Integrating the Healthcare Enterprise

IHE Radiology
Technical Framework Supplement

Encounter-Based Imaging Workflow (EBIW)
With Extensions for Lightweight Devices and Point of Care Ultrasound Image Management and Reporting

Rev. 3.1 – Trial Implementation

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Please verify you have the most recent version of this document. See here for Trial Implementation and Final Text versions and here for Public Comment versions.

Foreword

This is a supplement to the IHE Radiology Technical Framework V23.0. 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 19, 2025 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://www.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 IHE.net.

Information about the IHE Radiology domain can be found at IHE Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the process used to create them can be found at Profiles and IHE Process

The current version of the Radiology Technical Framework can be found at https://profiles.ihe.net/RAD.

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Introduction to this Supplement

This supplement documents an Encounter-Based Imaging Workflow Profile to address medical imaging performed outside the context of an ordered procedure. Two classes of modalities are considered: "traditional" imaging modalities (such as ultrasound or x-ray devices that are used at the point-of-care), and "lightweight" devices (such as digital cameras, smartphones, and tablets). Encounter-based imaging is typically used to capture clinical images for documentation, follow-up care, and diagnostics.

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.

Note: The IHE Radiology Technical Committee is exploring a transaction to obtain Encounter Imaging Context using a series of FHIR Queries, but it was not possible to resolve all the issues in time to include it in this version for Trial Implementation. An updated FHIR Queries Document may be circulated later using the normal IHE publication process.

Open Issues

Q1: What protocol should Get Encounter Imaging Context-RS use?

A. Committee decided to publish UPS-RS and continue working on FHIR.

The original profile used DICOM Modality Worklist for non-RESTful clients.
This draft adds the UPS-RS protocol to RAD-130. The content & logic is largely common with two APIs. Servers would be required to support both.

The Technical Committee is investigating how to map the needed information to a series of FHIR Queries. The draft FHIR-based transaction [RAD-Y1b] will be circulated in a separate document (EBIW-FHIRQuery) when the issues have been worked out. The FHIR approach makes all the lightweight modalities responsible for more business logic, mappings and handling case variants, but has the advantage that a Server which has implemented MWL could probably add the FHIR capability with an off the shelf library.

Servers would likely be required to support all protocols to allow clients to choose.

A. (POCUS PC): The POCUS user and vendor community continues to prefer Modality Worklist (MWL) due to its widespread support, and alignment with existing infrastructure. While there is some interest in RESTful approaches, this tends to lean toward FHIR, primarily for EMR integration (e.g., retrieving patient demographics and encounter details directly from the hospital EHR system).

Q2: How can this profile provide better visibility into studies with pending completion/documentation tasks?

Physicians rely on the EMR to track incomplete work, but current workflows may not notify users of unsigned reports or unfinished worksheets. One potential solution is an HL7 or DICOM Instance Availability notification to enable the EMR to track and highlight studies without finished reports.

A. This remains an open issue. The challenge of tracking incomplete reports or unfinished worksheets is well recognized, but it's unclear whether this is addressed through standards.

Q7: Should Store Instances Over the Web [RAD-108] be added as a named option for the POCUS Manager and the Acquisition Modality?

Handheld POCUS modalities might prefer implementing DICOMweb vs DIMSE.

A. This remains an open issue. While some handheld devices might prefer DICOMweb, many customers continue to require DIMSE-only support. This item will remain open pending potential feedback during Connectathon testing.

Q8: Should EBIW re-evaluate mandatory grouping of EBIW Image Manager/Archive with SWF.b Image Manager/Archive?

Table 47.3-1 mandates grouping of the EBIW Image Manager/Archive with the SWF.b Image Manager/Archive, which introduces all SWF.b requirements (e.g., HL7 v2.5.1 patient identity feed, MPPS, Storage Commitment, Image Availability Query). It is unclear whether this strict grouping is appropriate for all EBIW implementations, particularly lightweight or non-integrated environments.

Closed Issues

Q1. How are final images encoded?

A. in DICOM

Q2. 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 4.108 Store Instances over the Web [RAD-108] depending on suitability to the use cases.

Q3. Should we make any Measurement SR IODs mandatory for the SCP?

A. No.

Q4. Bias toward older (DICOM/HL7) VS newer (DICOMweb/FHIR) technologies?

A. Focus on HL7 v2 + DICOM + DICOMweb for this profile

Q5. 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.

Q6. 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.

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.

Q7. 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.)

Q8. 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.

Q9. 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

Q10. 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.

Q11. Where, if anywhere, should configuration of procedure lists be required?

A. Don’t require.

This draft (see Section 47.4.1.9) notes that lightweight modalities could configure “pick lists” of likely procedures from which users could select. E.g., the camera in the dermatology clinic would be configured with a different list than the camera in the burn unit.

Alternatively, the Encounter Manager could support such configurable lists and would provide the appropriate list to each modality based on its reported department. That would centralize configuration of the lists rather than having to configure and update each of the individual modalities. Could also make use of the Shared Value Sets (SVS) Profile or FHIR codeset services when they’re ready.

Neither of the above are required, leaving it up to users and their set of vendors to work something out.

Q12. 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.

Q13. 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.

Q14. 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.

Q15. 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.

Q16. 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.

Q17. Should the scope include "self-captured" data from patients at home or remote?

A. Deferred, focus on workflow within hospitals.

Q18. 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).

Q19. 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.

Q20. Are the 130, 131, 132 Requirements adequate to reliably meet the metadata needs in 47.4.1.8

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?

Q21. Can any of the Query/Return Key requirements in Table 4.130.4.1.2.1-1 be reasonably dropped?

A. Yes a couple.

Based on public comment, Confidentiality and Scheduled Procedure Step ID requirements were dropped, and it was clarified that display on the SCU is a design decision, not a profile requirement.

Fewer required fields makes it easier to implement, but we don't want to drop anything that is important to adequately meet the use cases and user needs.

Q22. 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***."

Q23. 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 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)>

Q24. 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.

Q25. 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
  - 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

Q26. 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.

Q27. 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.

Q28. 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.

Q29. 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

Q30. 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.

Q31. 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.

Q32. 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.

Q33. 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 Section 4.132.4.1.1 Trigger Events.

If implemented, Issuer of Accession Number might also help to identify those from the Encounter Manager, or if a prefix-suffix-known range 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).

Q34. 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:
  - Institution Name
  - Institutional Department Name
  - Station Name
  - Operator's Name
  - Operator's ID
  - Contribution Datetime
  - Contribution Description

Q35. Anything else in the white papers we should incorporate?

A. Yes, list these in a concept section

Relevant White papers:

- SIIM-HIMSS Enterprise Imaging Workgroup - White Papers
- A Foundation for Enterprise Imaging - JDI White paper
- Order-based vs Encounter-based Imaging - JDI White paper (Andrei)
- The Workflow Challenges of Enterprise Imaging - JDI White paper (Kevin)
- Technical Challenges of Enterprise Imaging - JDI White paper (Kevin)
- PCD Encounter-based Patient Identification Management white paper (Andrei)

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

Q36. What do you want to call the new actor?

A. Lightweight Modality

Briefly considered Image Capturer (from WIC) but the Separate Capture Use Case highlights the potential confusion since we distinguish the capture device from the Modality Actor that interacts with the other actors.

Q37. What devices/cases are not covered by PoCUS & Lightweight; and what's our plan?

A. A DIMSE path and a RESTful path seems to cover the needs.

Modalities that are similar to PoCUS (i.e., mostly DICOM-capable already and also used for order-based imaging) can implement EBIW as an Acquisition Modality.

Modalities that are similar to Lightweight (i.e., new to DICOM and mostly used for encounter-based imaging) can implement EBIW as a Lightweight Modality (using the RESTful interfaces defined here).

Are there examples of modalities that do not fall neatly into one or the other camp? Where would Endoscopes, Laparoscopes, and Dermatoscopes fall? They would likely choose one path or the other.

Would a modality want to be a hybrid that does a RESTful query and a DIMSE store? Is there value in un-pairing the query and the store transactions to allow mixing mechanisms? Examples were given that might support both paths, but no concrete example was put forward that would benefit from mixing.

Would a laptop that does DIMSE Q/R/Display want to add SLR capture and storage? Maybe but the Q/R/Display is outside this profile, and they might be more likely to do QIDO/WADO.

Q38. Are there any reasons that EBIW studies will not work smoothly with profiles like PDI, XCA-I, XDS-I, XDS, BIR, IRWF, etc. in the same way SWF.b does?

A. No. Public Comment didn't turn up anything major.

Kinson is submitting a CP to [RAD-68] to improve the metadata mapping for XDS-I of EBIW images.

The incorporation of an Accession # and the use of DICOM storage in EBIW should make encounter-based imaging largely compatible with the other imaging profiles.

No order-based assumptions in other profiles were noted that would be invalid for encounter-based images that might cause problems in the Enterprise Imaging space.

Consider a dermatology patient bringing a USB stick with some JPEGs for Encounter-based import. This is described as an extended variant of the Separate Capture use case #3.

Q39. How should the new requirements be added/packaged? **A.** Option A Option A: "Complete" existing EBIW Profile by adding a Lightweight Modality with RESTful transactions to the Encounter Manager and the Image Manager. Option B: Add a RESTful Option and a DIMSE Option to the existing Profile? Option C: Have two EBIW Profiles (EBIW and EBIW-RS?)
Q40. How should the new material from this cycle be documented? **A.** Change tracked edits to EBIW doc.
Q41. Should we support RAW? If so, how? A. Not yet. Include a Concept section to further the discussion.
Q42. Should we address Record Driven Acquisition? **A.** Not normatively. Added a concept section.
Q43. Should we address biometric approaches to patient id? **A.** Not normatively. Added a concept section.
Q44. Should we address deferred completion cases? **A.** Not normatively. Added to the concept section on Recording Encounter and Procedure Metadata.
Q45. Should we address Guided Acquisition; if so, how? (Not MUE) **A.** Added Concept section. Referenced CPs to UPS for Instruction Sequence.
Q46. How much do we need to describe the capture device? **A.** Add some guidance (e.g., populate Contributing Equipment Sequence) but no requirements.
Q47. Should we address mapping semantics between JPEG/EXIF tags and DICOM tags? **A.** Informative material provided in 47.4.1.6. No need for normative found.

Q48. How should Store Encounter Images-RS be documented?

A. Try Polymorphic [RAD-108] (have STOW behave differently in different profiles)

Need to blend the [RAD-131] attribute requirements with the [RAD-108] protocol and media type requirements.

Option A: Clone STOW – copy and tweak; push JPEG with 20 tags or so?

- Would duplicate a lot of option/behavior text for different media types
- So would need to determine which are still relevant, and maybe include the ones that are by reference rather than by copying.

Option B: Polymorphic [RAD-108] – have STOW behave differently in different profiles.

- (make subsections to clarify the differentiated requirements) – helps with review during PC, makes it clear for implementation, shouldn't be a burden for test organization either.
- Do we want to call our Actor Image Capturer? (Maybe but in the SLR-Laptop case that would be a bit misleading)

Q49. Are photographs taken during a conventional modality acquisition considered EBIW?

A. Not really.

Basically, these kind of studies (e.g., fMRI + video of the patient during, Chest X-Ray plus photo of chest) are scheduled multi-modality procedures. So the "right" way is for the lightweight modality to use MWL (or a UPS proxy for it) to get the shared Study UID and Accession # resulting in a new series in the same study as the conventional modality. So either a clever Encounter Manager (linked to the worklist server) or a clever Lightweight Modality (query the Worklist Server) can make this happen.

IHE Card CATH Profile basically works this way.

Q50. Should we document a FHIR variant of the STOW transaction?

A. No.

FHIR hasn't figured out yet how that might work. Go with the existing infrastructure.

Also there is a concern about fragmenting the image record. E.g., splitting the image record into different access APIs, formats and possibly locations (or in the case of VNA, one location with different APIs and formats for different subsets of the image record). Clients would then need to support a multitude of APIs and use different ones depending on what they are looking for and/or use all of them and collate the results.

Displays should present images regardless of which path was used for capture. If we fork capture, we want to avoid forking storage and indexing.

Q52. Should BIR functionality be added as a named option for the POCUS Image Display?

A. No.

The user community believes that BIR requirements are unnecessary, as the market naturally drives and dictates basic POCUS display functionality. BIR has been included as an Optional Actor Grouping in Section 47.6.

Q52. Are priors required for diagnosis?

A. No.

In POCUS workflows, clinical decisions are made on the spot at the bedside, based on real-time image acquisition. If prior studies are needed, reports can be accessed through an EHR or images can be viewed in a zero footprint viewer, but this is not a standard requirement for POCUS workflows.

Q53: Should there be a named option for the Acquisition Modality and POCUS Manager to support DICOM SRs in order for SR data elements to incorporate into the report?

DICOM Structured Reports (SRs) are commonly used to handle both automated and user-generated measurements, such as cardiac function or vascular assessments. If the modality generates SRs, the POCUS Manager could read and automatically incorporate them into the POCUS worksheet and final report, streamlining the workflow and improving accuracy.

A. No - No additional option is needed. The profile does not prohibit the use of DICOM Structured Reports (SRs), and implementers are free to leverage SRs for incorporating measurements or other structured content into reports. This capability can be supported without further specification in the profile.

Q54: Should Confidentiality Code (0040,1008) be profiled in the POCUS Option?

EBIW dropped confidentiality requirements based on Public Comment (see Closed Issues). Users requested thar the POCUS Use Cases mention use a Confidentiality Code (0040,1008)

A. No , however this is mentioned in the POCUS Reporting Concept Section

Q55: Should the report support alternative formats, such as PDF, for use in practices without an EMR?

Smaller practices without EMRs may need reports in PDF format for easier use. PDF as a report format could enable broader adoption of POCUS workflows in resource-limited settings

A. Yes. The POCUS Option reuses the OBX segment defined in RAD-128, which supports encapsulated PDF reports using the ED data type.

Q56: Should the POCUS Manager be able to create an order, e.g., right before sending the report?

Some EMRs support workflows where the POCUS Manager generates an order and links it to an appointment behind the scenes. This approach is often needed when images are sent to a PACS that requires HL7 data reconciliation. It helps keep POCUS images from showing up on unread worklists unnecessarily and ensures the PACS can accurately align study details like start and end times with the POCUS study.

A. No. We retained the original decision from the first version of EBIW. However, we added concept language noting that the POCUS Manager may create orders to support reconciliation. While this remains a real-world need, it's difficult to standardize across implementations.

Q57: Is the requirement for the Reason for Performed Procedure Code Sequence (0040,1012) in Store Encounter Images [RAD-131] prohibitive for modalities?

The initial release of the EBIW Profile did not mandate the use of the Reason for Performed Procedure Code Sequence because many modalities might lack a user interface to allow selection of this attribute.

User feedback highlights the importance of early identification of training studies to ensure segregation and prevent mixing with clinical systems. However, this may impact modality user interfaces. Would it be more appropriate to assign this requirement to the POCUS Manager instead?

A. No The determination of whether an imaging study is clinical or training is inherently made by the operator at the modality, making it a natural and practical point to select the Reason for Performed Procedure Code Sequence (0040,1012).

Q58: Is the addition of the Physician(s) of Record Identification Sequence (0008,1049) in RAD-130 an unreasonable extension for the Encounter Manager? We believe the Encounter Manager might typically obtain the Attending Physician information from PV1-7 in an ADT message, although this is not an actor requirement. **A.** No. This was added to the POCUS Option prior to Trial Implementation.
Q59: Is the addition of the Physician(s) of Record Identification Sequence (0008,1049) in RAD-131 an unreasonable extension for the Acquisition Modality? We believe that allowing user input to identify training studies directly on the modality is a reasonable accommodation to ensure proper study classification. **A.** No. It was added as a conditional requirement in the POCUS Option. The modality is required to copy the Physician(s) of Record Identification Sequence (0008,1049) into stored instances if available, but operator input at the modality is not required.
Q60: Should POCUS adopt the Unscheduled Patient order handling/reconciliation from SWF.b (Use Case #12)? While the Modality Procedure Step and Order transactions are not applicable, the Patient Update/Merge [RAD-12] transaction is be relevant. **A.** No. Instead of adopting SWF.b's unscheduled patient handling, the POCUS workflow uses the POCUS Manager to validate and reconcile unidentified studies before export. Patient updates may be handled via PAM Patient Demographics Consumer, and studies lacking valid identifiers are withheld from the Image Manager / Archive until properly resolved.

IHE Technical Frameworks General Introduction

The IHE Technical Frameworks General Introduction is shared by all of the IHE domain technical frameworks. Each technical framework volume contains links to this document where appropriate.

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Appendix A – Actors

*Add the following **new or modified** actors to the IHE Technical Frameworks General Introduction Appendix A:*

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.
Lightweight Modality	Acquires medical images and communicates using lightweight (RESTful) protocols.
POCUS Manager	**Manages point-of-care ultrasound workflow, including image data, documentation, and quality assurance.**

The table below lists *existing* actors that are utilized in this profile.

Complete List of Existing Actors Utilized in this Profile

Existing Actor Name	Definition
Image Manager / Image Archive	A system that stores and manages imaging data.
Image Display	A system that presents medical images and associated imaging data.

