquisition (room, department, facility, institution)

- Operator, Performing Physician, and/or Attending Physician

- Modality type

- Procedure Type, Performed Procedure Code

- Purpose/reason for performed procedure (code and text), Study description , Series description

The metadata that is useful for finding relevant images may also be useful for ranking relevancy or for grouping and presenting images (e.g., hanging protocols or layouts).

It may be useful to organize images into categories that are used/managed differently or to which different policies (e.g., retention) apply.

- Procedure documentation

- Observation evidence

- Diagnostic images

For further discussion of the organization of encounter-based imaging, refer to Roth, C.J., Lannum, L.M. & Persons, K.R. J Digit Imaging (2016) Volume 29. https://doi.org/10.1007/s10278-016-9882-0

47.4.1.8 Codesets

Being able to manage and find relevant encounter-based images depends significantly on the consistent use of appropriate codesets for things like procedure codes, anatomy/body part and reason for performed imaging. This profile does not mandate the use of particular codesets but makes the following recommendations.

DICOM provides several good anatomy codesets in PS3.16. CID 4 Anatomic Region is a good place to start since it, in turn, references several sub-codesets. New codes are being added to better support dermatological conventions for anatomical site coding. An important consideration for sites establishing local codes and conventions is what level of granularity is most appropriate. While fine-grained codes (anterior of distal left index finger) can provide greater specificity, more coarse codes (left hand) can provide shorter picklists and simpler queries.

The Radlex Playbook set of procedure codes from LOINC is worth investigating for ultrasound.

Point-of-Care Ultrasound systems should consider the code list provided in RAD TF-3:Appendix Z for populating the Reason for Performed Procedure Code Sequence (0040,1012).

47.4.1.9 Unidentified Patients

It is to be expected that some patients being imaged have not yet been identified (e.g., admitted while unconscious). This is sometimes referred to as the "John Doe" scenario.

Procedure and Pixel metadata should be populated as usual in this case since they are not affected by the patient identity.

Encounter metadata can be mostly populated as usual but might be a bit sparser since this scenario often occurs in an urgent care context. If the John Doe patient has been admitted, they should have the normal identification mechanisms (e.g., a wristband with an Admission ID) and the imaging device will still have whatever information it has about the department, operator, and location context.

Patient metadata will be sparser and the name/ID will likely be placeholders. The Modality and the Encounter Manager should be prepared to work with commonly used methods for handling John Doe patients. This may include:

- Having a list of temporary Patient ID values (MRNs) and conventions for Patient Name, sex and age.

- Registering the John Doe with sex and estimated age and assigning a temporary Patient ID which makes those details available to the Encounter Manager the same as for regular patients. The Modality would receive these from the Get Encounter Imaging Context

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550   [RAD-130] transaction by searching for the patient ID or admission ID from the wristband or manual entry.

- Managing a list of temporary IDs on the Encounter Manager, which are provided to the Modality in the Get Encounter Imaging Context [RAD-130] transaction when the Modality uses some mechanism defined by the Encounter Manager, e.g., query for a
555   Patient ID of 000.

Existing methods on the PACS and RIS for merging records with placeholder demographics after the patient has been properly identified should also work effectively for Encounter-Based imaging data. For more details, refer to the Unidentified Patient use cases in the Scheduled Workflow.b Profile and materials on Patient Information Reconciliation.

560   47.4.2 Use Cases

Encounter-based imaging can be found in a variety of clinical contexts. This profile is specifically considering the following:

- Point of Care Ultrasound

- Dermatology

565 - Wound Care/Management

- Infectious Diseases

- Burn Care

- Plastic Surgery

- Nursing/Clinic Photography

570   Goals:

- Easily identify the type of imaging performed and the anatomical region through an EMR imaging description

- Associate report or note describing the visit where the images were obtained with images displayed in an enterprise viewer

575   47.4.2.1 Use Case #1: Point of Care Ultrasound

Images are captured at the point-of-care using a DICOM-capable ultrasound modality device. The workflow is typically "order-less" in that it is not driven by an order from a referring physician.

47.4.2.1.1 Point of Care Ultrasound Use Case Description

580   The Point of Care Ultrasound Use Case is intended to generalize the following scenarios:

- Inpatient Status Check

    o A registered inpatient is in their bed in a ward

    o The care provider (nurse, tech, clinician) performs an ultrasound to determine the state of the bladder (empty, partial, full), or to confirm placement of a needle or a PICC line (peripherally inserted central catheter)

    o Although the image is typically evidentiary or for simple assessment rather than "diagnostic", it might still be referred to a radiologist if potential anomalies are observed.

- Emergency Room Evaluation

    o A patient presents in the Emergency Room and is registered with an ER designation (between in-patient and out-patient)

    o The ER physician captures ultrasound images as part of their evaluation of the patient:

        ▪ to diagnose, detect or confirm a disorder or disease state such as internal bleeding, soft tissue infection, pulmonary edema, pericardial effusion, deep venous thrombosis, gallstones, residual urine in the bladder or subcutaneous abscesses

        ▪ to localize fluid and evaluate the amount present

    o When such imaging is diagnostic, it may be "interpreted locally" rather than in a subsequent reading step by a radiologist.

- Procedure Guidance

    o A patient (either inpatient or outpatient) requires a procedure such as a biopsy, venous catheter placement, paracentesis or thoracentesis.

    o The care provider performs ultrasound to guide the procedure by visualization of the procedure device (needle, catheter, etc.) in relation to the relevant anatomy (tumor, blood vessel, abscess, etc.)

    o The ultrasound imaging may be kept as procedural evidence.

- Outpatient Supplemental Information

    o A patient makes scheduled visit to a specialist and is registered as an outpatient.

    o The specialist is consulting on an identified condition, such as a breast surgeon evaluating an abnormal lump detected by the patient's primary care physician.

    o The specialist decides to take ultrasound images to evaluate/characterize the condition or to document the absence of the suspected condition.

    o The findings from the imaging would be included in the specialist's report.

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615 An important aspect of this use case is that the imaging procedure is not ordered. There may be no need for an order for the imaging and, due to the ad hoc nature of the decision to use imaging manually, placing an order could interrupt the flow of care.

The Process Flow below shows the Acquisition Modality getting the encounter imaging context prior to the acquisition of images. In principle, the Acquisition Modality just needs to get the
620 context prior to storing the images to the Image Manager, so it could acquire the images and then get the context to compose the DICOM instances for storage. The diagram also shows the Encounter Manager grouped with a Patient Encounter Consumer which is just one of several ways to obtain patient and encounter metadata (see Sections 47.4.1.4 and 47.4.1.5) and is not formally part of the EBIW Profile.