Appendix B – Transactions

*Add the following **new or modified** transactions to the IHE Technical Frameworks General Introduction Appendix B:*

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.

Appendix D – Glossary

*Add the following **new or modified** glossary terms to the IHE Technical Frameworks General Introduction Appendix D:*

TODO: As part of Final Text, consider which of these need to be added to the IHE Glossary.

Editorial note: Many of these definitions are offered to provide context during Public Comment and may be removed prior to Trial Implementation.

Glossary Term	Definition	Synonyms	Acronyms/Abbreviation
Advanced Practice Provider	**A health care provider who is not a physician but who performs medical activities typically performed by a physician.**		APP
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.**		
Credentialing	**The process of verifying a healthcare professional's qualifications, including licensure, education, certifications, fellowships, and professional experience, to ensure they meet the standards required for clinical practice.** **Credentialing confirms qualifications whereas Privileging grants permission to perform specific tasks.**		
Physician of Record	**The physician responsible for overseeing the patient encounter and ensuring the appropriateness of care and accuracy of associated clinical reports. See DICOM PS3.2 Section C.7.2.1.1.1 for a model of physician roles in imaging.**	**Attending Physician** **Staff Physician** **Supervising Physician**	
Preliminary Report	**A version of a report that is not finalized, either because the initiator lacks the privileges to sign it or because it is pending review, additional input, or approval from a privileged physician.**	**Draft Report**	
Privileging	**The process of authorizing a healthcare professional to independently perform specific clinical procedures or services within their scope of practice, as defined by the facility or department where they work. Privilege policies are typically determined by a facility's privileging committee and may vary by facility, department, and clinical application. While privileging reciprocity within the same health system is common, it is not guaranteed.** **Privileging grants permission to perform specific tasks, whereas Credentialing confirms qualifications.**		

Glossary Term	Definition	Synonyms	Acronyms/Abbreviation
Imaging Report	**A formal document that presents the interpretation, analysis, and summary of an imaging study, including findings and measurements made by the interpreting physician. In most jurisdictions, it must be signed by a credentialed and privileged healthcare professional to be considered complete.**		
Report Addendum	**Supplementary text added at the end of a previously approved imaging report, to correct or expand on original statements.**		

Modify the following glossary terms in the IHE Technical Frameworks General Introduction Glossary as follows:

Glossary Term	Definition	Synonyms	Acronyms/Abbreviation
~~q~~**Q**uality ~~a~~**A**ssurance	~~**The process or set of processes used to measure and assure the quality of a product.**~~ **A systematic process for ensuring that organizational procedures, products, and services meet defined standards and continuously improve through monitoring, control, and risk management practices.**		QA
~~q~~**Q**uality ~~c~~**C**ontrol	~~**The process of ensuring products and services meet consumer expectations.**~~ **A set of activities and inspections focused on verifying that products and services consistently meet defined specifications and customer expectations through systematic measurement and corrective actions.**		QC

Volume 1 – Profiles

Modify Scheduled Workflow as shown:

3 Scheduled Workflow (SWF) Profile

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 (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) Profile.

Modify Scheduled Workflow.b as shown:

34 Scheduled Workflow.b (SWF.b)

The ***Scheduled Workflow.b Integration Profile*** establishes the continuity and integrity of basic departmental imaging data. It maintains the consistency of patient and ordering information as well as providing the scheduling and imaging acquisition procedure steps. This profile makes it possible to determine whether images and other evidence objects associated with a particular performed procedure step have been stored (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.

This profile also offers the means to match images, diagnostic reports, and other evidence objects acquired for a misidentified or unidentified patient (for example, during a trauma case) with the patient's record. In the example of the trauma case, this Profile allows subsequent reconciliation of the patient record with images that are acquired (either without a prior registration or under a generic registration) before the patient's identity can be determined. Thus, images can be acquired and interpreted immediately and later, when the patient's official registration and order information is entered into the ADT, Order Placer and Order Filler Systems, this information is matched with the acquired image set and reports, greatly simplifying these exception handling situations.

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) Profile.

Add a new profile Section 47.

47 Encounter-Based Imaging Workflow (EBIW) Profile

Medical imaging is increasingly done outside the context of an ordered procedure. The primary 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 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. For Point-of-Care Ultrasound (POCUS), it supports documenting reports and local privileging policies.

When such acquisition solutions are not integrated, complete and consistent, the efficiency and 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
- 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:

- establish encounter/patient/context
- convey metadata
- capture/store image data
- index/archive images

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.

47.1 EBIW Actors, Transactions, and Content Modules

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 mandatory grouping are shown in conjoined boxes.

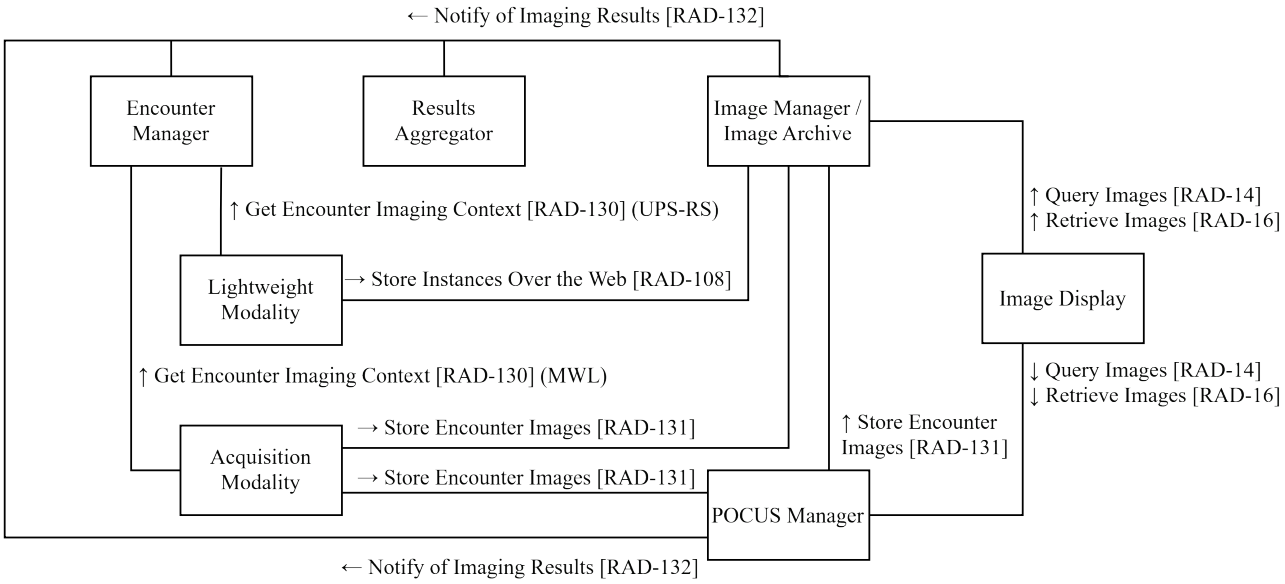

Figure 47.1-1: EBIW Actor Diagram

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	Initiator or Responder	Optionality	Reference
Encounter Manager	Get Encounter Imaging Context [RAD-130]	Responder	R	RAD TF-2: 4.130
	Notify of Imaging Results [RAD-132]	Responder	O	RAD TF-2: 4.132
Acquisition Modality	Get Encounter Imaging Context [RAD-130]	Initiator	R	RAD TF-2: 4.130
	Store Encounter Images [RAD-131]	Initiator	R	RAD TF-2: 4.131
Lightweight Modality	Get Encounter Imaging Context [RAD-130]	Initiator	R	RAD TF-2: 4.130
	Store Instances Over the Web [RAD-108]	Initiator	R	RAD TF-2: 4.108
	Store Encounter Images [RAD-131]	Responder	R	RAD TF-2: 4.131

Actors	Transactions	Initiator or Responder	Optionality	Reference
Image Manager/ Image Archive	Notify of Imaging Results [RAD-132]	Initiator	R	RAD TF-2: 4.132
	Store Instances Over the Web [RAD-108]	Responder	R	RAD TF-2: 4.108
Result Aggregator	Notify of Imaging Results [RAD-132]	Responder	R	RAD TF-2: 4.132
POCUS Manager	Store Encounter Images [RAD-131]	Responder Initiator	R	RAD TF-2: 4.131
	Notify of Imaging Results [RAD-132]	Initiator	R	RAD TF-2: 4.132
Image Display	Query Images [RAD-14]	Initiator	R	RAD TF-2: 4.14
	Retrieve Images [RAD-16]	Initiator	R	RAD TF-2: 4.16

47.1.1 Actor Descriptions and Actor Profile Requirements

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).

The Encounter Manager shall implement the MWL Semantics in the Get Encounter Imaging Context [RAD-130] transaction. If the Lightweight Modality Option is supported, then the Encounter Manager shall implement both the MWL Semantics and the UPS-RS Semantics in the Get Encounter Imaging Context [RAD-130] transaction.

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 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 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.,

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 47.4.1.10 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 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 and Lightweight Modality

For brevity, the term “Modality” is used in this section to refer to both the Acquisition Modality and the Lightweight Modality. Lightweight refers to the lightweight protocols used (e.g., RESTful), not to any physical characteristic of the device. The Lightweight Modality Option is intended for devices with limited resources that cannot support a full DIMSE protocol stack.

The Modality assembles acquired pixels with associated metadata (specifically including metadata obtained via Get Encounter Imaging Context [RAD-130] and perhaps operator input) and then stores the resulting image IODs. The 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 Modality product and are outside the scope of this profile.

For digital photography and video, XC (external-camera photography) is an appropriate value for Modality (0008,0060). VL Photographic Image is an appropriate IOD for photography. Video Photographic Image is an appropriate IOD for generic video. DICOM Secondary Capture should only be used for encounter-based images when there is no more appropriate SOP Class.

The Acquisition Modality shall implement the MWL Semantics in the Get Encounter Imaging Context [RAD-130] transaction.

The Lightweight Modality shall implement the UPS-RS Semantics in the Get Encounter Imaging Context [RAD-130] transaction.

A major responsibility of the Modality is to ensure that key metadata for the imaging procedure (such as the body part examined and series description) are included in the stored image. Populating these details may require interacting with the operator or using automated methods such as barcode scanners, RFID readers, or other digital identifiers. Without this information, encounter images cannot be properly managed, located, and accessed when they are needed. For the POCUS Option, operator and patient identification metadata are also used for managing privileges and generating reports. The full requirements for stored images are documented in the Store Encounter Images [RAD-131] transaction. See also Section 47.4.1.6 Recording Encounter and Procedure Metadata.

The 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 Modalities might also store non-DICOM clinical documents, such as HL7 CDA.

The 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 Modality be able to show the operator what values are being used and permit adjustment for metadata values like the department, operator, patient, procedure, etc.

After images are acquired, but before they are stored, the Modality may work with the operator to evaluate the quality of the images and decide which should be sent to the Image Manger/Archive. Such QA activities are not explicitly addressed in this profile. After images have been successfully stored to the Image Manager / Image Archive, it is likely the Modality will delete its local copies. Before deleting local instances, Modalities might query the Image Manager / Image Archive using the DICOM Storage Commitment Service, the DICOM C-FIND Service, or the DICOMweb QIDO-RS Service to confirm the images have been successfully stored. The Profile does not mandate support of these mechanisms.

The Lightweight Modality shall have a method of maintaining the correct time and UTC offset ("timezone") and ensuring that the time metadata (acquisition time, series time, etc.) are accurate to within seconds. The Acquisition Modality achieves this using the IHE Consistent Time Profile (based on NTP); the Lightweight Modality may choose to use the CT Profile or some other method. Mobile devices on a cellular network are likely time synchronized through that infrastructure, which is acceptable, and the time resulting from synchronization will be reflected in image metadata such as the EXIF tags. See DICOM PS3.17 Annex NNNN for additional details on what EXIF metadata corresponds to which DICOM attributes.

47.1.1.3 Image Manager / Image Archive

The Image Manager / Image Archive is required to send notifications to the Result Aggregator using Notify of Imaging Results [RAD-132]. Optionally, the Image Manager / Image Archive may be configurable to also send notifications to the Encounter Manager.

Consistent with the IHE Web Image Capture (WIC) Profile, the Image Manager / Image Archive is required to populate Image Pixel Macro fields that the Lightweight Modality may leave empty. See RAD TF-2: 4.108.4.1.3.

47.1.1.4 Result Aggregator

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

47.1.1.5 POCUS Manager

The POCUS Manager is responsible for coordinating and managing POCUS imaging studies.

The POCUS Manager generates and transmits clinical reports based on the imaging data and worksheet templates. It ensures consistency between imaging studies and their associated reports by performing operations such as coercion, merging, or splitting of studies.

The POCUS Manager shall be able to generate Study Instance UIDs and accession numbers.

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

The POCUS Manager shall be configurable to assure that the generated accession numbers 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 POCUS Manager shall separate clinical and training studies to prevent unintended inclusion of non-diagnostic or practice images in clinical workflows.

The POCUS Manager shall support the [RAD-132] transaction as an Initiator, including the POCUS-specific requirements in RAD TF-2: 4.132.4.1.2.3.

The POCUS Manager shall be able to provide a summary of incomplete studies at the individual (i.e., HCP), departmental, and organizational levels. The specifics of this mechanism are not defined in this profile; it could be implemented as an API, text export, or another suitable method. See Section 47.4.1.19 for information on POCUS reporting, and Section 47.4.1.20, for a description of incomplete study states.

The POCUS Manager may be grouped with the Encounter Manager, as encounter data (e.g., ADT messages) is essential for reconciling images with patient demographics and encounter contexts. It may also be grouped with the Image Display to enable seamless visualization and review of POCUS imaging studies.

47.1.1.6 Image Display

The Image Display is responsible for retrieving and consistently presenting images to the user.

In POCUS workflows, the Image Display may be grouped with the POCUS Manager or integrated via context launch mechanisms such as the IHE Invoke Image Display (IID) Profile or SMART to present images alongside the associated worksheet, enabling operators to simultaneously view images and complete reports. However, the POCUS Manager is the primary actor responsible for worksheet management and reporting.

The Image Display may query multiple systems and provide access to prior studies, though this is not required in the profile.

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. 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 (See Note 1)	Lightweight Modality Option	RAD TF-1: 47.2.2
	POCUS Option	RAD TF-1: 47.2.1
Acquisition Modality	POCUS Option	RAD TF-1: 47.2.1
Lightweight Modality (See Note 2)	DICOM Instance Storage Option	RAD TF-2: 4.108.4.1.2.6
	JPEG Storage Option	RAD TF-2: 4.108.4.1.2.3.1
	PNG Storage Option	RAD TF-2: 4.108.4.1.2.3.2
	MPEG4 Storage Option	RAD TF-2: 4.108.4.1.2.4.1
Image Manager / Image Archive (See Note 3)	PNG Storage Option	RAD TF-2: 4.108.4.1.3
	POCUS Option	RAD TF-1: 47.2.1
Result Aggregator	POCUS Option	RAD TF-1: 47.2.1
POCUS Manager	POCUS Option (See Note 4)	RAD TF-1: 47.2.1
Image Display	No options defined	--

Note 1: The Encounter Manager shall support at least one option.

Note 2: The Lightweight Modality shall support at least one option.

Note 3: The Image Manager / Image Archive is already required to support JPEG, MPEG4, and DICOM Instance Storage.

Note 4: The POCUS Manager shall support the POCUS Option. In the absence of the POCUS Option the POCUS Manager does not play a role in this profile.

47.2.1 POCUS Option

This option supports POCUS workflows by introducing additional requirements for operator identification, training workflows, privileging metadata, and structured reporting. It defines additional requirements for the Acquisition Modality while relaxing certain requirements for the Image Manager / Image Archive and the Encounter Manager.

The Acquisition Modality shall support:

- The MWL Semantics in the Get Encounter Imaging Context [RAD-130] transaction.
- The identification of patients and operators involved in the imaging procedure using identification methods such as barcode scanning, RFID, QR codes, or other equivalent technologies. In scenarios involving unregistered patients, the modality shall permit imaging while capturing metadata to indicate missing patient identification. Implementation details are left to the implementer. See Section 47.4.1.10.

  Note: The Encounter Manager is required to handle workflows involving unidentified patients.

- Populating the Operator Identification Sequence (0008,1072) with multiple items to represent all operators who participated in the imaging workflow, including those involved in training, as defined in RAD TF-2: 4.131.
- Mechanisms to ensure operator identification before image capture.
- Transmitting DICOM objects data via the Store Encounter Images [RAD-131] message directly to the POCUS Manager, rather than the Image Manager / Image Archive.
- Identification of training studies at the time of acquisition. This shall be captured in the Reason for Performed Procedure Code Sequence (0040,1012), as defined in RAD TF-2: 4.131.
- Support the display requirements defined in RAD TF-2: 4.130.4.1.2.1.1.

The Encounter Manager shall support:

- The MWL Semantics in the Get Encounter Imaging Context [RAD-130] transaction.
- The capability to map the HL7 Visit Number (PV1-19), or its equivalent, to the DICOM Admission ID (0038,0010).
- The capability to map the HL7 Attending Doctor (PV1-7), or its equivalent, to the DICOM Physician(s) of Record Identification Sequence (0008,009D).

Note: If the Lightweight Modality Option is supported, then the Encounter Manager shall implement both the MWL Semantics and the UPS-RS Semantics in the Get Encounter Imaging Context [RAD-130] transaction.

The Image Manager / Image Archive shall be configurable to not send the Notify of Imaging Results [RAD-132] message for instances received from the POCUS Manager via [RAD-131].

The Result Aggregator shall support receipt of the POCUS report via [RAD-132], including the additional HL7 segments defined in RAD TF-2: 4.132.4.1.2.3.

The POCUS Manager shall support the requirements specified in Section 47.1.1.5. There are no option-specific requirements for this actor.

47.2.2 Lightweight Modality Option

This option enables support for modalities with limited processing power, user interface, or network capabilities, such as digital cameras, smartphones, and tablets, to participate in Encounter Based Imaging using RESTful protocols.

The Lightweight Modality shall support the UPS-RS Semantics in the Get Encounter Imaging Context [RAD-130] transaction.

The Encounter Manager shall support the UPS-RS Semantics in the Get Encounter Imaging Context [RAD-130] transaction.

Note: If the POCUS Option is supported, then the Encounter Manager shall implement both the MWL Semantics and the UPS-RS Semantics in the Get Encounter Imaging Context [RAD-130] transaction.

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 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.

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.

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	--
Lightweight Modality	None	--	--
Image Manager / Image Archive	RAD SWF.b / Image Manager / Image Archive	RAD TF-1: 34	--
Result Aggregator	ITI CT / Time Client	ITI TF-1: 7	--
POCUS Manager	ITI CT / Time Client	ITI TF-1: 7	--
Image Display	None	--	--

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 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. For POCUS workflows, the profile supports reporting and local privileging policies.

Many of the concepts in this profile were influenced by a set of white papers on Enterprise Imaging done by members of a joint working group of the Society for Imaging Informatics in Medicine (www.siim.org) and the Healthcare Information and Management Systems Society

(www.himss.org). The white papers (available from http://siim.org/page/himss_siim_white_pap) include:

- A Foundation for Enterprise Imaging
- Order-based vs Encounter-based Image Capture
- Workflow Challenges of Enterprise Imaging
- Technical Challenges of Enterprise Imaging

The POCUS concepts in this profile were influenced by clinical guidelines from the American College of Emergency Physicians (ACEP), The guidelines (available from https://www.acep.org/by-medical-focus/ultrasound) include:

- Emergency Ultrasound Standard Reporting Guidelines
- Emergency, Point-of-care, and Clinical Ultrasound Guidelines in Medicine
- Emergency Ultrasound: Essential Machine Features
- Consensus Terminology for Point of Care Ultrasound Studies with Incomplete Documentation and Workflow Elements
- Credentialing and Privileging in Emergency Ultrasound

Readers may also find useful the white paper from the IHE Devices 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

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.

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.

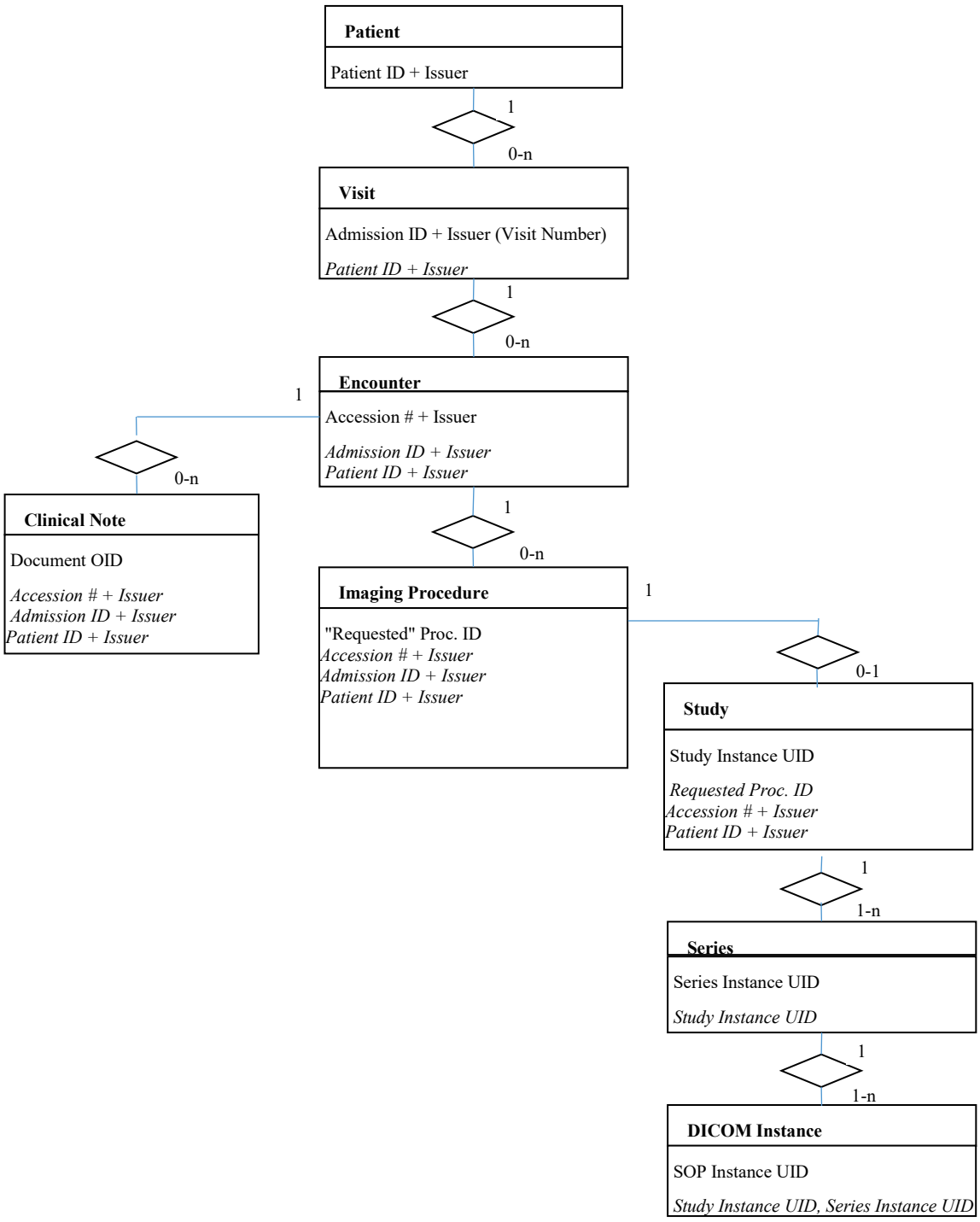

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Figure 47.4.1.1-1: Encounter-Based Imaging Information Model

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 instead create a single Study with multiple Series. Some PACS compensate for 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 subsequent imaging.

It is often left to the 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 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 (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 47.1.1-1 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 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 CDA documents.

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

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 imaging workflow.

The information model diagram (see Figure 47.4.1.1-2) extends the encounter-based imaging information model for POCUS, relating operational entities to DICOM and related documents for POCUS.

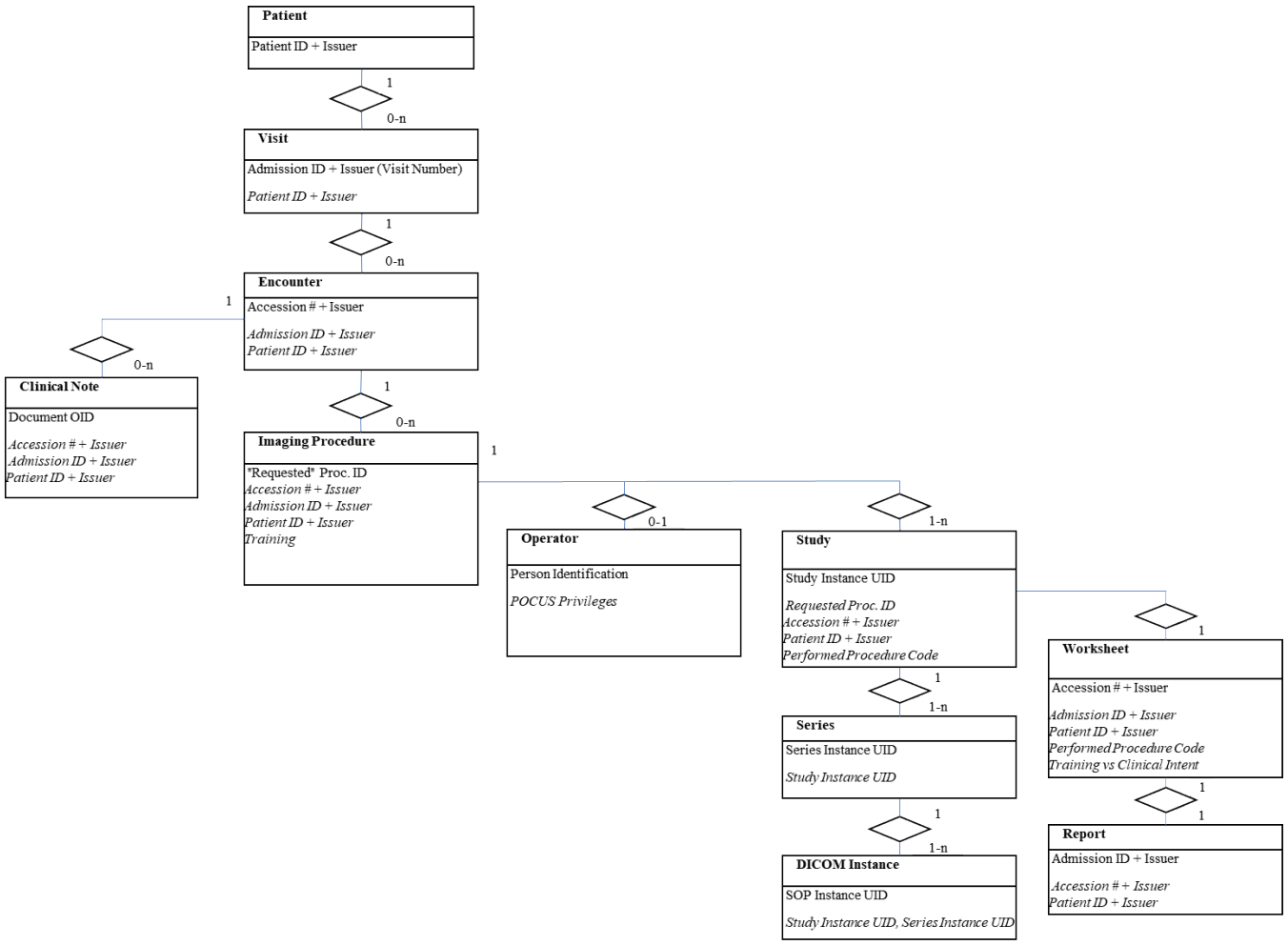


Figure 47.4.1.1-2: Encounter-Based Imaging Information Model for POCUS

The Patient, Visit, Encounter and Clinical Note entities are unchanged from the Encounter-Based Imaging Information Model.

The Imaging Procedure adds a training indicator that is entered at the modality for training studies.

The Operator represents the healthcare professional(s) or trainees performing the imaging. Operator identification metadata captures the operators' identification details to support POCUS privileging. The POCUS Manager verifies operator privileges before reports can be signed.

In POCUS, the worksheet is a precursor to the report and serves as a template for recording measurements, findings, and observations related to POCUS imaging. It includes details such as the procedure intent (e.g., training vs. clinical) and key clinical observations. See Section 47.4.1.19.

A report may be used for both clinical documentation and billing purposes. The report is transmitted as an HL7v2 message, but may exist in other representations (e.g., FHIR DiagnosticReport).

47.4.1.2 Accession Numbers

The Accession Number has become a significant index for managing an imaging study in each patient's 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 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 encounter-based imaging, the Accession Number is generated by the Encounter Manager, and is associated with the encounter that provided the context for, and initiated, the imaging procedure. The Issuer of Accession Number Sequence is required to ensure the uniqueness of accession numbers within the enterprise.

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" (one procedure per Accession Number) in orders and encounters.

In POCUS workflows, the Encounter Manager generates the initial Accession Number as part of the Modality Worklist (MWL) response. In some cases, the Acquisition Modality operator may capture multiple studies for a patient without refreshing the worklist or receiving a new Accession Number. In such scenarios, the operator at the POCUS Manager initiates a study split to align image grouping with the selected worksheets. The POCUS Manager is then expected to generate new, unique accession numbers for each resulting study, with each study corresponding to a separate worksheet, as described in Section 4.131.4.1.2.2.2.

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.

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.

Deployment facilities may create orders following the imaging procedure to support billing and tracking requirements. Some deployments may require the POCUS Manager to explicitly generate the order, while others may generate the order automatically by the EMR in the background upon patient admission (e.g., Rong et al., 2021). While this functionality is not mandated by the profile, the POCUS Manager may consider supporting Scheduled Workflow order-based transactions, such as Placer Order Management [RAD-2] and/or Filler Order Management [RAD-3].

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 to ensure accurate association of acquired images. For order-based imaging workflows, this metadata is typically obtained from a list of scheduled procedures for specific patients. In encounter-based imaging workflows, such as POCUS, the metadata is dynamically generated by the Encounter Manager to reflect a list of active patients. The list of patients can be filtered or selected based on location or clinical context. Since this list is created in real time and may initially be broad, the Modality and Encounter Manager need to apply constraints and filters to make it practical for the operator to identify the correct patient.

Various HL7 v2.5.1 message segments and fields contain relevant patient details. This profile does not mandate support for any specific set of HL7v2 messages containing those segments, but several IHE profiles are worth considering.

The Encounter Manager could group with a Patient Demographics Consumer in the ITI Patient Administration Management (PAM) Profile to receive a feed of patient demographics for all patients in the facility. The Patient Identity Management [ITI-30] transaction profiles six HL7 ADT messages, although depending on the option selected the actor only needs to implement four or five of them. Implementers of the PAM Profile are advised to pay close attention to the additional regional requirements described in ITI TF-4 for National Extensions. Note that the Encounter Manager could alternatively group with a Patient Encounter Consumer (see Section 47.4.1.5) since the Patient Encounter Management [ITI-31] transaction also contains patient demographics. Refer to RAD TF-2x: Appendix U for a mapping of ADT fields to MWL attributes.

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

The Encounter Manager could group with a Patient Demographics Consumer in the ITI Patient Demographics Query for Mobile (PDQm) Profile to get patient demographics on demand. The Mobile Patient Demographics Query [ITI-78] transaction provides the same details as PDQv3 using RESTful services.

If the Encounter Manager is grouped with a 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 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 and fields contain relevant encounter details. For example, PV1-7 contains the attending physician information, and PV1-19 includes the visit number, which can link the report and images in the EMR. 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 ITI Patient Administration Management (PAM) Profile to receive a feed of encounter details for all patients 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 five 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. Refer to RAD TF-2x: Appendix U for a mapping of ADT fields to MWL attributes.

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

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 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

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.

The Acquisition Modality and Lightweight Modality are responsible for meeting the full requirements for stored images as documented in the Store Encounter Images [RAD-131] transaction and the Store Instances Over the Web [RAD-108] 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 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. E.g., given the care team specialty and the reason for visit, a table might be able to provide a short list for the body part and/or procedure type.

The Acquisition Modality and Lightweight 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 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 Recording Image Metadata

Image (pixel) metadata is captured by traditional Acquisition Modalities in ways particular to those medical devices. Lightweight Modalities will likely capture and submit images in consumer image or video formats that support EXIF tags that record metadata relevant to the procedure and to the image encoding.

Much of the information that may exist in EXIF tags can be recorded in the DICOM VL Photographic Equipment Module (see DICOM PS3.3 Section C.8.12.10), the DICOM VL Photographic Acquisition Module (see DICOM PS3.3 Section C.8.12.11), and the Photographic Geolocation Module (see DICOM PS3.3 Section C.8.12.12).

For further guidance on mapping EXIF values into DICOM attributes, refer to DICOM PS3.17 Annex NNNN Mapping of Visible Light Photography Related Attributes to EXIF and TIFF/EP Tags (Informative).

In the case where the image capture device is separate from the Lightweight Modality that is generating the stored DICOM image instance, the General Equipment Module will describe the Lightweight Modality, but the image capture device can be described in the Contributing Equipment Sequence (0018,A001), which includes details such as:

- Manufacturer, Model, Serial Number
- Software Version
- Spatial Resolution
- Last Calibration
- Institution Name. Institutional Department Name
- Station Name
- Operator's Name, Operator's ID
- Contribution Datetime
- Contribution Description

Although not required by this profile, if the Lightweight Modality modifies values from EXIF tags before recording them in DICOM attributes, it might consider recording the original EXIF values in the Original Attributes Sequence (0400,0561).

47.4.1.8 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

The key is being able to find relevant images amongst a potentially very large collection.

The most important metadata, 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 Care Team associated with images is also a useful axis for organizing and accessing images. A Care Team may capture a list of members and also associate the team with a care task or clinical specialty.

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

47.4.1.9 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 DICOM PS3.16 CID 4 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 LOINC RadLex Playbook set of procedure codes is worth investigating for ultrasound.

Point-of-Care Ultrasound systems should consider the code list provided in RAD TF-2x: Appendix O Table O-1 for populating the Reason for Performed Procedure Code Sequence (0040,1012).