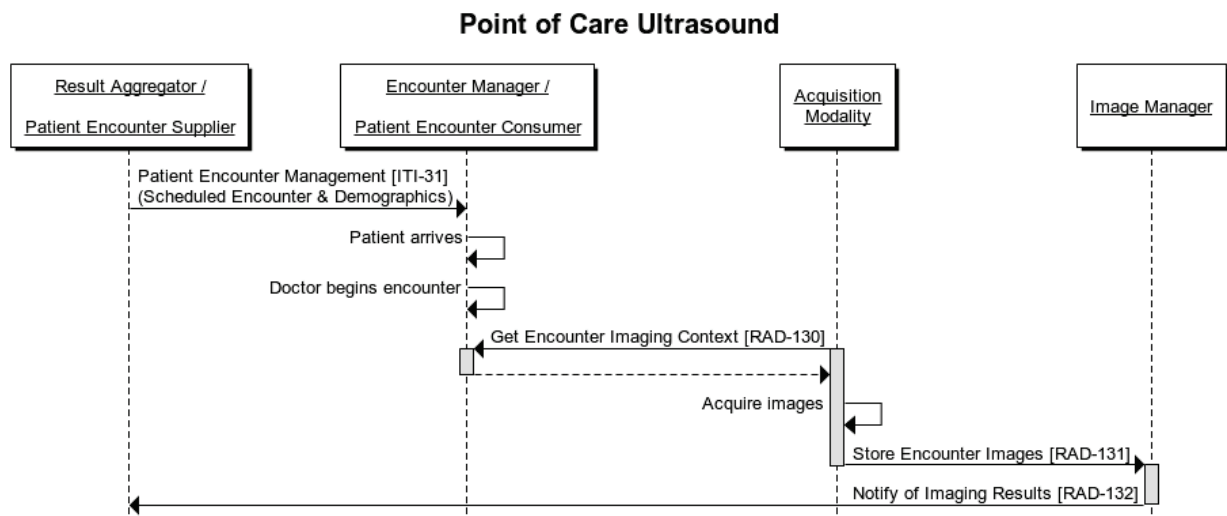625 **47.4.2.1.2 Point of Care Ultrasound Process Flow**

Figure 47.4.2.1.2-1: Point of Care Ultrasound Process Flow in EBIW Profile

The text in Figure 47.4.2.1.2-2 was used to generate the diagram in Figure 47.4.2.1.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

```
title Point of Care Ultrasound

participant Result Aggregator /\n\nPatient Encounter Supplier as RA
participant Encounter Manager /\n\nPatient Encounter Consumer as EM
participant Acquisition\nModality as Modality

RA->EM: Patient Encounter Management [ITI-31]\n(Scheduled Encounter & Demographics)
EM->EM: Patient arrives
EM->EM: Doctor begins encounter
Modality->+EM: Get Encounter Imaging Context [RAD-130]
activate Modality
EM-->-Modality:
Modality->Modality: Acquire images
Modality->-Image Manager: Store Encounter Images [RAD-131]
activate Image Manager
Image Manager->-RA: Notify of Imaging Results [RAD-132]
```

630

Figure 47.4.2.1.2-2: Diagram Pseudocode for Point of Care Ultrasound Process Flow

47.5 EBIW Security Considerations

Refer to RAD TF-1: Appendix F Security Environment Considerations.

Personal Healthcare Information (PHI) is present in the context query response, the stored
635 images and the notification message.

47.5.1 Security Considerations for Actors

All actors in the EBIW Profile should consider grouping with a Secure Application or Secure
Node Actor in the Audit Trail and Node Authentication (ATNA) Profile.

This profile strongly recommends implementation of the ATNA Record Audit Event [ITI-20]
640 transaction to record when and where encounter-based imaging is distributed.

The ATNA Profile also requires that all actors implement the Authenticate Node [ITI-19]
transaction to further ensure the integrity of transactions. Implementers are advised to take
advantage of the authentication and communication encryption capabilities that Authenticate
Node [ITI-19] transaction provides between Secure Nodes and to take advantage of TLS when
645 communicating over the Internet or other environments where the communications might be
vulnerable to cybersecurity attacks.

Modalities used for encounter-based imaging are often mobile and used by a variety of users in a
variety of settings over the course of a day. This raises challenges with authenticating the
operator, and with the Acquisition Modality being exposed to people who are not authorized to
650 use it or access the information it contains. The Acquisition Modality will need to implement
access control mechanisms consistent with the organization's policies, e.g., which care team
members and non-members are permitted to view images, etc.

The Image Manager/Archive is expected to often be the same as that used for order-based imaging. The security considerations are similar for both cases.

47.5.2 Security Considerations for Encounter-based Images

Images contain personal demographic information and clinical information.

47.6 EBIW Cross Profile Considerations

Table 47.6-1 describes various actors in various other profiles that might be useful to group with EBIW Profile actors.

Table 47.6-1: Encounter-Based Imaging Workflow - Optional Actor Groupings

EBIW Actor	Might group with	Potential Purpose
Encounter Manager	SWF.b Order Filler	To manage both order-based and encounter-based imaging, and potentially leverage existing support for handling patient demographics and providing modality worklist.
	PDQ/PDQv3/PDQm Patient Demographics Consumer	To query for patient demographics that could populate the encounter-based imaging context. See 47.4.1.4 for discussion of usage. See ITI TF-1: 8, ITI TF-1:24, ITI TF-1:38 for profile details.
	PAM Patient Demographics Consumer	To receive a feed of patient demographics that could populate the encounter-based imaging context. See also 47.4.1.4 for discussion of usage. See ITI TF-1: 14 for profile details.
	PAM Patient Encounter Consumer	To receive a feed of encounter details that could populate the encounter-based imaging context. See also 47.4.1.5 for discussion of usage. See ITI TF-1: 14 for profile details.
	SOLE Event Reporter	To capture timestamps of encounter-based imaging activity for departmental analytics.
	ATNA Secure Node	To establish secure connections to the Acquisition Modality and ADT, and to log security related events. See ITI TF-1: 9 for profile details.
	IRWF.b Importer	To import prior images on media that a patient has brought to an encounter.
Acquisition Modality	SWF.b Acquisition Modality	To support both order-based and encounter-based imaging.
	PDI Portable Media Creator	To export encounter-based images on media.
	SOLE Event Reporter	To capture timestamps of encounter-based imaging activity for departmental analytics.
	ATNA Secure Node	To establish secure connections to the Encounter Manager and Image Manager/Archive, and to log security related events. See ITI TF-1: 9 for profile details.
Image Manager/ Archive	XDS-I.b Image Document Source	To make encounter-based images available for sharing across the enterprise. Since the images have all the relevant metadata, including Accession #, this should work transparently.
Result Aggregator	BIR Image Display	To present to clinicians for review encounter-based images it has indexed.
	IID Image Display Invoker	To launch a viewer for clinicians to review encounter-based images it has indexed.

Volume 3 – Transactions

Add new transaction 4.130

4.130 Get Encounter Imaging Context [RAD-130]

4.130.1 Scope

665 This transaction is used to get the contextual metadata that will be associated with encounter-based imaging acquisitions. This may include metadata about the patient demographics, admission status, details of the encounter/visit and possibly the procedure(s) being performed.

This transaction is analogous to the Query Modality Worklist [RAD-5] transaction that is used in the context of order-based imaging procedures.

670 ### 4.130.2 Actor Roles

The roles in this transaction are defined in the following table and may be played by the actors shown here:

Table 4.130.2-1: Actor Roles

Role:	Requester: Requests contextual metadata for an encounter-based imaging acquisition.
Actor(s):	The following actors may play the role of Requester: Acquisition Modality
Role:	Responder: Processes a request and returns metadata results that matches the requested filter (if any).
Actor(s):	The following actors may play the role of Responder: Encounter Manager

675 Transaction text specifies behavior for each role. The behavior of specific actors may also be specified when it goes beyond that of the general role.

4.130.3 Referenced Standards

DICOM PS3.4: Modality Worklist SOP Class

4.130.4 Interaction Diagram

Requester　　　　　　　　　　　　　　Responder

Request Encounter Metadata →

← Return Matching Metadata
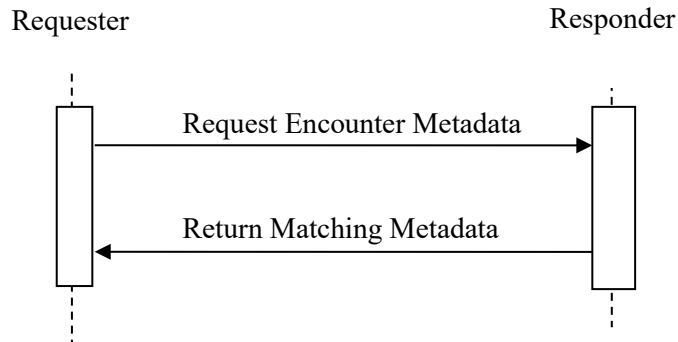
680

4.130.4.1 Request Encounter Metadata

The Requester sends a filter to the Responder in a request for matching encounter metadata.

The Responder shall support handling such messages from more than one Requester. The Requester shall support making requests to more than one Responder.

685 #### 4.130.4.1.1 Trigger Events

A user or an automated function on the Requester needs to obtain information about an encounter being managed by the Responder.

Typically, the Requester intends to perform image acquisition in the context of the encounter and associate the acquisition results with the medical record of the patient.

690 This transaction supports the use of various matching query keys to find the appropriate patient encounter. In some implementations, the Requester may scan a barcode or RFID, such as those found on patient wristbands, to automatically populate such matching query keys. It should be noted that some wristbands encode the Admission ID rather than the Patient ID, and the patient name might only be in printed text on the wristband. Requesters may need to be configurable to
695 support such variations in automatic queries.

4.130.4.1.2 Message Semantics

The message is a DICOM C-FIND request of the DICOM Modality Worklist SOP Class. The Requester is the SCU, and the Responder is the SCP.

The Requester shall support the required SCU query keys listed in Table 4.130.4.1.2-1.

700 Table 4.130.4.1.2-1 summarizes the matching key requirements and lists the optional and required attributes that may be requested by the SCU (Requester) and shall be returned by the SCP (Responder). Requirements indicated with R+ or R+* highlight the requirements added by the IHE Technical Framework. See RAD TF-2: 2.2 for more information. All display

requirements are an addition to the DICOM Standard requirements for the Modality Worklist SOP Class.

Specific attributes (return keys) in these requirements support compliance with requirements in the Store Encounter Images [RAD-131] transaction. Additional attributes that are not used to populate objects may be queried for use on the Requester (e.g., attributes displayed to the operator).

The Requester shall include the Scheduled Station AE Title (0040,0001) as a Matching Key populated with its own AE Title. The value is intended to be informative for the Responder (see Section 4.130.4.1.3).

The Requester shall include the Modality (0008,0060) as Matching Key populated with its own modality. The value is intended to be informative for the Responder (see Section 4.130.4.1.3).

Table 4.130.4.1.2-1: Return and Matching Keys for Encounter Metadata

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Patient Metadata					
Patient Identification					
Patient's Name	(0010,0010)	R+	R	R+	R
Patient ID	(0010,0020)	R+	R	R+	R
Issuer of Patient ID	(0010,0021)	O	R+	R+	R+
Other Patient IDs Sequence	(0010,1002)	O	O	O	R+
Patient Demographic					
Patients Birth Date	(0010,0030)	O	O	R+	R+
Patient's Sex	(0010,0040)	O	O	R+	R+
Confidentiality constraint on patient data	(0040,3001)	O	O	O	R+
Ethnic Group	(0010,2160)	O	O	O	O
Patient Medical					
Pregnancy Status	(0010,21C0)	O	O	O	O
Contrast Allergies	(0010,2110)	O	O	O	O
Patient's Weight	(0010,1030)	O	O	O	O
Patient's Size	(0010,1020)	O	O	O	O
Encounter Metadata					
Visit Identification					
Institution Name	(0008,0080)	O	R+	R+	R+
Institution Code Sequence	(0008,0082)	O	O	R+	R+
Institution Address	(0008,0081)	O	O	R+	R+
Institutional Department Name	(0008,1040)	R+	R+	R+	R+

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Institutional Department Code Sequence [IHE-6]	(xxxx,yyyy)	R+	R+	R+	R+
Admission ID	(0038,0010)	R+	R+	R+	R+
Issuer of Admission ID Sequence	(0038,0014)	R+	R+	R+	R+
Visit Admission					
Admitting Date	(0038,0020)	O	O	O	R+
Admitting Time	(0038,0021)	O	O	O	R+
Admitting Diagnoses Description	(0008,1080)	O	O	O	O
Admitting Diagnoses Code Sequence	(0008,1084)	O	O	O	O
Reason(s) for Visit [IHE-6]	(xxxx,yyyy)	O	O	O	R+
Reason(s) for Visit Code Sequence [IHE-6]	(xxxx,yyyy)	O	O	O	R+
Consulting Physician's Name	(0008,009C)	O	O	O	O
Consulting Physician Identification Sequence	(0008,009D)	O	O	O	O
Referring Physician's Name	(0008,0090)	O	O	O	O
Referring Physician Identification Sequence	(0008,0096)	O	O	O	O
Referring Physician's Telephone Numbers	(0008,0094)	O	O	O	O
Visit Status					
Current Patient Location	(0038,0300)	O	O	O	O
Procedure Metadata					
Imaging Service Request					
Accession Number	(0008,0050)	O [IHE-4]	O [IHE-4]	R+	R+ [IHE-3]
Issuer of Accession Number Sequence	(0008,0051)	O	O	R+	R+
Requesting Service	(0032,1033)	O	O	O	O
Requesting Service Code Sequence	(0032,1034)	O	O	O	O
Requested Procedure					
Requested Procedure Description	(0032,1060)	O	O	O	R [IHE-5]
Requested Procedure Code Sequence	(0032,1064)	O	O	O	R [IHE-5]
Reason for the Requested Procedure	(0040,1002)	O	O	O	O
Reason for Requested Procedure Code Sequence	(0040,100A)	O	O	O	O
Study Instance UID	(0020,000D)	O	O	R+*	R
Scheduled Procedure Step					
Scheduled Procedure Step Sequence	(0040,0100)			[IHE-1]	[IHE-2]
>Scheduled Station AE Title	(0040,0001)	R+	R	R+	R
>Scheduled Procedure Step Start Date	(0040,0002)	O	R	O	R