Digital photography is used in a wide range of settings and for a wide variety of purposes; however, a given device in a given department will likely be used for a much smaller subset of purposes. Moreover, the local department may have specific conventions for how the procedures are named. Supporting the ability to configure a departmental list of codes is a sensible approach. The list could either be configured into the Encounter Manager which would return an appropriate list in the Get Encounter Imaging Context [RAD-130] transaction based on the department details in the query, or the lists could be individually configured on each of the Lightweight Modality Actors depending on where they are currently being used.

A few medical photography-related codes are provided for consideration in RAD TF-2x: Appendix O Table O-2. Ultimately though, many images are taken as supportive evidence for an associated procedure (e.g., dermabrasion, or alveolar recontouring). Recording the associated "primary" procedure (rather than the secondary procedure of "medical photography") can make it easier to find relevant images later and understand the purpose of each. In a similar vein, Reason for Visit (0032,1066) or Reason for Visit Code Sequence (0032,1067) might be a practical analog for the reason for imaging.

47.4.1.10 Unidentified Patients

It is to be expected that some patients being imaged have not yet been identified (e.g., admitted while unconscious). Two significant variants of this situation are:

- Unidentified Patient Registered at ADT: The unidentified patient has been registered in the ADT system using a pseudonym such as "John Doe". The associated imaging metadata contains placeholder demographics that can be reconciled later.
- Unregistered Patient/Unidentified Study: No patient registration exists and no demographics are available in the images. This may be due to unknown patient identity, user error, or a network failure preventing the Modality from querying the Modality Worklist (see Sections 47.4.1.20 and 47.4.1.23).

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; the patient name and patient ID (MRN) will likely be placeholders, and the sex and age may be assigned based on conventions. The content of the Patient ID and associated Issuer of Patient ID will typically indicate they are temporary and thus the patient identity was not known at the time of imaging. The Modality and the Encounter Manager should be prepared to work with commonly used methods for handling John Doe patients. This may include:

- The ADT registering the John Doe with sex and estimated age and assigning a temporary Patient ID. Those details are then available to the Encounter Manager the same as for regular patients. The Modality receives these from the Get Encounter Imaging Context [RAD-130] transaction by searching for the Patient ID or admission ID from the wristband or manual entry.
- The Encounter Manager maintaining a list of temporary IDs for unregistered patients. The Modality receives these in the Get Encounter Imaging Context [RAD-130] transaction by using some mechanism defined by the Encounter Manager to indicate the patient seems to be unregistered, e.g., query for a Patient ID of 99 (a Japanese convention in some hospitals for emergency patients).
- The Modality using an alternate AE Title to query for temporary IDs for unregistered patients (this might be a configurable control or when an “emergency button” in the modality user interface is pushed). The alternate AE Title for temporary IDs might be provided by the Encounter Manager, the EMR, or some other system. The ability to switch between different MWL SCPs may already be present on the modality to switch between querying an Order Filler for order-based imaging procedures and an Encounter Manager for encounter-based imaging procedures.
- The Modality maintaining a list of temporary IDs for unregistered patients. Subsequent manual reconciliation will likely depend on matching departmental patient handling notes with the acquisition time and the specific modality device used.

An advantage of the first two methods is that they can be implemented centrally on the ADT or Encounter Manager, and do not require modifications to the many modality devices beyond, perhaps, training the operator.

Methods based on specific values, such as the 99 code, have the advantage that they do not depend on any specific capability of the modality and can be implemented by training the operator. Other methods may take advantage of settings that are commonly configurable on the

modality. For example, since the modality may have a configurable control to switch between different MWL SCPs (so the modality can switch between querying an Order Filler for order-based imaging procedures and an Encounter Manager for encounter-based imaging procedures), the Encounter Manager could offer an additional AE Title that can be queried to receive temporary Patient IDs. A modality might also switch to the alternate AE Title when an "emergency button" in the modality user interface is pushed.

To understand encounter-based cases for unidentified patients, it is instructive to consider the analysis already performed in the IHE Scheduled Workflow and Patient Information Reconciliation Profiles. PIR describes a number of variations of the Unidentified Patient Case (See RAD TF-1: 4.4) for order-based imaging. In those cases, where the patient has been registered at the ADT prior to imaging (Cases 1, 2, 3, 4) the Encounter Manager in a corresponding encounter-based case would have received the demographics and the encounter-based imaging workflow would proceed as usual. The case where temporary demographics are prepared at the modality, Case 5, can be handled similarly for encounter-based imaging. As described in Case 6, in the midst of imaging an unidentified patient, the identity of the patient may be determined; however, the modality should continue to acquire images using the originally received metadata and leave reconciliation to the Image Manager / Image Archive and other infrastructure systems.

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. In POCUS workflows, it is recommended that the POCUS Manager be grouped with a PAM Patient Demographics Consumer to receive patient demographics updates, ensuring that the correct identifiers are applied to support patient reconciliation workflows (see Section 47.6). The POCUS Manager may also provide a mechanism to correct unidentified studies before export. Prior to transmitting to the Image Manager / Image Archive, the POCUS Manager validates that the study includes a valid Patient ID and Patient's Name. Studies failing this validation are not transmitted until properly reconciled.

Similarly, the Result Aggregator (EMR), which will have received a Notify of Imaging Results [RAD-132] message with the placeholder ID and demographics, will likely also receive the same patient merge message as the PACS and act appropriately. For more details on patient reconciliation, refer to the Unidentified Patient use cases in the Scheduled Workflow.b Profile.

47.4.1.11 RAW Camera Images

Some Lightweight Modalities are capable of recording images in vendor-specific file formats often referred to collectively as RAW. Those RAW images are typically converted to formats like JPEG and PNG for general distribution. This profile covers the JPEG and PNG but does not currently address RAW formats.

Compared to the JPEG images, the RAW images typically contain more bits per pixel, span a wide color gamut, and thus don't impose particular white balance and exposure choices associated with the loss of data when "downsampling" and compressing into JPEG. The extra

bits can be important when there is medical value in the extended sensitivity of the sensors; for example, infrared can be relevant to dermatology applications.

DICOM attributes support multiple samples per pixel and high numbers of bits per sample, however most current IODs do not support both at the same time. The DICOM VL Photographic Image IOD has 3 samples per pixel, but the VL Image Module places a limit of 8-bit samples. A number of Image IODs allow 16-bit samples, but only 1 sample per pixel. The VL Whole Slide Microscopy Image IOD demonstrates the precedent of 3 samples per pixel and 16-bit samples.

Note that DICOM requires image storage SCPs to be capable of providing an uncompressed version of stored images that are losslessly compressed.

Although the DICOM Raw Data IOD has "raw" in the name, it was not named for the RAW image format. The Raw Data IOD was developed to provide a way to leverage the DICOM storage infrastructure for opaque blobs of binary data, such as unreconstructed CT sinogram data. Aside from storage, the Raw Data instances are otherwise non-interoperable since the payload remains proprietary. Since the use case only involved storage and retrieval back to a corresponding proprietary system, the lack of interoperability was not an issue.

47.4.1.12 Record-Driven Acquisition

For some EBIW use cases, an operator might find it convenient for the current imaging to inherit its context from an existing entry in the patient record. For example, a practitioner who is interacting with the encounter manager or a patient record viewer might initiate imaging to capture a current image of a previously imaged skin lesion ("take follow-up image"), or to capture an image of a wound to accompany the existing evaluation of the current state of the wound (supportive).

Inheriting the context could avoid re-entry of details such as patient, body part, reason for imaging, etc. This profile does not specifically require such functionality, but some possible implementations are described here. One might think of this as a "push workflow" where the procedure is initiated from somewhere other than the modality, or perhaps as a "repeat order for current date" where the existing image represents the "prior order" to be repeated.

An Encounter Manager that is integrated with an EMR or enterprise imaging system could extract metadata from the record that is currently being viewed and use that to populate an Encounter Imaging Context entry combined with a new Study UID, Accession #, Admission ID, etc. The entry might identify the Lightweight Modality in the Scheduled Station AE Title (0040,0001) or the operator in the Scheduled Performing Physician's Name (0040,0006), allowing a pre-configured query on the Lightweight Modality to get the current task semi-automatically.

Depending on the situation, the Encounter Manager might search the archive for relevant priors for the current list of patients and populate Encounter Imaging Context entries from which the operator could select.

A Lightweight Modality that is grouped with an EMR Viewer, for example a tablet with a camera, could pull much of the context from the record and only use the query to the Encounter Manager to get the Study UID, Accession # and other administrative details. From the operator's point of view, they would select the "Follow-up" button in the viewer and the tablet camera would be activated. The rest would happen in the background with perhaps a metadata confirmation screen at completion of the imaging.

A Lightweight Modality could do Deferred Completion (see Section 47.4.1.16) and associate the new images with the existing patient record entry after the images have been acquired.

47.4.1.13 Biometric-based Patient Identification

In recent years, the use of biometric information (such as fingerprints, facial recognition, iris scans, voiceprints, etc.) to identify people has been gradually seeing wider use in a variety of contexts. One could imagine the camera on a smartphone being used for facial recognition prior to acquiring medical images.

This Profile does not dictate how the modality obtains a Patient ID with which to query for demographic and encounter metadata. It is expected that it will be most common to either scan a patient wristband or enter the ID manually, however implementers are not restricted from exploring more advanced technologies.

It should be noted, however, that such technologies typically depend on local infrastructure. For example, reference biometrics will need to be collected for a large enough portion of the patient population to make this useful, and a "mapping service" will be needed to match the biometrics of the current patient undergoing encounter-based imaging against the reference biometrics to generate a positive ID.

Also, biometric-based patient identification will likely have a non-zero error rate so corresponding exception handling and related measures will be needed. The Patient Information Reconciliation Profile provides some guidance on handling mis-identified patients.

Security and privacy issues might also be raised if either the current patient biometrics or the reference biometrics were stored on the modality or in the clinical record.

47.4.1.14 Guided Acquisition

The diagnostic quality of medical photography could benefit from presenting instructions to the operator describing important details such as how the anatomy is to be positioned and illuminated, how the camera should be oriented, how the field of view should be framed, etc., effectively a protocol for acquiring the images. An Instruction Sequence (0018,9914) containing such instructions might be returned by the Get Encounter Imaging Context [RAD-130] transaction.

For example, instructions could be sent to the camera ("First photo the whole left arm", "confirm", "Now zoom halfway in to the lesion", "Now turn on the special lighting and fill 75%

of the image with the lesion", etc.) and displayed to the operator, allowing them to confirm as each image is acquired.

Such guided acquisition might support automatically assigning the correct metadata for the body part and type of photo without further interaction by the operator.

Note that the acquisition is guided in the sense of “static” instructions, not necessarily in the sense of an interactive feedback loop.

47.4.1.15 Study and Series Organization

DICOM requirements cover when data *must* be put into separate studies or series, but beyond that deliberately leaves to implementations and operators the choice of when to further separate studies and series of acquired images.

At a minimum, switching to a different acquisition device, operator, protocol, or body part results in a new series; and a different referring physician, consulting physician, physician of record, or service results in a new study.

Typically, one would expect that different encounters, even if during the same admission, would be recorded in different studies and the images from a single encounter would usually be in the same study unless they were being acquired for different purposes.

It is also common that images that are reported together are kept in the same study.

Implementations may also find it useful to interact with the operator to determine groupings when many images are acquired on a patient during one encounter, especially if several procedures have been performed. For example, photos may be taken documenting multiple surgical procedures during a single encounter in the operating room.

It is common practice for the Image Manager / Image Archive to coerce/re-organize the Series and Study groupings submitted by the Acquisition Modality based on facility conventions and that practice is also applicable in this Profile.

See Section 47.4.1.2 for a related discussion of accession numbers.

47.4.1.16 Deferred Completion

Metadata obtained and incorporated at the time of acquisition is the most readily available and likely to be the most accurate. It is, however, conceivable that products may be developed that devise mechanisms to reliably incorporate accurate metadata, completing the image object, some time after acquisition. Completion may be deferred for workflow reasons, or it may simply result from the photographer being interrupted or called away from a current case to attend to a more urgent case or some other matter.

In POCUS workflows, accurate, complete, and consistently formatted metadata is critical to ensure the integrity of patient records, billing, and clinical documentation. Scenarios such as "Ghost Studies," "Orphan Studies," and "Blind Studies" (see Section 47.4.1.20) can occur if the

metadata is incomplete or deferred for too long, leading to missing patient identifiers, operator identification, or unsaved images, which can compromise the quality of care or reimbursement.

In another example, a product consisting of a camera and software might involve the camera photographing a barcode or QR code before and after photographing the corresponding patient. This might be sufficient for the software to correlate that code to a schedule or metadata query entry when images are transferred from the camera to the software system sometime later. The completion activity might also include human operation to confirm or assign body part labels or other metadata. Such software might be grouped with the Image Manager / Image Archive or Encounter Manager Actors.

Although such solutions are not further described here, they would be compatible with this profile where the software plays the role of the Lightweight Modality. The interface between the image capture device and the modality software (See Section 47.4.2.3) is out of scope of this profile (in the same way that the interface between a CT gantry and the modality console is out of scope of the Scheduled Workflow.b Profile).

47.4.1.17 Use of the POCUS Option in EBIW

The POCUS Option introduces additional requirements, including operator identification and training workflows. These address common workflow challenges and support privileging, reporting, billing, and quality assurance. The POCUS Option is optional for ultrasound Modalities implementing EBIW, and it does not prevent an ultrasound modality from participating in a POCUS workflow without claiming the option. In such cases, modalities can operate in environments where workflows do not rely on billing integration, training documentation, or operator privilege enforcement. For use cases where the POCUS Option is not claimed, the baseline EBIW capabilities remain fully applicable. See Section 47.1.1.2.

47.4.1.18 POCUS Privileging

Privileging in POCUS refers to the authorization by a healthcare institution allowing an HCP to independently perform, interpret, and finalize specific POCUS studies. This process differs from credentialing, which broadly verifies qualifications, training, and licensure; privileging is determined locally by each institution or department based on its policies. Both physicians and advanced practice providers (APPs) such as Physician Assistants (PAs) and Nurse Practitioners (NPs) may be privileged depending on institutional policies and the provider's scope of practice.

Privileging may be categorized as:

- Global: Covers all POCUS studies within an organization or department.
- CPT-Based: Grants privileges for procedures tied to specific CPT (Current Procedural Terminology) codes.

- Study-Type: Applies to specific types of POCUS exams, such as cardiac or abdominal ultrasound.
- Procedure-Specific: Complex procedures like Transesophageal Echocardiography (TEE) may require additional competency verification due to their specialized nature.

A Quality Assurance (QA) program is integral to maintaining privileging and ensuring HCPs sustain their skills and competency. This involves regular review of completed POCUS studies to assess trends, compliance with guidelines, and documentation quality. QA highlight areas for improvement, identify best practices, and ensure adherence to local policies. A QA feedback loop providing feedback to the initial operator who performed the POCUS study ensures continuous improvement, reinforces best practices, and address any identified issues in technique or interpretation.

Note: While privileging status determines whether a healthcare provider may finalize a report in this profile, the technical and policy requirements for granting privileges are determined by institutional governance, credentialing bodies, or local policy, and are out of scope for this profile.

While this profile does not specify transactions for QA or privileging, the POCUS Manager is expected to restrict the report finalization to HCPs with appropriate privileges.

47.4.1.19 POCUS Reporting

POCUS reporting involves structured documentation of imaging findings, interpretations, and supporting data for clinical and training purposes. Priors are generally unnecessary in POCUS workflows, as decision-making occurs with a focus on evaluating current findings to guide immediate treatment. Operator identification at the modality is critical to associate the responsible operator (HCP) with the accuracy and completeness of the imaging report. This also identifies POCUS Learners involved in the study for the tracking of training activities.

Worksheets standardize reporting for common procedures, capturing clinical history, indications, acquired images, and interpretation/findings. HCPs interact with worksheets to input, review, and finalize data during reporting. Worksheets are established locally based on professional guidelines, such as those from ACEP or SCCM, and are linked to imaging studies using the Accession Number. Multiple studies acquired as a single study instance on the modality may be reported in separate worksheets to comply with local policies, billing requirements, or procedural documentation needs. Additionally, DICOM Structured Report (SR) content can be integrated into worksheets via the POCUS Manager to streamline reporting.

This profile distinguishes between documentation of imaging guidance and documentation of the intervention itself. While a POCUS report may describe imaging performed to guide a procedure, the procedure note (i.e., a report detailing the intervention) is typically created in a separate system and is out of scope for this profile. For examples of structured documentation of procedures, see the IHE CARD Cardiac Procedure Note (CPN) Profile and Procedures and

Interventions in the IHE PCC Emergency Department Encounter Summary (EDES) Profile. See Section 47.2.4 for further discussion of procedural documentation patterns and their relationship to POCUS reporting.

The POCUS Manager may allow the HCP to apply a confidentiality code to indicate the degree to which special confidentiality protection should be applied to the report. This does not encode site policy, but rather describes the nature of the study, which would facilitate the implementation and invocation of site policies. Either a DICOM or HL7 confidentiality code may be used. The selection and enforcement of such codes are out of scope for this profile.

Modalities may consider supporting downloadable worksheets for bedside completion at the Modality (see Section 47.4.1.19). This might be implemented using FHIR Questionnaire resources, with the POCUS Manager hosting the questionnaire and the modality downloading and utilizing it.

Final reports, derived from worksheets, are encoded as HL7 v2 ORU^R01 messages and integrated into the patient's medical record as clinical notes. Privileged HCPs review and sign final reports to ensure compliance with local privileging requirements (see Section 47.4.1.20). Preliminary reports, drafted by POCUS Learners, require review and approval by a privileged HCP. Addendums allow updates, corrections, or clarifications to signed reports (see Section RAD TF-2: 4.128.4.1.2.6). These reference the original report and are appended to maintain a complete record. The Notify Imaging Results [RAD-132] transaction defines HL7v2.5.1 ORU^R01 message to enable a POCUS Manager to submit and amend imaging results.

A signature, whether traditional or electronic, serves as legal authentication that validates the healthcare provider's identity and privileges while confirming they have reviewed, agree with, and take responsibility for the report's content, ensuring regulatory compliance. The POCUS Manager often utilizes electronic signatures to enforce local privileging criteria, blocking POCUS Learners from finalizing reports and routing them to supervising physicians as needed.

Note: Technical requirements for electronic signatures are determined by jurisdiction, institution or payors, and out of scope of this profile.

Training studies follow a distinct workflow. See Section 47.4.1.21.

47.4.1.20 POCUS Workflow Challenges

POCUS workflows often occur in fast-paced, emergency settings where clinical needs compete with documentation requirements. These challenges can lead to incomplete studies with issues such as incomplete metadata, unfinalized reports, and unverified privileges, potentially impacting data and billing integrity, and overall quality of care.

POCUS Managers and Acquisition Modalities can facilitate the resolution of a variety of the resulting POCUS workflow issues.

- *Unidentified Studies* include images and operator information but lack patient identification. These situations may arise due to user error (e.g., failure to select a patient), imaging an unidentified patient (e.g., trauma or emergency), or network issues that prevent the Modality from retrieving demographics from the Encounter Manager. These studies are reconciled in the POCUS Manager once the patient is identified.
- *Orphan Studies* contain images but are missing both patient identification and an assigned operator. The modality can avoid this through efficient identification of patients and operators.
- *Unassigned Studies* have patient identification and images but no assigned operator. The POCUS Manager can support the manual assignment or claiming of these by operators.
- *Blind Studies* may include metadata but no associated clinical images, but the study contains some other patient-related information (e.g., a measurement or a Secondary Capture image) . The modality could prevent transfers of studies without clinical images. The POCUS Manager could block, or annotate as incomplete, the worksheet for these studies.
- *Empty Studies* are initiated studies where no images or other patient-related information were obtained. The modality can auto-close these after a predefined timeout to avoid clutter in the system.
- *Ghost Studies* occur when images are not saved and no identification of the patient or operator are captured, leaving no trace of the procedure. These are irreparable; institutions should implement policies to ensure every exam is documented and identifiable.
- *Unreported Studies* are missing a finalized report. The POCUS Manager could send an email notification to the HCP, including a link to access the POCUS Manager and finalize the report. Alternatively, the EMR message center or inbox could send a notification to the HCP.
- *Abandoned Studies* were stopped for clinical reasons. The Acquisition Modality should typically send the study as usual to the POCUS Manager for disposition. The POCUS Manager should allow the HCP to decide whether to finalize the report. The report may include a reason for discontinuation.
- *Unprivileged Studies* are performed by a HCP not privileged for the specific procedure. The POCUS Manager should allow these to be finalized by a privileged HCP.
- *Non-Transmitted Studies* occur when network connectivity or other issues prevent the studies from being sent to the POCUS Manager. The modality could resolve these through automated retries and operator notifications. See Section 47.4.1.23.

47.4.1.21 POCUS Training

POCUS training equips POCUS Learners with the skills to perform, interpret, and document ultrasound exams effectively. Training ensures proficiency in image acquisition, interpretation, and reporting.

Hands-on experience is central to POCUS training. POCUS Learners often initially perform studies in simulated settings. As their training progresses, they perform non-clinically indicated training studies within clinical settings, as well as clinical studies performed under supervision in clinical settings. Feedback from supervising physicians ensures adherence to competency standards and fosters skill refinement.

Completion of training typically requires performing a specified number of exams, submitting studies for review, and passing competency assessments. The POCUS Learner's training progress, including study volume, feedback received, and competency milestones, is tracked to ensure adherence to institutional requirements. POCUS Learners are granted privileges to perform POCUS studies independently based on institutional criteria.

Training is ongoing, with HCPs engaging in CME, practice, and periodic re-evaluations to maintain competency. QA programs review training studies to ensure continued adherence to standards, offering feedback for improvement and tracking performance.

Training studies are classified as non-clinical, and thus are not signed by a privileged HCP and typically not sent to the Result Aggregator, but are stored for QA review and privileging assessment purposes.

The POCUS Manager can facilitate training workflows by:

- Differentiating training and clinical studies.
- Enabling supervising physicians to review and provide feedback.
- Tracking POCUS Learner progress and study quality.
- Facilitating QA reviews and closed-loop communication to uphold training standards.
- Providing export of de-identified images and videos for didactic education.

47.4.1.22 POCUS Billing

In some regions, billing may be critical to the integration of encounter-based imaging into clinical practice. Billing practices vary widely and depend on institutional policies, encounter documentation, and regulatory requirements. Key considerations include professional fees, facility charges, and supporting data such as procedure metadata and clinical notes.

A billing workflow may rely on embedded procedure codes (e.g., CPT) in the report or a post-study order. For example, a single billing code, such as for a limited abdominal ultrasound, might be encoded in the HL7 ORU^R01 message, while more complex scenarios may involve multiple billing codes for separate procedures (e.g., transabdominal and transvaginal imaging). These may be specified in the POCUS worksheet and reflected in the report metadata.

Procedural POCUS introduces further complexity, as some procedures bundle ultrasound guidance into a single billing code, while others require separate codes for needle guidance. Institutions may choose to bill procedural POCUS either through predefined workflows or ad hoc documentation in the electronic health record (EHR). Placement checks, such as confirming PIC line placement, are typically not billed.

47.4.1.23 Intermittently Connected Modalities

In encounter-based workflows, the modality may experience intermittent network connectivity. This is common for handheld devices, or in environments with limited network coverage, frequent transitions between networks, or temporary disconnections during use. Despite these challenges, the modality will continue to support clinical operations.

In addition to the considerations in RAD TF-1x: Appendix M, the modality supporting the POCUS Option should consider mechanisms to ensure worksheet access during network disruptions. Standards such as FHIR Questionnaire can facilitate the availability of offline worksheets. See Section 47.4.1.19.

47.4.1.24 Study Append

In some encounter-based imaging scenarios, all series might not be acquired at the same time. This may occur when the operator is interrupted and later resumes the study on the same Modality device. Rather than creating a new study, additional images may be appended to the existing study, resulting in a single logical study composed of multiple series acquired over time. This pattern may be referred to as append case or study merge.

Depending on system behavior, this may be achieved by:

- Re-selecting the same Modality Worklist (MWL) entry,
- Resuming the original study using a stored context on the Modality, or
- Having the POCUS Manager coerce metadata to ensure consistency with the original study.

In all cases, the resulting DICOM instances share the same study level attributes, but introduce new series that must reflect the correct acquisition time, operator, and context.

See RAD TF-2x: Appendix A.6 for attribute consistency requirements.

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
- Wound Care/Management

- Infectious Diseases
- Burn Care
- Plastic Surgery
- Nursing/Clinic Photography

Note: Pre-hospital Point-of-Care Ultrasound (POCUS), such as imaging performed in ambulances or other emergency transport settings, is outside the scope of this profile.

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

An important aspect of all these use cases 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 imaging may also be a Standard of Care component of the larger procedure or treatment plan.

47.4.2.1 Use Case #1: Diagnostic Point of Care Ultrasound

This is the typical ("normal") case that involves a diagnostic study performed and reported by a privileged HCP for a registered patient. This Use Case is predicated on the POCUS Option. See Section 47.2.1.

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 Diagnostic Point of Care Ultrasound Use Case Description

A diagnostic study is performed to evaluate a specific medical condition (e.g., shock), or to evaluate a patient's anatomy or physiology (e.g., left ventricle chamber size and function). This could be an initial evaluation or a reassessment study:

- The patient is registered for an encounter in a healthcare facility (e.g., emergency department, critical care unit, cardiology office, obstetrics and gynecology suite, or operating room).
- The HCP enters their ID in the modality (i.e., with a barcode scanner, RFID, QR code or manual entry).
- The HCP enters the Patient ID in the modality (i.e., with a barcode scanner, RFID, QR code or manual entry).

Note: Depending on the system, the Patient ID could also be a medical record number or billing number. Examples include: CSN (Contact Serial Number), FIN (Financial Identification Number) or ASN (Appointment Serial Number). See the Compliance section for more information.

- The modality displays a MWL entry specific to the patient. The HCP confirms the patient demographic information (name, date of birth, gender, etc.), and selects the patient prior to initiating exam specific image capture.
- The HCP performs a focused POCUS study (e.g., biliary scan for cholelithiasis). Images are transferred to the POCUS Manager.
- The HCP accesses the POCUS Manager (through a client application on a handheld device, client web browser or PC workstation) and searches for the study completed in the previous step.
- The HCP views the images. The POCUS Manager proposes a worksheet based on the clinical context (e.g., Study Description, Body Part Examined, etc.). The HCP confirms the relevancy of the worksheet, and completes it, entering the obtained images (views), purpose (indication), and findings (interpretations).
- The HCP applies their signature to the report. This signature is typically generated using a unique identifier tied to their identity within the POCUS Manager.
- The POCUS Manager verifies the HCP privileges, as well as required report elements (i.e., a valid MRN, CSN/FIN, a valid patient name, obtained images (views), purpose (indication), and findings (interpretations)).
- The POCUS Manager also validates that the study contains at least one image, and that all images contain a valid MRN/CSN/FIN, Patient's Name and Accession Number issued from either the Encounter Manager namespace, or the POCUS Manager namespace.
- Because the HCP has appropriate POCUS privileges, and both the report and images meet validation criteria, the POCUS Manager sends the report (i.e., the signed report) as an unsolicited observation to the Result Aggregator via [RAD-132], and transfers DICOM images to the Image Manager / Image Archive (a.k.a. VNA).
- The POCUS report is associated with the patient encounter in the Result Aggregator.

  Note: Based on local policy, the Result Aggregator may also create an order for billable studies, as well as financial transactions necessary for charging, and is not formally part of the EBIW Profile.

- The POCUS Manager initiates Quality Assurance based on the local sampling plan.

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 context prior to storing the images to the POCUS Manager, so it could acquire the images and then get the context to compose the DICOM instances for storage. The diagram also shows the POCUS Manager grouped with the Encounter Manager, Patient Encounter Consumer, and Image Display, a common grouping in the real-world that is not required by the EBIW Profile.

Note: Creation of an order based on the [RAD-132] result message is not required, but is a common practice to support billing or reconciliation. See Section 47.4.1.3.

47.4.2.1.2 Diagnostic Point of Care Ultrasound Process Flow

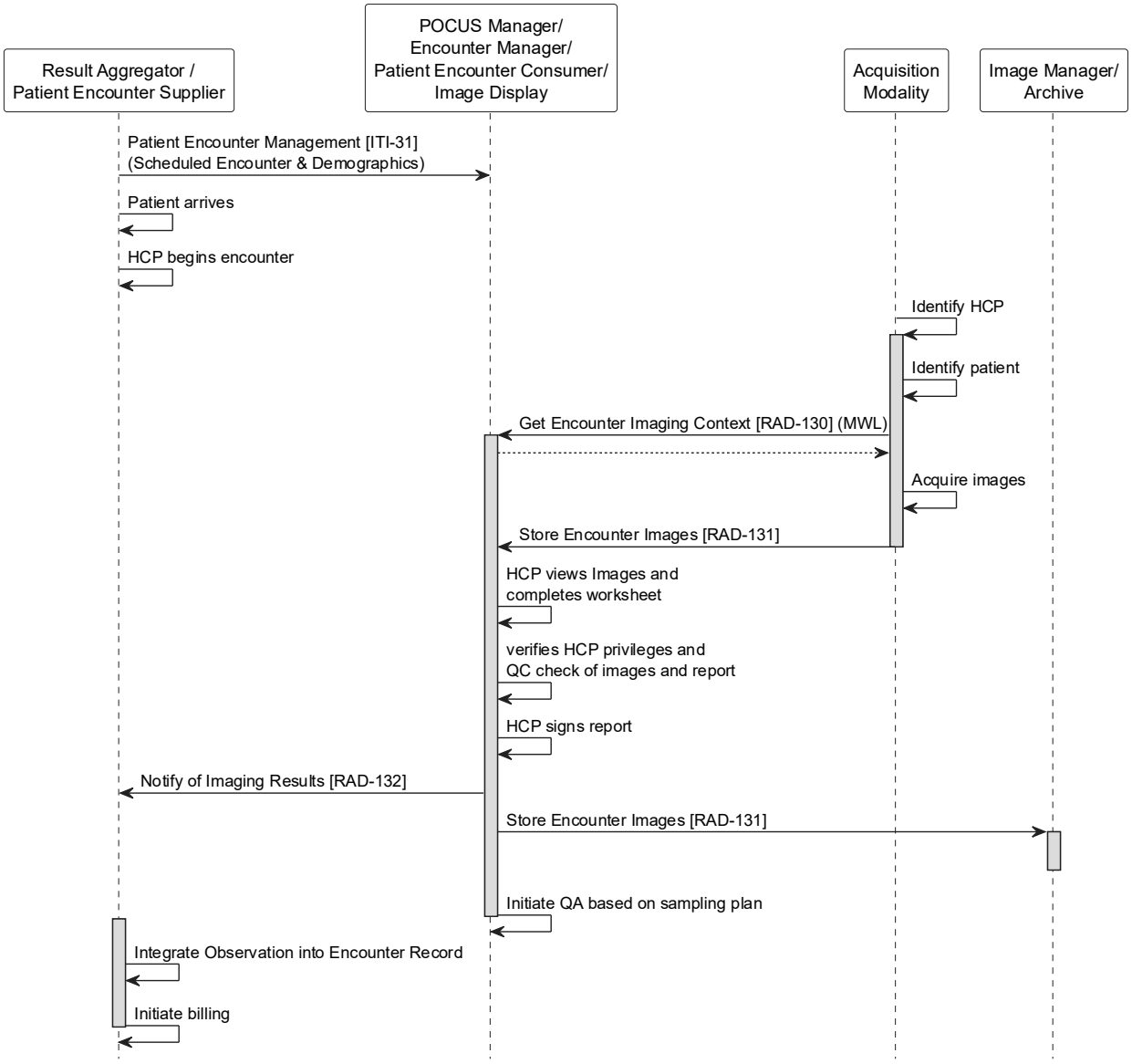


Figure 47.4.2.1.2-1: Point of Care Ultrasound Process Flow in EBIW Profile

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.


```
@startuml
hide footbox
skinparam ParticipantBackgroundColor transparent

participant "POCUS Manager/\nEncounter Manager/\nImage Display" as US
participant "Acquisition\nModality" as Modality

Modality->Modality: Identify POCUS Learner(s)
activate Modality #D3D3D3
Modality->Modality: Identify subject
Modality->US: Get Encounter Imaging Context [RAD-130] (MWL)
activate US #D3D3D3
US-->Modality
Modality->Modality: Identify study as training
Modality->Modality: Acquire images
Modality->US: Store Encounter Images [RAD-131]
deactivate Modality
```

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

47.4.2.2 Use Case #2 Training-only Point of Care Ultrasound

As in all training scenarios, the primary objective is to impart ultrasound technique, diagnostic skills, and the importance of proper documentation. This includes not only documenting findings in the report but also emphasizes the significance of accurate demographic data entry into the ultrasound system.

47.4.2.2.1 Training-only Point of Care Ultrasound Use Case Description

In this case, a POCUS Learner conducts an ultrasound study with no clinical intent:

- This subject can be a non-patient volunteer model, an anatomical phantom, or a procedural phantom, such as a gel phantom or a trans-esophageal simulator.
- The volunteer (e.g., simulated patient) is not a registered patient.
- The POCUS Learner(s) enters their ID in the modality (i.e., with a barcode scanner, RFID, QR code or manual entry).

  Note: Multiple operators may be entered in the modality in case of multiple POCUS Learners
- The POCUS Learner enters the Patient ID in the modality (i.e., with a barcode scanner, RFID, QR code or manual entry). This could be:
  - an ID band with a fictitious ID,
  - manual entry of a fictitious Patient ID based on local policy,
  - manual entry of a pseudonym based on local policy, or
  - a fictitious Patient ID generated by the modality.
- The POCUS learner also enters the training supervisor (i.e., attending physician, staff physician, or attending). This could be:

- a training supervisor, or
- a fictitious supervising physician

Note: Some programs may not require entry of a supervising physician during lab-based training, and the systems may be configured to skip this step.

- The modality displays a MWL entry specific to the patient. Depending on departmental policy:
  - there may be a standing admission for training studies,
  - the MWL server may be required to generate, or access fictitious patients in the Result Aggregator,
  - the modality may hold a local cache of MWL responses (see Section 47.4.1.23), or
  - a fictitious patient may be entered manually based on local naming conventions.