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>Scheduled Procedure Step Start Time	(0040,0003)	O	R	O	R
>Scheduled Procedure Step Location	(0040,0011)	O	O	O	O
>Modality	(0008,0060)	R+	R	R+	R
>Scheduled Performing Physician's Name	(0040,0006)	O	R	O	O
>Scheduled Procedure Step ID	(0040,0009)	O	O	O	R
>Scheduled Protocol Code Sequence	(0040,0008)	O	O	O	O
>Scheduled Procedure Step Description	(0040,0007)	O	O	O	R

[IHE-1]: To obtain attribute values in the Scheduled Procedure Step Sequence, SCUs request a universal attribute match by including selected attributes in the Scheduled Procedure Step Sequence (0040,0100) in the Matching Key list.

720 [IHE-2]: SCP implementations shall support, per the DICOM Standard, the method described in IHE-1. The SCP will return managed attributes that were selected.

[IHE-3]: A value (non-empty field) shall be returned in the Accession Number attribute.

[IHE-4]: The matching performed by the SCP for the Accession Number attribute shall be single value (SV) matching.

725 [IHE-5]: Requested Procedure Description (0032,1060) and Requested Procedure Code Sequence (0032,1064) are type 1C return keys with the condition that one or the other or both shall be supported by the SCP.

[IHE-6]: The Tag numbers for these attributes is pending completion of a Change Proposal in DICOM. When that CP is complete, a corresponding CP in IHE Radiology will update this table.

730 **4.130.4.1.2.1 Example Matching Key Usage**

Due to the variety of encounter contexts, one can expect a variety of query patterns using the matching keys.

- Wristband-driven Query

735 Patients often have an identification wristband with a barcode or RFID that a reader connected to the Acquisition Modality could scan. Typically the value returned is either a value for Patient ID (0010,0020) or Admission ID (0038,0010) that could be matched. The Acquisition Modality may need to be configured to know which attribute is coded on the wristbands at its institution and may need to be configured with the value for the local Issuer of Patient ID (0010,0021) or Issuer of Admission ID (0038,0014).

740 Wristbands often also have the Patient Name printed in text, although that would have to be entered on the modality console by the operator.

Note: SCUs are recommended to append a wildcard "*", if one was not previously entered by the user, at the end of each component of the structured Patient Name.

- Query by Department

745   Using Institutional Department Name (0008,1040) or the Institutional Department Code Sequence (xxxx,yyyy), the Acquisition Modality can query for all patient encounters planned for this clinical unit. Ideally, the department value reflects the context of the acquisition, rather than ownership of the device. The Acquisition Modality may be configured with the department to which it belongs or a short list of departments in which

750   it is typically used. An additional range match against the Scheduled Procedure Step Start Date (0040,0002) and Scheduled Procedure Step Start Time (0040,0003) could allow the Acquisition Modality to request planned encounters for a particular day or shift. An intermittently connected Acquisition Modality might also query and cache the returned list for use while disconnected from the network.

755   Note: DICOM defines that dates and times are matched by their meaning, not as literal strings. If an SCU is concerned about how a single value matching of dates and times is performed by an SCP, it may consider using range matching instead (e.g., "<today>-<today>"), which is always performed by meaning.

- Query by Operator/Physician

By including Scheduled Performing Physician's Name (0040,0006) in the query, the

760   Acquisition Modality can request that the Responder return procedures relevant to the named person. Note that the name may be a performing operator that is not strictly a physician. The modality may be able to use the identity of the currently logged-in account to populate or map this field, or the operator may scan their own badge when activating the modality to perform the procedure.

765   - Query by Room/Location

Using Scheduled Procedure Step Location (0040,0011), the Acquisition Modality can query against a more fine grained location such as a room.

4.130.4.1.3 Expected Actions

The Responder shall accept and process the request. This involves parsing the matching key

770   values provided by the Requester, using those to determine matching patient/encounter records, and composing worklist entries, containing the requested return keys, for return to the Requester in the Return Encounter Metadata message.

Whether the Responder maintains a list of planned or possible encounters which it searches locally, or whether the Responder marshals the contents of the return keys on-demand from one

775   or more sources, is not specified by this transaction. Similarly, the Responder may or may not know whether encounters have been completed and can thus be omitted from the list of worklist entries. Such business logic likely cannot be definitive and is typically based clues such as whether the patient has been discharged, transferred to another department, or whether Notify of Imaging Results [RAD-132] transactions have already been received for this patient/encounter

780   and on configuration settings for which queries such clues affect. In contrast to the situation for
the Query Modality Worklist [RAD-5] transaction, the imaging procedure that will be performed
is typically not known or prescribed by the Responder. The Responder still includes an item in
the Scheduled Procedure Step Sequence (0040,0100) even though the encounter-based imaging
procedure may not have been specifically scheduled.

785   Scheduled Station AE Title (0040,0001) will be present in the request as a Matching Key. The
Responder shall return that same value as a Return Key in the response. The value may be
helpful for the Responder to tailor the response based on the specific device making the request.

Modality (0008,0060) will be present in the request as a Matching Key. The Responder shall
return that same value as a Return Key in the response. The value may be helpful for the
790   Responder to tailor the response based on the specific modality type making the request.

If a worklist entry in the response does not correspond to a specifically scheduled datetime, the
Responder shall populate the Scheduled Procedure Step Start Date (0040,0002) and Scheduled
Procedure Step Start Time (0040,0003) with the current date and time.

The Responder shall populate both the Accession Number (0008,0050) and the Requested
795   Procedure ID (0040,1001) with the Accession Number value.

When required to return a value for Scheduled Procedure Step Description (0040,0007),
Requested Procedure Description (0032,1060) and/or Requested Procedure Code Sequence
(0032,1064), the Responder may provide a description of the planned procedure or next imaging
step if known. Since a specific imaging procedure may not have been scheduled, the Responder
800   is permitted to provide a generic code or description such as "Perform Imaging".

4.130.4.2 Return Encounter Metadata

The Responder sends matching worklist entries back to the Requester.

4.130.4.2.1 Trigger Events

The Responder receives a Request Encounter Metadata Message.

805   ### 4.130.4.2.2 Message Semantics

The message is a DICOM C-FIND response of the DICOM Modality Worklist SOP Class. The
Requester is the SCU, and the Responder is the SCP.

The Responder shall support the matching and return keys as shown for the SCP in Table
4.130.4.1.2-1.

810   The primary purpose of this message is to convey details, such as the patient demographics and
encounter metadata, to the point of care where it can be properly associated with acquired data.
The Responder is not necessarily the original source of those details but may have obtained them
via other transactions. Populating the C-FIND responses may include transcoding the metadata
from HL7 fields into DICOM attributes.

815 It is the responsibility of the Responder to ensure that the patient and encounter information is current in the Modality Worklist response. For a list of some potential methods to obtain such information, see RAD TF-1: 47.4.1.4 and 47.4.1.5.

4.130.4.2.3 Expected Actions

The Requester shall accept the returned responses.

820 The Requester has no other expected actions in the context of completing the transaction; however, profiles using this transaction will typically incorporate the details from the Return Encounter Metadata message into subsequent actions and transactions.

RAD TF-2:2.2 specifies that the Query SCU (in this case the Requester) shall display for the user the returned value of all attributes specified as R or R+ in the normal user interface. While this
825 transaction uses the notation of RAD TF-2:2.2, the most effective method of presenting response entries to the operator for selection is left to the product design.

4.130.5 Security Considerations

The patient demographics and encounter details returned in the response, and potentially matching details contained in the query, typically constitute personal health information.

830 ### 4.130.5.1 Security Audit Considerations

This transaction is associated with a Query Information ATNA Trigger Event.

4.131 Store Encounter Images [RAD-131]

4.131.1 Scope

This transaction is used to send images that were acquired in the course of a patient encounter
835 (i.e., not as an ordered imaging procedure).

This transaction is analogous to the Modality Images Stored [RAD-8] transaction that is used in the context of order-based imaging procedures.

4.131.2 Actor Roles

The roles in this transaction are defined in the following table and may be played by the actors
840 shown here:

Table 4.131.2-1: Actor Roles

Role:	Sender:
	Sends encounter-based imaging data.

Actor(s):	The following actors may play the role of Sender:
	Acquisition Modality
Role:	Receiver:
	Receives and stores imaging data.
Actor(s):	The following actors may play the role of Responder:
	Image Manager/Archive

Transaction text specifies behavior for each role. The behavior of specific actors may also be specified when it goes beyond that of the general role.

845 **4.131.3 Referenced Standards**

DICOM PS3.4: Storage Service Class.

4.131.4 Interaction Diagram
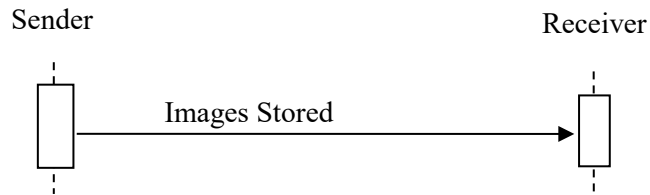
4.131.4.1 Images Stored

850 The Sender sends images to the Receiver.

The Receiver shall support handling such messages from more than one Sender. The Sender shall support making requests to more than one Receiver.

4.131.4.1.1 Trigger Events

A user or an automated function on the Sender determines that imaging objects should be sent to
855 the Receiver.

Typically, the trigger is associated with an intention that the Receiver persistently store the images.

4.131.4.1.2 Message Semantics

The message is a DICOM C-STORE request. The DICOM SOP Class depends on the type of
860 data being stored. The Sender is the SCU, and the Receiver is the SCP.

The Sender can transfer images to the Receiver sequentially within one or more DICOM associations, as the images become available or collectively.

The Sender shall conform to the requirements in Table 4.131.4.1.2-1. Effectively, this table strengthens the type definition of some DICOM attributes for the IHE Technical Framework.

865   The Sender shall omit the Request Attributes Sequence (0040,0275). This transaction is for encounter-based images for which there was no ordered Imaging Service Request.

Table 4.131.4.1.2-1: Required Attributes

Attribute	Tag	Type	Notes
Patient's Name	(0010,0010)	R+	Important for organizing/finding images
Patient ID	(0010,0020)	R+	Important for organizing/finding images
Issuer of Patient ID	(0010,0021)	R+	Important for organizing/finding images
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	O	Important for organizing/finding images
Other Patient IDs Sequence	(0010,1002)	O	Important for organizing/finding images
Patients Birth Date	(0010,0030)	R+	Important for organizing/finding images
Patient's Sex	(0010,0040)	R+	Important for organizing/finding images
Ethnic Group	(0010,2160)	O	
Patient's Weight	(0010,1030)	O	
Patient's Size	(0010,1020)	O	
Patient State	(0038,0500)	O	
Pregnancy Status	(0010,21C0)	O	
Medical Alerts	(0010,2000)	O	
Contrast Allergies	(0010,2110)	O	
Institution Name	(0008,0080)	R+	Important for organizing/finding images
Institution Address	(0008,0081)	R+	Important for organizing/finding images
Institution Code Sequence	(0008,0082)	R+	Important for organizing/finding images
Institutional Department Name	(0008,1040)	R+	Important for organizing/finding images
Institutional Department Code Sequence [IHE-1]	(xxxx,yyyy)	R+	Important for organizing/finding images
Admission ID	(0038,0010)	R+	Important for organizing/finding images
Issuer of Admission ID	(0038,0011)	R+	Important for organizing/finding images
Consulting Physician's Name	(0008,009C)	O	
Consulting Physician Identification Sequence	(0008,009D)	O	
Referring Physician's Name	(0008,0090)	O	
Referring Physician's Address	(0008,0092)	O	
Referring Physician's Telephone Numbers	(0008,0094)	O	

Attribute	Tag	Type	Notes
Referring Physician Identification Sequence	(0008,0096)	O	
Admitting Diagnoses Description	(0008,1080)	O	
Admitting Diagnoses Code Sequence	(0008,1084)	O	
Reason(s) for Visit [IHE-1]	(xxxx,yyyy)	O	
Reason(s) for Visit Code Sequence [IHE-1]	(xxxx,yyyy)	O	
Route of Admissions	(0038,0016)	O	
Study Instance UID	(0020,000D)	R	Important for organizing/finding images
Accession Number	(0008,0050)	R+	Important for organizing/finding images
Issuer of Accession Number Sequence	(0008,0051)	R+	Important for organizing/finding images. Can also be an indicator to differentiate encounter-based imaging from unscheduled radiology.
Study Date	(0008,0020)	R+	Important for organizing/finding images
Study Time	(0008,0030)	R+	Important for organizing/finding images
Study Description	(0008,1030)	R+	Important for organizing/finding images. Many hanging protocols and data browsing interfaces use this prominently.
Study ID	(0020,0010)	O	
Procedure Code Sequence	(0008,1032)	O	
Reason for Performed Procedure Code Sequence	(0040,1012)	O	This is strongly recommended since it is important for organizing/finding images, however since some modalities might lack a user interface to select this, it is optional in this transaction. See RAD TF-3: Appendix Z for potential codes.
Name of Physician(s) Reading Study	(0008,1060)	O	
Physician(s) Reading Study Identification Sequence	(0008,1062)	O	
Physician(s) of Record	(0008,1048)	O	May contain Admitting Physician
Physician(s) of Record Identification Sequence	(0008,1049)	O	
Series Date	(0008,0021)	R+	Important for organizing/finding images
Series Time	(0008,0031)	R+	Important for organizing/finding images
Series Description	(0008,103E)	R+	Important for organizing/finding images
Series Description Code Sequence	(0008,103F)	O	
Modality	(0008,0060)	R	Important for organizing/finding images