Note: The school of medicine or training lab may be organizationally separated from the clinical environment, and the POCUS device may be required to switch between multiple Modality Worklists, i.e., a production (clinical) and non-production (non-clinical) MWL.

- The POCUS Learner indicates on the Modality that the study is a training study.
- The POCUS Learner performs a POCUS study. Images are sent to the POCUS Manager.
- The POCUS Manager sequesters training studies to keep them out of the patient care pathway. In this example, it supports both training and clinical studies, distinguishing between them as needed. Alternatively, a dedicated POCUS Manager could be used exclusively for training studies, with a separate instance handling clinical workflows.
- The POCUS Learner accesses the POCUS Manager system and searches for the study completed in the previous step.
- The POCUS Learner views the images. The POCUS Manager proposes a worksheet based on the clinical context (e.g., Study Description, Body Part Examined, etc.). The POCUS Learner confirms the relevancy of the worksheet, and completes it. During the image review, the POCUS Learner designates the training supervisor if it was not encoded in the modality instances.
- The POCUS Manager segregates the training reports and images from clinical data. The reports and images are not added to any patient record and are not sent to the Result Aggregator and the Image Manager / Image Archive.
- The POCUS Manager identifies the study as ready for privileging assessment.
- The training supervisor asynchronously reviews training studies for technical adequacy, completeness, clinical accuracy, and documentation, providing feedback to the POCUS Learner within the POCUS Manager.

The Process Flow described below demonstrates the workflow for handling training-only POCUS, where emphasis is on ultrasound technique, documentation accuracy, and real-world

workflow simulation. As a physically or virtually segregated training environment, it excludes the Result Aggregator and Image Manager / Image Archive.

The subject may be a non-patient volunteer, an anatomical phantom, or a simulator. Local requirements dictate the use of fictitious or pseudonymous patient identifiers, allowing learners to practice entering demographics. The modality records multiple learners and allows the operator to identify the study as training.

Captured images are sent to the POCUS Manager, simulating real-world image transfer. The POCUS Manager segregates images and worksheets from patient care records and facilitates QA by providing training data for review by a training supervisor, ensuring training objectives are met and feedback is provided.

47.4.2.2.2 Training-only Point of Care Ultrasound Process Flow

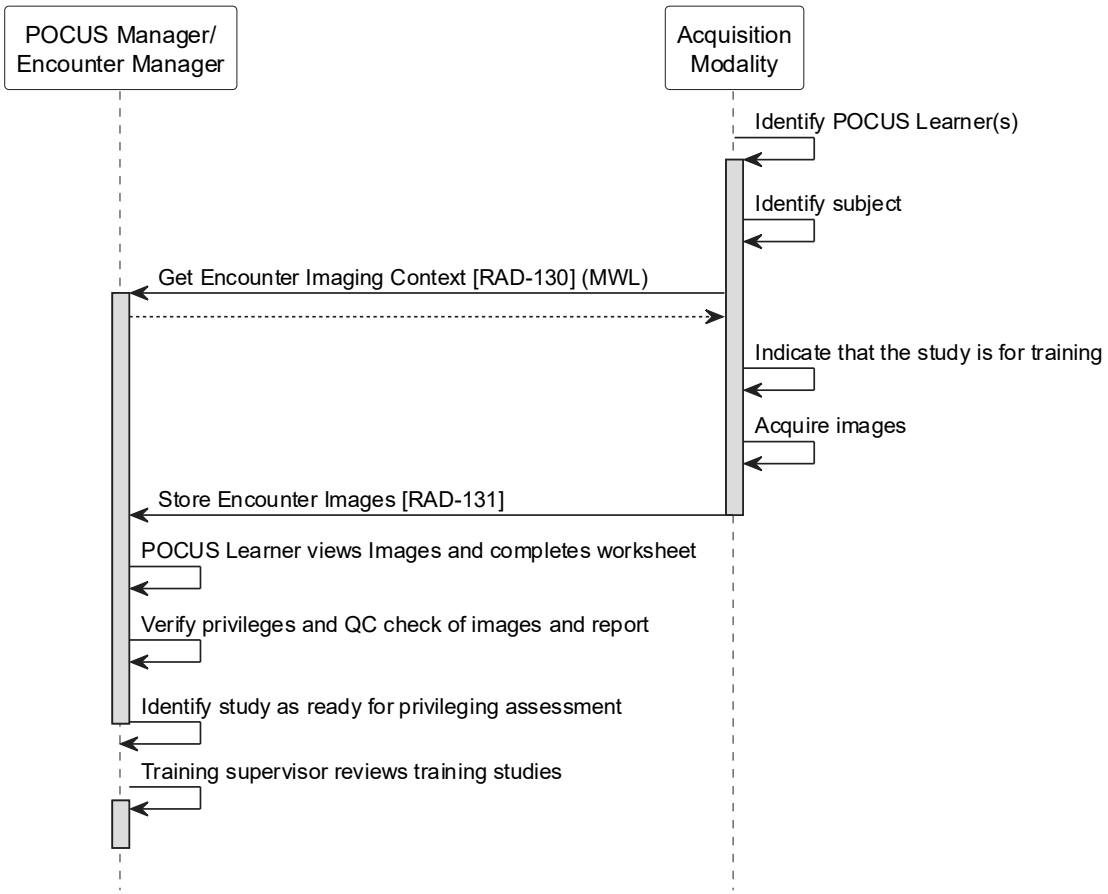


Figure 47.4.2.2.2-1: Training-only POCUS Process Flow in EBIW Profile

The text in Figure 47.4.2.2.2-2 was used to generate the diagram in Figure 47.4.2.2.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.


```
@startuml
hide footbox
skinparam ParticipantBackgroundColor transparent

participant "POCUS Manager/\nEncounter Manager" as US
participant "Acquisition\nModality" as Modality

Modality->Modality: Identify POCUS Learner(s)
activate Modality #D3D3D3
Modality->Modality: Identify subject
Modality->US: Get Encounter Imaging Context [RAD-130] (MWL)
activate US #D3D3D3
US-->Modality
Modality->Modality: Indicate that the study is for training
Modality->Modality: Acquire images
Modality->US: Store Encounter Images [RAD-131]
deactivate Modality
```

Figure 47.4.2.2.2-2: Diagram Pseudocode for Training-only POCUS Process Flow

47.4.3.2 Use Case #3: Non-privileged Operator Clinical and Training POCUS

Training and education are integral in many POCUS workflows. Within each patient evaluation stud(y/ies) may be clinically indicated and/or performed for training.

47.4.2.3.1 Non-privileged Operator Clinical and Training POCUS Use Case Description

In this case, a POCUS Learner (non-privileged operator) performs multiple studies upon a registered patient within a clinical environment.

As in Case #1, the patient is registered for an encounter.

A pregnant patient presents with the need for a fetal heart rate assessment. A pelvic ultrasound is clinically indicated, yet the POCUS Learner also obtains permission to image her heart, lungs, and kidneys for privileging purposes (training):

- The POCUS Learner(s) enters their ID in the modality (i.e., with a barcode scanner, RFID, QR code or manual entry).

  Note: Multiple operators may be entered in the modality in case of multiple POCUS Learners.

- The POCUS Learner enters the Patient ID in the modality (i.e., with a barcode scanner, RFID, QR code or manual entry).

  Note: Depending on the system, the Patient ID could also be a medical record number or billing number known. Examples include: CSN (Contact Serial Number), FIN (Financial Identification Number) or ASN (Appointment Serial Number). See the Compliance section for more information.

- The modality displays a MWL entry specific to the patient. The POCUS Learner confirms the patient demographic information (name, date of birth, gender, etc.). and selects the patient prior to initiating exam specific image capture.
- The POCUS Learner indicates on the Modality that the study is a training study.

- The POCUS Learner acquires multiple imaging studies (in this case, Obstetrical Pelvic, Renal, Cardiac, and Thoracic views) concurrently, all with the same Accession Number, Study Description and Study Instance UID. Images are transferred to the POCUS Manager.
- The POCUS Learner accesses the POCUS Manager system (through a client application on a handheld device, client web browser or PC workstation) and searches for the study completed in the previous step.
- The POCUS Learner views the images. The POCUS Manager proposes worksheets based on the clinical context (e.g., Study Description, Body Part Examined, etc.). The POCUS Learner confirms the relevancy of the worksheets, and completes them, entering the obtained images (views), purpose (indication), and findings (interpretations). During the image review, the POCUS Learner designates the supervising physician if it was not encoded in the modality instances.
- The POCUS Learner performs a hard split, resulting in the creation of three separate studies: Obstetrical Pelvic, Renal, and Thoracic. The POCUS Learner applies the training identifier to the Renal and Thoracic reports, but not the Obstetrical Pelvic study.

  Note: Although the Obstetrical Pelvic study is not marked as training, the POCUS Learner will receive training credit for all 3 studies because they are identified as the operator.
- The new studies are associated with their respective reports, with unique Accession Numbers, Study Descriptions, and Study Instance UIDs.

  Notes:

  1. This may result in images being duplicated in multiple studies.
  2. The order of report selection and hard split is determined by the implementer.
- The POCUS Manager sequesters training studies to keep them out of the patient care pathway. In this example, it supports both training and clinical studies, distinguishing between them as needed. Alternatively, a dedicated POCUS Manager could be used exclusively for training studies, with a separate instance handling clinical workflows.
- The POCUS Learner applies their signature to the clinical report. This signature is typically generated using a unique identifier tied to their identity within the POCUS Manager.
- The POCUS Manager verifies the POCUS Learner credentials, as well as required report elements (i.e., a valid MRN, CSN/FIN, a valid Patient's Name, obtained images (views), purpose (indication), and findings (interpretations)) and checks for the presence of a supervising physician.
- The POCUS Manager also validates that the study contains at least one image, and that all images contain a valid MRN/CSN/FIN, Patient's Name and Accession Number issued from either the Encounter Manager namespace, or the POCUS Manager namespace.

- Since the POCUS Learner is not privileged for the clinical Obstetrical Pelvic study, the report from the POCUS Learner is considered draft, and the POCUS Manager identifies it as ready for overread by the supervising physician. See Section 47.4.1.8.

  Note: Some local policies may require the POCUS Manager to send preliminary reports to the Result Aggregator and images to the VNA (e.g., in cases where the report has not been signed by a Privileged Operator). It is expected that the POCUS Manager will later send an addended report signed by a supervising physician.

- The supervising physician accesses the POCUS Manager and evaluates the images and the draft report. If necessary, they edit the report, and sign it.

  Note: In case of a preliminary report, the Preliminary Report is reviewed and signed by a Privileged HCP prior to finalization.

- Because the supervising physician is privileged for the Obstetrical Pelvic study, and its report and images meet validation criteria, the POCUS Manager sends the report (i.e., the signed report) as an unsolicited observation to the Result Aggregator, and transfers DICOM images to the Image Manager / Image Archive (a.k.a. VNA).

- The POCUS report is associated with the patient encounter in the Result Aggregator.

  Note: Based on local policy, the Result Aggregator may also create an order for billable studies, as well as financial transactions necessary for charging, and is not formally part of the EBIW Profile.

- The POCUS Manager initiates Quality Assurance for the Obstetrical Pelvic study based on the local sampling plan.

- The POCUS Manager segregates the Renal and Thoracic training reports and images from clinical data. The reports and images are not added to any patient record and are not sent to the Result Aggregator and the Image Manager / Image Archive.

  Note: Local policy may optionally dictate VNA archive of non-clinical POCUS studies [RAD-131]; however, there is no Notification of Results for these images [RAD-132].

- The POCUS Manager identifies the Renal and Thoracic training studies as ready for privileging assessment.

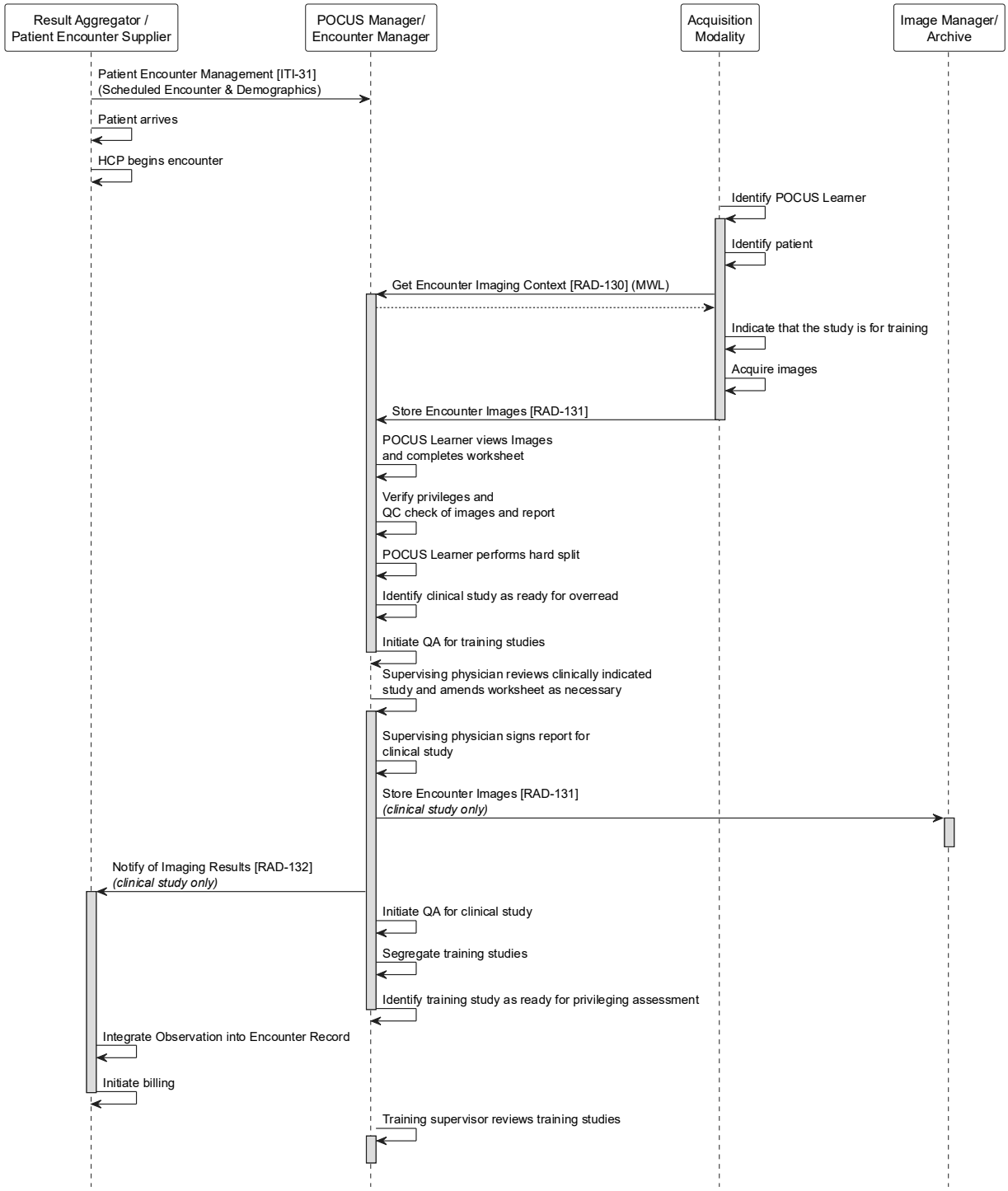
- The training supervisor asynchronously reviews the Obstetrical Pelvic, Renal, and Thoracic training studies, identified based on the operator, for technical adequacy, completeness, clinical accuracy, and documentation, providing feedback to the POCUS Learner within the POCUS Manager.

The Process Flow described below demonstrates the workflow for handling non-privileged operator clinical and training POCUS studies, with emphasis on the support for multiple operators using the Operator Identification Sequence. When multiple operators, such as POCUS learners, are involved in performing the studies, the modality must ensure that all relevant operators are recorded in the Operator Identification Sequence.

Any metadata corrections or modifications are performed afterward by the POCUS Manager ensuring attribute consistency in the new studies created by the hard split, as well as maintaining consistency from any updates or corrections in the worksheet. The POCUS Manager confirms

privileging status of the HCP before allowing the report to be finalized and sent to the Result Aggregator.