Attribute	Tag	Type	Notes
Performing Physician's Name	(0008,1050)	O	Important for organizing/finding images
Performing Physician Identification Sequence	(0008,1052)	O	Important for organizing/finding images
Operators' Name	(0008,1070)	R+	Important for organizing/finding images. Also important for attributing the images to a specific person for quality purposes. The Operator may also be the Performing Physician.
Operator Identification Sequence	(0008,1072)	R+	Important for organizing/finding images
Body Part Examined	(0018,0015)	R+	Important for organizing/finding images
Laterality	(0020,0060)	O	Note that laterality is handled in several ways
Anatomic Region Sequence	(0008,2218)	O	The Anatomic Region describes the anatomy visible in the imaging, which is often more than the Body Part Examined. This is strongly recommended since it is important for organizing/finding images, especially for use as priors, however since some modalities might lack a user interface to select this, it is optional in this transaction. See DICOM PS3.16. CID 4 Anatomic Region for potential codes.
Anatomic Region Modifier Sequence	(0008,2220)	O	Important for organizing/finding images
Primary Anatomic Structure Sequence	(0008,2228)	O	The Primary Anatomic Structure describes the focus of the imaging procedure. This typically corresponds to the text value in Body Part Examined (0018,0015). See DICOM PS3.16. CID 4 Anatomic Region for potential codes.
Primary Anatomic Structure Modifier Sequence	(0008,2230)	O	

[IHE-1]: The Tag numbers for these attributes is pending completion of a Change Proposal in DICOM. When that CP is complete, a corresponding CP in IHE Radiology will update this table.

See RAD TF-2: 2.2 DICOM Usage Conventions.

4.131.4.1.2.1 DICOM Image Storage SOP Classes

Receivers claiming the Encounter-Based Imaging Workflow Profile shall support all SOP Classes listed in Table 4.131.4.1.3.1-1. Senders claiming the Encounter-Based Imaging Workflow Profile shall support one or more of the SOP Classes listed in Table 4.131.4.1.3.1-1.

Table 4.131.4.1.2.1-1: Encounter-based Imaging SOP Classes

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage
1.2.840.10008.5.1.4.1.1.3.1	Ultrasound Multi-frame Image Storage

4.131.4.1.2.2 Study UIDs and Series UIDs

The Encounter-Based Imaging Workflow Profile explains how the Study information and Study Instance UID are generated by the Encounter Manager and made available to the Acquisition Modality through [RAD-130]. Generation of these items by the Acquisition Modality or workstation are restricted in general and are only permitted in specifically outlined exception cases, when the encounter imaging context information is not available to the modality.

Series Instance UID creation must be compatible with a number of DICOM rules.

Multiple performed procedure steps are not permitted to reference the same series. So conversely, one series cannot contain the output of different performed procedure steps. Therefore, adding images to a series in a procedure step which has been completed is not permitted since a procedure step cannot be modified.

Adding images after completion of a procedure step shall trigger the creation of a new series.

One series cannot contain the output of different equipment (in part because a series must have a single Frame Of Reference). Creating images on different equipment shall trigger the creation of a new series.

All images in a series must share the same Frame Of Reference. Generally this means creating images with different patient positioning shall trigger the creation of a new series. Note that if the Frame Of Reference is not present (at the Series level), this requirement is avoided.

Images reconstructed on a different piece of equipment are required to be in a separate Series.

4.131.4.1.3 Expected Actions

The Receiver will store the received DICOM objects.

The DICOM objects shall be stored such that they can be later retrieved (see RAD TF-2: 4.16 Retrieve Images) in a fashion meeting the requirements defined for a DICOM Level 2 Storage SCP (Refer to DICOM PS3.4 B.4.1).

4.131.5 Security Considerations

The DICOM objects conveyed typically constitute personal health information.

4.131.5.1 Security Audit Considerations

This transaction is associated with a Begin-storing-instances ATNA Trigger Event on the Sender and an Instances-Stored ATNA Trigger Event on the Receiver.

4.132 Notify of Imaging Results [RAD-132]

4.132.1 Scope

This transaction is used to notify a system that images (typically newly acquired in the course of a patient encounter) are available to the patient record. The notification is an HL7 v2.5.1 Unsolicited Observation (ORU) message.

The metadata provided is intended to be sufficient for an EMR to manage the imaging entry in the patient record, which may include creating a proxy order at the discretion of the EMR.

4.132.2 Actor Roles

The roles in this transaction are defined in the following table and may be played by the actors shown here:

Table 4.132.2-1: Actor Roles

Role:	Sender: Sends a notification of the availability of imaging data.
Actor(s):	The following actors may play the role of Sender: Image Manager/Archive
Role:	Receiver: Receives the notification.
Actor(s):	The following actors may play the role of Responder: Result Aggregator Encounter Manager

Transaction text specifies behavior for each role. The behavior of specific actors may also be specified when it goes beyond that of the general role.
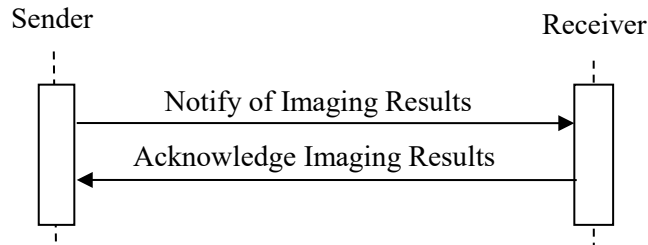
4.132.3 Referenced Standards

HL7 Messaging Standard v2.5.1, Observation Reporting (Chapter 7)

HL7 Messaging Standard v2.5.1, Control (Chapter 2)

RAD TF-2: 2.3.1 Conventions for HL7 v2.5.1 messages

4.132.4 Interaction Diagram

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4.132.4.1 Notify of Imaging Results

The Sender sends a notification to the Receiver.

The Receiver shall support handling such messages from more than one Sender. The Sender shall support making requests to more than one Receiver.

930 #### 4.132.4.1.1 Trigger Events

New imaging objects have been acquired that the Receiver is likely unaware of, for example as part of encounter-based imaging.

Typically, the trigger is associated with an intention that the Receiver catalog the information as part of the electronic medical record of the patient.

935 This transaction is not typically used for new order-based imaging (e.g., in the context of the Scheduled Workflow Profile (SWF.b)) since the Receiver will already have been made aware of the order driving the imaging procedure. The Sender can generally distinguish between encounter-based images, order-based images and imported images by examining the Accession Number (0008,0050) and the Request Attributes Sequence (0040,0275) in the new imaging
940 objects. The Request Attributes Sequence (0040,0275) will be absent for encounter-based images and for the Unscheduled Case of Scheduled Workflow.b, while it will be populated for imported or other Scheduled Workflow.b cases. Accession Number (0008,0050) will have a value for encounter-based images, but be empty for Unscheduled SWF.b images, allowing those two to be distinguished.

945 It is conceivable that multiple notifications might be sent for the same Study, but the contents would be consistent so it is not expected to be a problem for the Receiver. For example, a Sender might send a notification as it becomes aware of each new series. A Sender cannot presume that a study is "complete" in the sense that no new data will be added since new series may be added to a study at any time.

950 #### 4.132.4.1.2 Message Semantics

The message is an HL7 v2.5.1 Observation Reporting (ORU) message. The Sender is the HL7 sender. The Receiver is the HL7 recipient.

This message specification is based on the Send Imaging Result Message in the Send Imaging
Result [RAD-128] transaction with minor changes. For example, [RAD-132] does not include an
imaging report. In this message the physician with whom the patient had the encounter belongs
in the Attending Physician field of the PV1 segment.

955

Note: The [RAD-128] transaction is currently specified in the Results Distribution (RD) Trial Implementation Supplement.

The Sender shall encode the ORU message and segments as defined in this section.

Table 4.132.4.1.2-1: HL7 v2.5.1 Notify of Imaging Results (ORU) Message

Segments	Message Content	HL7 v2.5.1 Chapter	Reference
MSH	Message Header	2	Section 4.128.4.1.2.2 MSH Segment
PID	Patient Identification	3	Section 4.128.4.1.2.3 PID Segment
PV1	Patient Visit	3	Section 4.128.4.1.2.4 PV1 Segment
[ORC]	Order Common	4	Section 4.128.4.1.2.5 ORC Segment
OBR	Order Detail	4	Section 4.132.4.1.2.1 OBR Segment
TQ1	Timing/Quantity	4	Section 4.132.4.1.2.2 TQ1 Segment
OBX	Observation/Result (DICOM Study Instance UID)	7	Section 4.128.4.1.2.8 OBX Segment

960

Adapted from the HL7 Standard, version 2.5.1

See RAD TF-2: 2.3.1 "Conventions for HL7 v2.5.1 messages" for a complete definition of the
notation used in the sections referenced by Table 4.132.4.1.2-1.

4.132.4.1.2.1 OBR Segment

965 The Observation Request (OBR) Segment defines attributes ("metadata") for the imaging result.

The OBR segment definition is based on HL7 Version 2.5.1 (Chapter 4, Order Entry, Section
4.5.3).

This OBR Segment shall be further constrained as specified in Table 4.132.4.1.2.1-1.

Table 4.132.4.1.2.1-1: HL7 v2.5.1 ORU OBR Segment

SEQ	LEN	DT	OPT	TBL#	ITEM #	ELEMENT NAME
2	22	EI	R2		00216	Placer Order Number
3	22	EI	R2		00217	Filler Order Number
4	250	CE	R		00238	Universal Service ID
5	2	ID	X		00239	Priority (retired)
6	26	TS	X		00240	Requested Date/time

SEQ	LEN	DT	OPT	TBL#	ITEM #	ELEMENT NAME
7	26	TS	R		00241	Observation Date/Time
12	250	CE	X		00246	Danger Code
18	60	ST	R		00251	Placer Field 1
19	60	ST	R2		00252	Placer Field 2
24	10	ID	R	0074	00257	Diagnostic Serv Sect ID
25	1	ID	R	0123	00258	Result Status
27	200	TQ	R		00221	Quantity/Timing
28	250	XCN	O		00260	Result Copies To
31	250	CE	R2		00263	Reason for Study
32	200	NDL	R2		00264	Principal Result Interpreter
33	200	NDL	R2		00265	Assistant Result Interpreter
34	200	NDL	R2		00266	Technician
44	250	CE	R		00393	Procedure Code
46	250	CE	R2	0411	01474	Placer Supplemental Service Information

970

Adapted from the HL7 Standard, version 2.5.1

Fields *OBR-2 Placer Order Number* and *OBR-3 Filler Order Number* will typically be empty in the case of encounter-based imaging since that is usually unordered.

Field *OBR-4 Universal Service ID* shall contain a procedure code in the first three components:
975 *OBR-4.1 Identifier*, *OBR-4.2 text code meaning*, *OBR-4.3 coding system*. The use of codes from a standardized coding system for procedures, such as the RadLex Playbook LOINC codes, is recommended. In order of preference, the procedure code may be taken from:

- Procedure Code Sequence (0008,1032)

- Requested Procedure Code Sequence (0032,1064)

980 - A code for a generic imaging procedure

Field *OBR-7 Observation Date/Time* shall contain a date/time representative of the imaging procedure. When choosing the date/time to use, consider that an EMR might use this date/time to find other clinical entries for the patient at or near this time which might provide context for the imaging procedure. The date/time might be taken from one of the following attributes in the
985 associated DICOM image objects:

- Study Date (0008,0020) & Study Time (0008,0030)

- Series Date (0008,0021) & Series Time (0008,0031)

990 Field *OBR-18 Placer Field 1* shall contain the Accession Number (0008,0050) of the associated DICOM image objects. Note that in the HL7 v2.5.1 semantics for the Procedure Scheduled [RAD-4] transaction the Accession Number is provided in IPC-1, but the IPC Segment is not included in an ORU Message, so the HL7 v2.3.1 interpretation of this field is used.

Field *OBR-19 Placer Field 2* shall contain the Assigning Authority that corresponds to the contents of the Issuer of Accession Number Sequence (0008,0051) in the associated DICOM image objects.

995 Note: The string in OBR-18 may contain a prefix or suffix that may hint at the Assigning Authority for the Accession Number or otherwise make it unique.

Field *OBR-24 Diagnostic Serv Sect ID* shall be populated based on the value of Institutional Department Code Sequence (xxxx,yyyy) in the associated DICOM image objects. This may require a mapping table to match locally used of the diagnostic service section IDs (which for 1000 some sites may be HL7 Table 0074).

Field *OBR-25 Result Status* shall contain values from Table 4.132.4.1.2.1-2.