47.4.2.3.2 Non-privileged Operator Clinical and Training Process Flow



1545 **Figure 47.4.2.3.2-1: Non-privileged Operator Clinical and Training Process Flow in EBIW Profile**

The text in Figure 47.4.2.3.2-2 was used to generate the diagram in Figure 47.4.2.3.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

```
@startuml
hide footbox
skinparam ParticipantBackgroundColor transparent

participant "Result Aggregator /\nPatient Encounter Supplier" as RA
participant "POCUS Manager/\nEncounter Manager" as US
participant "Acquisition\nModality" as Modality
participant "Image Manager/\nArchive" as VNA

RA->US: Patient Encounter Management [ITI-31]\n(Scheduled Encounter & Demographics)
RA->RA: Patient arrives
RA->RA: HCP begins encounter
Modality->Modality: Identify POCUS Learner
activate Modality #D3D3D3
Modality->Modality: Identify patient
Modality->US: Get Encounter Imaging Context [RAD-130] (MWL)
activate US #D3D3D3
US-->Modality
Modality->Modality: Indicate that the study is for training
Modality->Modality: Acquire images
Modality->US: Store Encounter Images [RAD-131]
deactivate Modality

US->US: POCUS Learner views Images\nand completes worksheet
US->US: Verify privileges and\nQC check of images and report
US->US: POCUS Learner performs hard split
US->US: Identify clinical study as ready for overread
US->US: Initiate QA for training studies
deactivate US
US->US: Supervising physician reviews clinically indicated\nstudy and amends worksheet as necessary
activate US #D3D3D3
US->US: Supervising physician signs report for\nclinical study
US->VNA: Store Encounter Images [RAD-131]\n//(clinical study only)//
activate VNA #D3D3D3
deactivate VNA
US->RA: Notify of Imaging Results [RAD-132]\n//(clinical study only)//
activate RA #D3D3D3
US->US: Initiate QA for clinical study
US->US: Segregate training studies
US->US: Identify training study as ready for privileging assessment

deactivate US
RA -> RA: Integrate Observation into Encounter Record
RA -> RA: Initiate billing
deactivate RA
US->US: Training supervisor reviews training studies
activate US #D3D3D3
deactivate US
@enduml
```

Figure 47.4.2.3.2-2: Diagram Pseudocode for Non-privileged Operator Clinical and Training Process Flow

47.4.2.4 Use Case #4 Procedural Adjunct Point of Care Ultrasound

Procedural Adjunct refers to POCUS utilized for guidance during invasive procedures such as thoracentesis, nerve blocks, and vascular access. It offers both static periprocedural imaging and dynamic guidance methods, aiding in the verification of placements or interventions through real-time manipulation of ultrasound probes and invasive devices.

In procedural workflows, a POCUS report describing image guidance and a procedure note detailing the intervention (i.e., a clinical report of the procedure performed) are typically recorded as separate documents, depending on local procedure codes and billing requirements. See ACEP procedure guidelines (available from https://www.acep.org/siteassets/uploads/uploaded-files/acep/membership/sections-of-membership/ultra/acep-us-cpt-update-2024.pdf).

Depending on institutional policy three documentation patterns may occur:

1. A standalone POCUS report generated by the POCUS Manager documents the imaging guidance, while a separate procedural note is generated by another system.
2. A single procedure note incorporates both the imaging guidance and the procedural documentation; a separate POCUS report is not generated.
3. A POCUS report incorporates both the imaging guidance and the procedural documentation; a separate procedure note is not generated. See Use Case #1: Diagnostic Point of Care Ultrasound in Section 47.4.2.1.

This profile does not define the structure or content of procedural notes.

In some instances, a diagnostic POCUS study may immediately lead to an intervention, this profile treats diagnostic and procedural documentation separately.

47.4.2.4.1 Procedural Adjunct Point of Care Ultrasound Use Case Description

In this case, a HCP (i.e., anesthesiologist) uses POCUS guidance for a nerve block for real-time visualization of needle placement, precise local anesthetic administration, and assessment of anesthetic spread.

As in Case #1, the patient is registered for an encounter. The HCP enters their ID into the modality, enters the Patient ID, and selects the patient from the MWL. The HCP utilizes POCUS for guidance, and transfers an image demonstrating needle tip placement to the POCUS Manager.

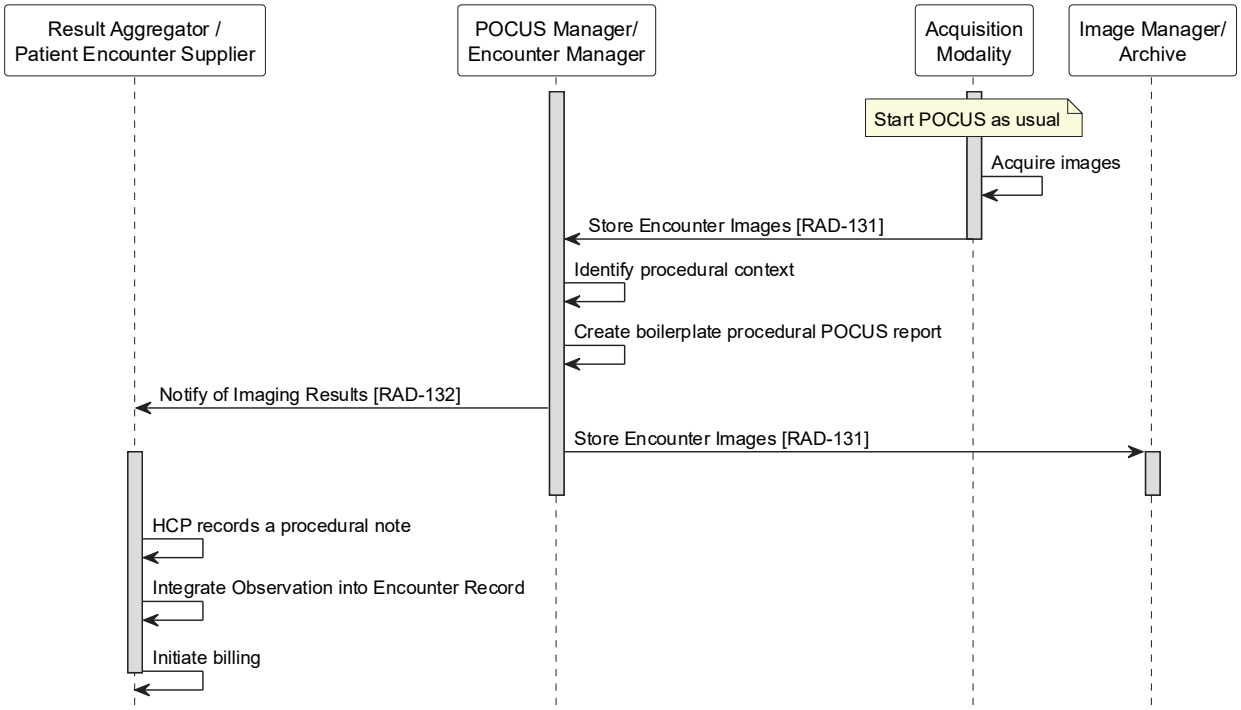
- The POCUS Manager identifies the procedural context based on the clinical context (e.g., Study Description, Body Part Examined, AE title etc.) that triggers an automated process that selects a worksheet containing a boilerplate procedural POCUS report explaining the ultrasound guidance was used, referring to the Result Aggregator for the procedural note.

- The HCP confirms the relevancy of the worksheet and applies their signature to the report. This signature is typically generated using a unique identifier tied to their identity within the POCUS Manager.
- As in Case #1, the POCUS Manager also validates that the study contains at least one image, and that all images contain a valid MRN/CSN/FIN, Patient's Name and Accession Number issued from either the Encounter Manager namespace, or the POCUS Manager namespace.
- Because the HCP has appropriate POCUS privileges, and both the report and images meet validation criteria, the POCUS Manager sends the report as an unsolicited observation to the Result Aggregator, and transfers DICOM images to the Image Manager / Image Archive (a.k.a. VNA).
- The HCP records a procedural note in the Result Aggregator describing the indication, procedure, imaging and assessment of the nerve block.
- The POCUS report is associated with the patient encounter in the Result Aggregator.
- The POCUS Manager initiates Quality Assurance based on the local sampling plan.

The Process Flow below highlights the consistency between the Diagnostic Point of Care Ultrasound Use Case and the Procedural Adjunct Point of Care Ultrasound Use Case. In this scenario, a procedural POCUS report originating from the POCUS Manager documents the imaging guidance, while a separate procedural note created by the HCP in the Result Aggregator describes the intervention.

Alternatively, a single procedural note authored by the HCP could have been created in the Result Aggregator incorporating both the imaging guidance and the procedural documentation.

47.4.2.4.2 Procedural Adjunct POCUS Process Flow



1610 **Figure 47.4.2.4.2-1: Procedural Adjunct POCUS Process Flow in EBIW Profile**

The text in Figure 47.4.2.4.2-2 was used to generate the diagram in Figure 47.4.2.4.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.

```
@startuml
hide footbox
skinparam ParticipantBackgroundColor transparent

participant "Result Aggregator /\nPatient Encounter Supplier" as RA
participant "POCUS Manager/\nEncounter Manager" as US
participant "Acquisition\nModality" as Modality
participant "Image Manager/\nArchive" as VNA
note over Modality: Start POCUS as usual
activate Modality #D3D3D3
activate US #D3D3D3

Modality->Modality: Acquire images
Modality->US: Store Encounter Images [RAD-131]
deactivate Modality

US->US: Identify procedural context
```

1615 **Figure 47.4.2.4.2-2: Diagram Pseudocode for Procedural Adjunct POCUS Process Flow**

47.4.2.5 Use Case #5: Lightweight Modality

Images are captured at the point-of-care using a "lightweight" device such as a smartphone, tablet or digital camera that is capable of being programmed to use RESTful HTTP messages. The workflow is typically "order-less" in that it is not driven by an order from a referring physician.

47.4.2.5.1 Lightweight Modality Use Case Description

The Lightweight Modality Use Case is intended to generalize the following scenarios:

- Patient Status Check
  - A registered inpatient is in their bed in a ward, or an outpatient has come to visit a clinic.
  - In the course of checking the status of a condition (e.g., changing the dressing on a wound or burn) the care provider captures images of the current state.
  - Although the image is typically evidentiary or for simple assessment rather than "diagnostic", it might still be referred to a specialist if potential anomalies are observed. There are also examples of clinical applications that could analyze the current (and prior) images to identify potential issues (such as necrotized tissue or infection) or estimate the rate of healing.
- Consultation
  - A care provider captures images of the patient to supplement a consultation request to a colleague.
- Procedure Evidence
  - A patient (either inpatient or outpatient) is having a procedure such as an excision.
  - The care provider captures images of the procedure site before and/or after the procedure.
  - The imaging may be kept in the medical record as evidence of the nature of the tissue on which the procedure was performed, the outcome of the procedure, and perhaps the state of the patient before and after the procedure.
- Outpatient Supplemental Information
  - A patient makes scheduled visit to a specialist and is registered as an outpatient.
  - The specialist is consulting on an identified condition, such as a dermatologist evaluating a skin lesion detected by the patient's primary care physician.
  - The specialist decides to take additional photographs to evaluate/characterize the condition or to document the absence of the suspected condition.
  - The findings from the imaging would be included in the specialist's report.

The Process Flow below shows the Lightweight Modality getting the encounter imaging context prior to the acquisition of images. In principle, the Lightweight Modality just needs to get the context prior to storing the images to the Image Manager / Image Archive, 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.

Since mobile devices might choose to use DICOMweb, the flow diagram shows the use of [RAD-108] for storage and [RAD-130] would correspondingly use UPS-RS Semantics.

47.4.2.5.2 Lightweight Modality Process Flow

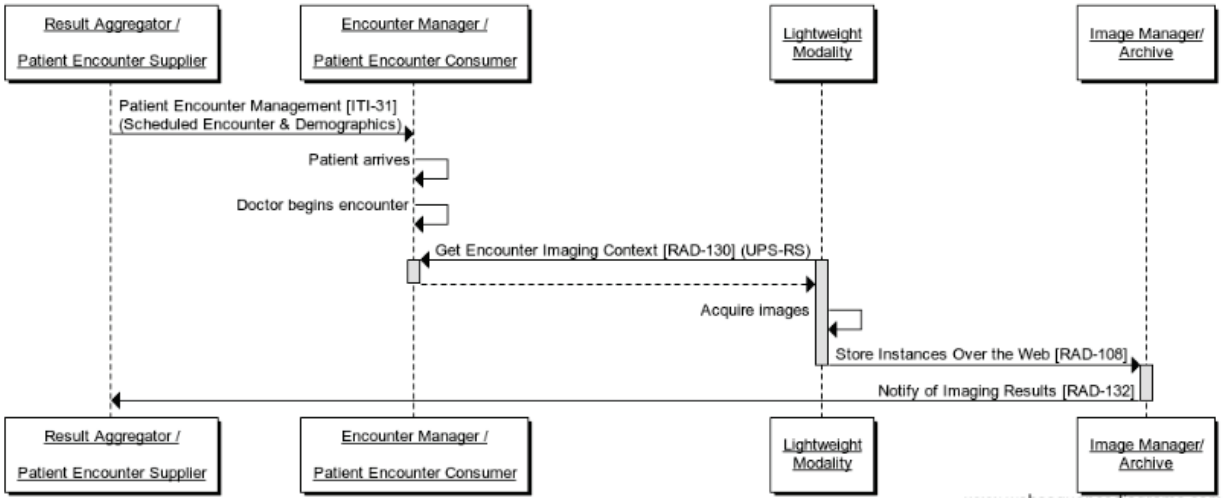


Figure 47.4.2.5.2-1: Lightweight Modality Process Flow in EBIW Profile

The text in Figure 47.4.2.5.2-2 was used to generate the diagram in Figure 47.4.2.5.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.


```
title Lightweight Modality

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

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] (UPS-RS)
activate Modality
EM-->-Modality:
Modality->Modality: Acquire images
Modality->-Image Manager: Store Instances Over the Web [RAD-108]
activate Image Manager
Image Manager->-RA: Notify of Imaging Results [RAD-132]
```

Figure 47.4.2.5.2-2: Diagram Pseudocode for Lightweight Modality Process Flow

47.4.2.6 Use Case #6: Separate Capture

Images are captured at the point-of-care using a device, such as a digital camera, that is not programmed to use RESTful HTTP messages. The images from this separate capture device are communicated to another system that plays the role of the Lightweight Modality. This is analogous to the way the gantry of a CT scanner, which does the actual image data acquisition, communicates with the console using vendor proprietary mechanisms, while the console plays the role of the Acquisition Modality in profiles such as Scheduled Workflow, using the prescribed standard interfaces.

The EBIW Profile does not dictate how a modality communicates with the image capture component. A digital camera might be directly tethered to the modality system, or might be connected wirelessly, or it might depend on the operator manually removing a memory card from the camera and inserting it in a reader on the modality.

Handling images acquired at home by a patient might possibly be addressed as a variant of this use case. The unmodified patient device (a camera or smartphone) would play the role of Capture Device, then during an encounter (either physical or virtual), the images would be accessed by hospital software playing the role of the Lightweight Modality. The Modality, as usual, would do a context query, apply the metadata to the accessed images, and store the resulting DICOM objects to the Image Manager. How the operator selects the appropriate images and correlates them to the correct metadata is beyond the scope of the profile.

Many variants could be imagined, including patient monitoring, motion-triggered image capture, hourly image updates, etc.

47.4.2.6.1 Separate Capture Use Case Description

The Separate Capture Use Case is intended to handle the same scenarios described in the Lightweight Modality Use Case (see Section 47.4.5.2).

In the following diagram, the operator acquires the images first, then confirms and cues up the metadata second whereupon they are combined and stored. In principle, the operator could get the encounter metadata before using the capture device to acquire the images.

Separating the capture device from the Lightweight Modality introduces design questions, a few of which are mentioned here, that are left to the implementation to resolve.

Separate capture devices typically have internal clocks and will need some process to keep their date/time accurately synchronized with the Lightweight Modality system.

If the operator interacts with the capture device and the Lightweight Modality separately, care will need to be taken to keep the acquired images associated with the correct patient/procedure/bodypart metadata. Such issues can be exacerbated when using Deferred Completion (see Section 47.4.1.16)

The flow diagram shows the use of [RAD-108] for storage and UPS-RS Semantics in [RAD-130].