Table 4.132.4.1.2.1-2: OBR-25 Result Status Values

Value	Description
R	Results stored; not yet verified (see Note)
F	Final results; results stored and verified. Can only be changed with a corrected result.
C	Correction to results, such as an amended final imaging result

Adapted from the HL7 Standard, version 2.5.1, Table 0123

1005 Note: Table 0123 in HL7 v2.5.1 contains a value of "P" for "Preliminary". Unverified imaging results, also referred to as "preliminary imaging results", are sent with status value "R" rather than "P". The value "P" is used more often for laboratory results, where a final result may be awaiting development of a culture, but the preliminary results are usable for clinical treatment planning.

Field *OBR-27 Quantity/Timing* shall be retained for backwards compatibility only. The value of *OBR-27.6 Priority* shall match *TQ1-9.1 Priority*, as described in Section 4.132.4.1.2.2. Other 1010 components of *OBR-27* shall not be valued.

Field *OBR-28 Copy Results To* will typically be empty but may be used to trigger further notifications from an EMR based on local workflow/policies.

Field *OBR-31 Reason for Study* shall be valued, if known. This might be taken from one of the following attributes in the associated DICOM image objects:

1015 • Reason for Performed Procedure Code Sequence (0040,1012)

• Reason for the Requested Procedure (0040,1002) or Code Sequence (0040,100A)

• Reason(s) for Visit (xxxx,yyyy) or Code Sequence (xxxx,yyyy)

o The Tag numbers for these attributes is pending completion of a Change Proposal in DICOM. When that CP is complete, a corresponding CP in IHE Radiology will update this text.

- Admitting Diagnoses Description (0008,1080) or Code Sequence (0008,1084)

Field *OBR-32 Principal Result Interpreter* will typically be empty in the case of encounter-based images, since most are not formally interpreted. Even if they are, interpretation would often occur some time after the images are initially stored and this [RAD-132] notification was sent. The resulting report would be a separate submission to the Receiver.

Field *OBR-33 Assistant Result Interpreter* will typically be empty but shall be valued if known and contributed to generating these imaging results.

Field *OBR-34 Technician* shall be valued, if the person who acquired the images is known. This might be taken from one of the following attributes in the associated DICOM image objects:

- Operators' Name (0008,1070) or Operator Identification Sequence (0008,1072)

- Performing Physician's Name (0008,1050) or Performing Physician Identification Sequence (0008,1052)

Field *OBR-44 Procedure Code* shall match *OBR-4*.

Field *OBR-46 Placer Supplemental Service Information* shall contain the laterality (Left/Right) indicator in the <site modifier (CE)> component if laterality is relevant to the procedure and laterality is not conveyed in the code value in OBR-4 *Universal Service ID*. Otherwise, OBR-46 is typically omitted.

4.132.4.1.2.2 TQ1 Segment

The HL7 v2.5.1 TQ1 Segment defines the priority of the imaging results. The Timing/Quantity (TQ1) Segment definition is based on HL7 Version 2.5.1 (Chapter 4, Order Entry, Section 4.5.4).

At the time RAD-132 is sent in the Encounter Based Imaging Workflow Profile, the imaging procedure will have been completed. Encounter-based imaging results are not typically urgent. The TQ1 Segment may be sent empty. If populated, a TQ1-9 *Priority* value of R^Routine^HL70078 would be appropriate for many cases.

4.132.4.1.3 Expected Actions

The Receiver shall accept and process the message.

The Receiver shall support receiving multiple imaging result messages for the same DICOM Study Instance UID. That is, multiple imaging Series may each result in a separate notification message despite being part of a single DICOM Study.

Receiver actions subsequent to receiving an image result will depend on internal business logic and/or the profile in which the transaction is being performed.

4.132.4.2 Acknowledge Imaging Result

The Sender and Receiver shall implement the Acknowledge Imaging Result message as described in Section 4.128.4.2.

1055   ### 4.132.5 Security Considerations

The metadata and referenced imaging data in this message typically constitute personal health information.

4.132.5.1 Security Audit Considerations

This transaction is associated with a Procedure-record-event ATNA Trigger Event.

1060

> *Add the following rows to RAD TF-3: Table 5.1-2*

5.1 ITI-20 Record Audit Event

…

Table 5.1-2: IHE Radiology transactions and resulting ATNA trigger events

IHE Radiology Transaction	ATNA Trigger Event(s)	Actor(s) that shall be able to record audit event
Patient Registration [RAD-1]	Patient-record-event	ADT Order Placer, DSS/OF – when PHI is presented
…		
Get Encounter Imaging Context [RAD-130]	**Query Information**	**Responder: Encounter Manager**
Store Encounter Images [RAD-131]	**Begin-storing-instances**	**Sender: Acquisition Modality**
	Instances-Stored	**Receiver: Image Manager/Image Archive**
Notify of Imaging Results [RAD-132]	**Procedure-record-event**	**Sender: Image Manager/Image Archive**

1065

> *Add the following Appendix to RAD TF-3*

Appendix Z – Reason for Procedure Codesets (Informative)

1070

This appendix provides codesets for consideration when populating the Reason for Performed Procedure Code Sequence (0040,1012).

Table Z-1: Point-of-Care Ultrasound Procedure Reasons

Coding Scheme Designator	Code Value	Code Meaning
LN	69280-6	Evaluate State of Urinary Bladder with US
LN	39415-5	Evaluate Gastrointestinal Tract with US
LN	80871-7	Detect/Evaluate Ovary for Torsion with US
LN	80877-4	Detect/Evaluate Scrotum and Testicle for Torsion with US
SCT	401186003	Detect/Evaluate Deep Venous Thrombosis
LN	39527-7	Detect/Evaluate Unspecified Body Region for Foreign Body with US
SCT	710241003	Guide Removal of Retained Foreign Body with US
LN	87162-4	Guide Placement of Needle
LN	38032-9	Determine/Evaluate Localization of Needle with US
LN	25059-7	Guide Biopsy with US
LN	30643-1	Guide Placement of CV catheter in Vein with US
LN	87144-2	Guide Placement of PICC Line
LN	87019-6	Guide Drainage
LN	87017-0	Evaluate Drainage Catheter for Abscess
SCT	431805002	Guide Embolization with US
SCT	61593002	Guide Procedure with US
SCT	439864002	FAST (Focused Assessment with Sonography in Trauma) (See http://pubs.rsna.org/doi/full/10.1148/radiol.2017160107)

Some other reasons of interest for which codes were not found include:

- Evaluate Breast Lump

1075
- Evaluate Reduction of Fracture or Dislocation

- Localize/Evaluate Fluid or Abscess

- Detect/Evaluate Detached Retina

- Detect/Evaluate Gallstones

- Detect/Evaluate Internal Bleeding

1080
- Determine/Evaluate Position of Line (Arterial, central venous)

- Determine/Evaluate Position of PICC Line

- Guide Fluid Collection

- Guide Placement of Airway Tube

- Determine/Evaluate Position of Airway Tube

1085
- Collect Procedural Evidence

- Evaluate Success of Procedure