47.4.2.6.2 Separate Capture Process Flow

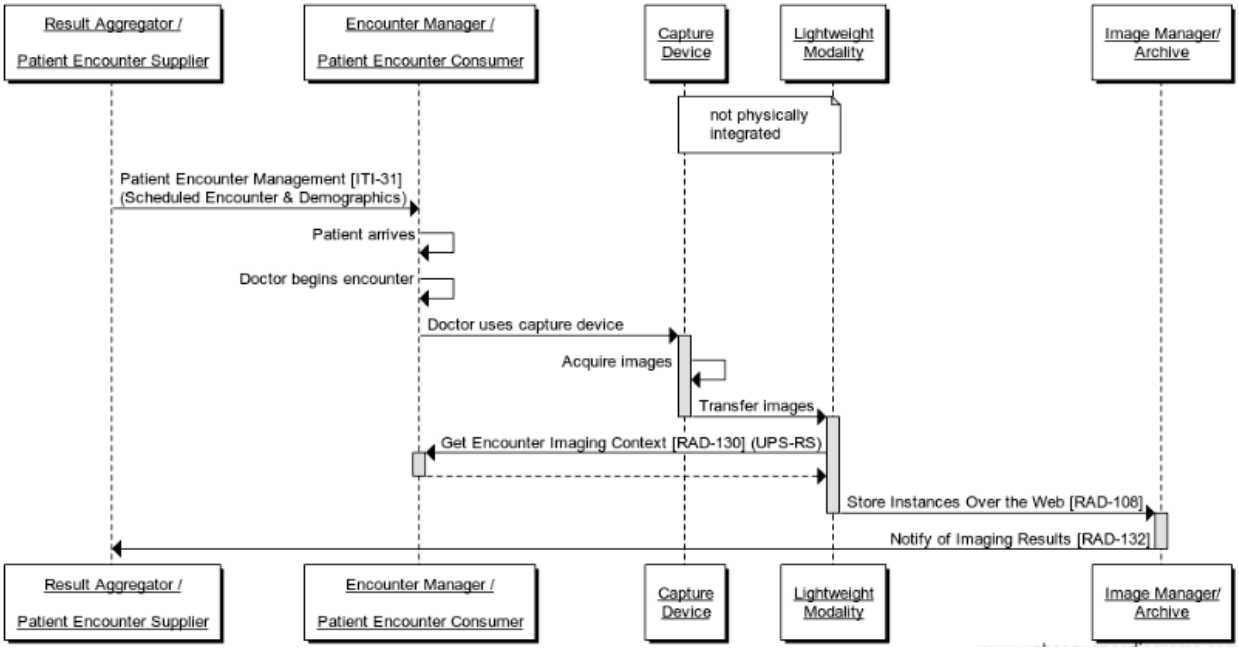


Figure 47.4.2.6.2-1: Separate Capture Process Flow in EBIW Profile

The text in Figure 47.4.2.6.2-2 was used to generate the diagram in Figure 47.4.2.6.2-1. Readers will generally find the diagram more informative. The text is included here to facilitate editing.


```
title Separate Capture

participant Result Aggregator /\n\nPatient Encounter Supplier as RA
participant Encounter Manager /\n\nPatient Encounter Consumer as EM
participant Lightweight\nModality as Modality
participant Capture\nDevice as Capture
participant Image Manager/\nArchive as Image Manager

note over Modality, Capture: not physically\n integrated
RA->EM: Patient Encounter Management [ITI-31]\n(Scheduled Encounter & Demographics)
EM->EM: Patient arrives
EM->EM: Doctor begins encounter
EM->+Capture: Doctor uses capture device
Capture->Capture: Acquire images
Capture->-Modality: Transfer images
activate Modality
Modality->+EM: Get Encounter Imaging Context [RAD-130] (UPS-RS)
EM-->-Modality:
Modality->-Image Manager: Store Instances Over the Web [RAD-108]
activate Image Manager
Image Manager->-RA: Notify of Imaging Results [RAD-132]
```

Figure 47.4.2.6.2-2: Diagram Pseudocode for Separate Capture Process Flow

47.5 EBIW Security Considerations

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

Personal Healthcare Information (PHI) is present in the context query response, the stored 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 in the ITI Audit Trail and Node Authentication (ATNA) Profile.

This profile strongly recommends implementation of the Record Audit Event [ITI-20] transaction to record when and where encounter-based imaging is distributed. Mobile devices may prefer to support batch upload of audit events in addition to the syslog submission, e.g., for battery optimization.

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 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 modality being exposed to people who are not authorized to use it or access the information it contains. The Acquisition Modality and Lightweight 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 risk of a device being lost or stolen is higher for small mobile devices, so implementers should consider encrypting data-at-rest on the device, implementing data retention policies, promptly deleting data after upload, etc.

The Image Manager / Image 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 Section 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 Section 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 Section 47.4.1.5 for discussion of usage. See ITI TF-1: 14 for profile details.
	SVS Value Set Repository	To centrally manage code lists of procedures, anatomy, etc. used by Lightweight Modalities or Acquisition Modalities.
	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 or Lightweight 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.
	SVS Value Set Consumer	To retrieve centrally managed code lists of procedures, anatomy, etc. (e.g., to populate picklists used by operators).

EBIW Actor	Might group with	Potential Purpose
	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 / Image 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.
	SWF.b Order Placer	To create an order for billable studies.
POCUS Manager	IID Image Display Invoker	To launch a viewer for clinicians to review encounter-based images it has indexed.
	PAM Patient Demographics Consumer	To receive a feed of patient demographics in order to update demographics for unidentified patients registered under a pseudonym.
	TCE Export Selector	To tag images for teaching files, quality issues and research.
Image Display	IID Image Display	To launch a viewer for clinicians to review encounter-based images it has indexed.
	BIR Image Display	To present to clinicians for review encounter-based images it has indexed.

Volume 2 – Transactions

Update Section 4.14.2 as indicated below.

Note: This change assumes updates in CP-RAD-554 Refactor RAD-14 for Reuse

4.14 Query Images [RAD-14]

…

4.14.2 Actor Roles

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

Table 4.14.2-1: Actor Roles

Role:	**Requester:** Queries for study metadata.
Actor(s):	The following actors may play the role of Requester: Image Display
Role:	**Responder:** Returns metadata for matching query results.
Actor(s):	The following actors may play the role of Responder: Image Manager / Image Archive **POCUS Manager**

Update Section 4.16.2 as indicated below.

Note: This change assumes updates in CP-RAD-545 Refactor RAD-16 for Reuse

4.16 Retrieve Images [RAD-16]

…

4.16.2 Actor Roles

Table 4.16.2-1: Actor Roles

Role:	**Requester:** Submit retrieve requests for DICOM images
Actor(s):	The following actors may play the role of Requester: Imaging Display Imaging Document Consumer Evidence Creator
Role:	**Responder:** Return the requested DICOM images
Actor(s):	The following actors may play the role of Responder: Image Manager / Image Archive Imaging Document Source **POCUS Manager**

Add new Sections 4.130, 4.131 and 4.132

4.130 Get Encounter Imaging Context [RAD-130]

4.130.1 Scope

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.

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 Lightweight 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

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 Annex K: Modality Worklist SOP Class

DICOM PS3.18 Section 11.9: Worklist Service – Search Transaction

DICOM PS3.4 Annex CC: Unified Procedure Step Service and SOP Classes

DICOM PS3.3 B.26: Unified Procedure Step Information Object

DICOM PS3.17 Annex GGG: Unified Worklist and Procedure Step - UPS (Informative)

4.130.4 Messages

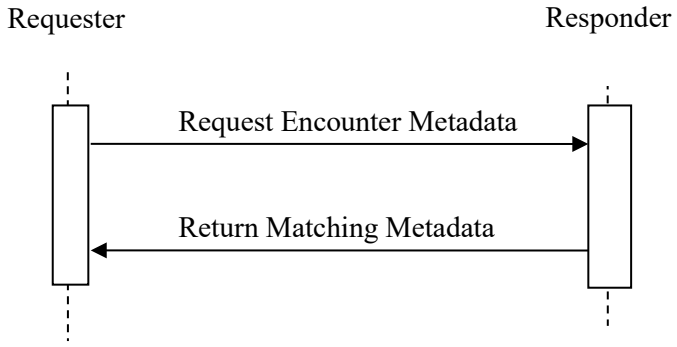


Figure 4.130.4-1: Interaction Diagram

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.

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.

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 support such variations in automatic queries.

4.130.4.1.2 Message Semantics

Message semantics are defined for both the DICOM Modality Worklist Service (MWL Semantics) and the DICOM UPS-RS Worklist Service (UPS-RS Semantics). Whether an actor is required to support one, the other, or both sets of semantics is defined by the Profile and/or Option that incorporates this transaction.

4.130.4.1.2.1 Message Semantics (MWL)

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 4.130.4.1.2.1-1.

Table 4.130.4.1.2.1-1 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+* highlight the requirements added by the IHE Technical Framework. See RAD TF-2: 2.2 for more information. In contrast to Query Modality Worklist [RAD-5], this transaction does not place display requirements for specific attributes on the Requester. Effective selection of the correct metadata and communication with the operator is left to the design of the device implementing the Requester.

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).

Table 4.130.4.1.2.1-1: 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)				
>Patient ID	(0010,0020)	O	O	O	R+
>Issuer of Patient ID	(0010,0021)	O	O	O	R+
>Issuer of Patient ID Qualifiers Sequence	(0010,0024)	O	O	O	R+
>>Universal Entity ID	(0040,0032)	O	O	O	R+
>>Universal Entity ID Type	(0040,0033)	O	O	O	R+
>Type of Patient ID	(0010,0022)	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	O
Encounter Metadata					
Visit Identification					
Institution Name	(0008,0080)	O	R+	R+*	R+
Institution Code Sequence	(0008,0082)				
>Code Value	(0008,0100)	O	O	R+*	R+
>Coding Scheme Version	(0008,0103)	O	O	O	O
>Coding Scheme Designator	(0008,0102)	O	O	R+*	R+
>Code Meaning	(0008,0104)	O	O	R+*	R+
Institution Address	(0008,0081)	O	O	R+*	R+
Institutional Department Name	(0008,1040)	R+*	R+	R+*	R+
Institutional Department Type Code Sequence	(0008,1041)				
>Code Value	(0008,0100)	R+*	R+	R+*	R+
>Coding Scheme Version	(0008,0103)	O	O	O	O
>Coding Scheme Designator	(0008,0102)	R+*	R+	R+*	R+
>Code Meaning	(0008,0104)	O	O	R+*	R+
Admission ID	(0038,0010)	R+*	R+	R+*	R+
Issuer of Admission ID Sequence	(0038,0014)				
>Local Namespace Entity ID	(0040,0031)	O	O	O	R+
>Universal Entity ID	(0040,0032)	O	O	O	R+

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>Universal Entity ID Type	(0040,0033)	O	O	O	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 for Visit	(0032,1066)	O	O	O	R+
Reason for Visit Code Sequence	(0032,1067)				
>Code Value	(0008,0100)	O	O	O	R+
>Coding Scheme Version	(0008,0103)	O	O	O	O
>Coding Scheme Designator	(0008,0102)	O	O	O	R+
>Code Meaning	(0008,0104)	O	O	O	R+
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)				
>Local Namespace Entity ID	(0040,0031)	O	O	R+*	R+
>Universal Entity ID	(0040,0032)	O	O	R+*	R+
>Universal Entity ID Type	(0040,0033)	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]

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
>Scheduled Station AE Title	(0040,0001)	R+*	R	R+* [IHE-6]	R
>Scheduled Procedure Step Start Date	(0040,0002)	O	R	O	R
>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+* [IHE-7]	R
>Scheduled Performing Physician's Name	(0040,0006)	O	R	O	O
>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.

[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.

[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 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 influence the business logic of the Responder (see Section 4.130.4.1.3).

[IHE-7]: The Requester shall include the Modality (0008,0060) as Matching Key populated with its own modality. The value is intended to influence the business logic of the Responder (see Section 4.130.4.1.3).

4.130.4.1.2.1.1 POCUS Option

An Acquisition Modality and Encounter Manager supporting the POCUS Option shall conform to the requirements in Table 4.130.4.1.2.1.1-1 in addition to the requirements in Table 4.130.4.1.2.1-1.

This option places display requirements (see RAD TF-2: 2.2 for notation) for specific attributes, similar to those in Query Modality Worklist [RAD-5] on the Requester.

Table 4.130.4.1.2.1.1-1: Return and Matching Keys for Encounter Metadata for POCUS Option

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
Patient Demographic					
Patients Birth Date	(0010,0030)	O	O	R+	R+
Encounter Metadata					
Visit Identification					
Institutional Department Name	(0008,1040)	R+	R+	R+	R+
Admission ID	(0038,0010)	R+*	R+	R+* [IHE-1]	R+
Visit Admission					
Physician(s) of Record Identification Sequence	(0008,1049)				
> Person Identification Code Sequence	(0040,1101)				
>>Code Value	(0008,0100)	O	O	R+*	R+
>>Coding Scheme Version	(0008,0103)	O	O	O	O
>>Coding Scheme Designator	(0008,0102)	O	O	R+*	R+
>>Code Meaning	(0008,0104)	O	O	R+*	R+

[IHE-1]: If multiple values for Admission ID (0038,0010) are returned, the modality shall display all Admission IDs to the operator to ensure appropriate encounter selection.

4.130.4.1.2.2 Message Semantics (UPS-RS)

The message is a Search Transaction of the DICOM Worklist Service (UPS-RS). The Requester is the User-Agent, and the Responder is the Origin-Server.

The Requester and the Responder shall meet the requirements in Section 4.130.4.1.2.1 (MWL) using the corresponding RESTful mechanisms as described in DICOM PS3.18 Section 11.9 and using the mappings from MWL attributes to UPS attributes described in Table 4.130.4.1.2.2-1

Note: This transaction uses UPS-RS Search but does not presume the Responder will actually instantiate and manage workitems (e.g., to claim, update, subscribe to, or send notifications about workitems).

The requirements on the SCU and the SCP in Table 4.130.4.1.2.1-1 apply to the UPS-RS user agent and origin server, respectively. Since a few of the attributes in UPS differ from those in MWL, the UPS Mapping column in Table 4.130.4.1.2.2-1 shows which attributes correspond to those in MWL.

When the UPS Mapping says “same”, it means that UPS uses the same attribute as is used in MWL (shown on the left)

Table 4.130.4.1.2.2-1: Encounter Metadata Mapping from Table 4.130.4.1.2.1-1 to UPS-RS

MWL Attribute Name	Tag	UPS Mapping
Patient Metadata		
Patient Identification		
Patient's Name	(0010,0010)	Same
Patient ID	(0010,0020)	Same
Issuer of Patient ID	(0010,0021)	Same
Other Patient IDs Sequence	(0010,1002)	Same
Patient Demographic		
Patients Birth Date	(0010,0030)	Same
Patient's Sex	(0010,0040)	Same
Confidentiality constraint on patient data	(0040,3001)	Same
Encounter Metadata		
Visit Identification		
Institution Name	(0008,0080)	Same
Institution Code Sequence	(0008,0082)	Same
Institution Address	(0008,0081)	Same
Institutional Department Name	(0008,1040)	Same
Institutional Department Type Code Sequence	(0008,1041)	Same
Admission ID	(0038,0010)	Same
Issuer of Admission ID Sequence	(0038,0014)	Same
Visit Admission		
Admitting Date	(0038,0020)	Same
Admitting Time	(0038,0021)	Same
Admitting Diagnoses Description	(0008,1080)	Same
Admitting Diagnoses Code Sequence	(0008,1084)	Same
Reason for Visit	(0032,1066)	Same
Reason for Visit Code Sequence	(0032,1067)	Same
Referring Physician's Name	(0008,0090)	Same. (in Referenced Request Sequence (0040,A370))
Referring Physician Identification Sequence	(0008,0096)	Same
Referring Physician's Telephone Numbers	(0008,0094)	Same
Visit Status		
Current Patient Location	(0038,0300)	Same
Procedure Metadata		
Imaging Service Request		
Accession Number	(0008,0050)	Same. (in Referenced Request Sequence (0040,A370))

MWL Attribute Name	Tag	UPS Mapping
Issuer of Accession Number Sequence	(0008,0051)	Same. (in Referenced Request Sequence (0040,A370))
Requesting Service	(0032,1033)	Same. (in Referenced Request Sequence (0040,A370))
Requesting Service Code Sequence	(0032,1034)	Same. (in Referenced Request Sequence (0040,A370))
Requested Procedure		
Requested Procedure Description	(0032,1060)	Same. (in Referenced Request Sequence (0040,A370))
Requested Procedure Code Sequence	(0032,1064)	Same. (in Referenced Request Sequence (0040,A370))
Reason for the Requested Procedure	(0040,1002)	Same. (in Referenced Request Sequence (0040,A370))
Reason for Requested Procedure Code Sequence	(0040,100A)	Same. (in Referenced Request Sequence (0040,A370))
Study Instance UID	(0020,000D)	Same.
Scheduled Procedure Step		
Scheduled Procedure Step Sequence	(0040,0100)	Some of the following attributes not nested in UPS
>Scheduled Station AE Title	(0040,0001)	Station Name Code Sequence (0040,4025) putting AE Title in the code meaning with a local coding scheme
>Scheduled Procedure Step Start Date	(0040,0002)	Scheduled Procedure Step Start Date and Time (0040,4005)
>Scheduled Procedure Step Start Time	(0040,0003)	
>Scheduled Procedure Step Location	(0040,0011)	Scheduled Station Geographic Location Code Sequence (0040,4027)
>Modality	(0008,0060)	Scheduled Station Class Code Sequence (0040,4026) using codes from DICOM PS3.16 CID 29 Acquisition Modality
>Scheduled Performing Physician's Name	(0040,0006)	Human Performer's Name (0040,4037) in Scheduled Human Performers Sequence (0040,4034)
>Scheduled Protocol Code Sequence	(0040,0008)	Scheduled Workitem Code Sequence (0040,4018)
>Scheduled Procedure Step Description	(0040,0007)	Procedure Step Label (0074,1204)

4.130.4.1.2.3 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

  Patients often have an identification wristband with a barcode or RFID that a reader connected to the Requester 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 Requester 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 Sequence (0038,0014). 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's Name.

- Query by Department

  Using Institutional Department Name (0008,1040) or the Institutional Department Type Code Sequence (0008,1041), the Requester 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 Requester may be configured with the department to which it belongs or a short list of departments in which 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 Requester to request planned encounters for a particular day or shift. An intermittently connected Requester might also query and cache the returned list for use while disconnected from the network.

  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/Photographer/Physician

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

- Query by Room/Location

  Using Scheduled Procedure Step Location (0040,0011), the Requester 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 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.

The Responder shall identify Workitems with a matching Patient ID (0010,0020) (and Issuer of Patient ID (0010,0021), if provided) either inside the Other Patient IDs Sequence (0010,1002) or outside that sequence (i.e., in the "primary" ID).

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

worklist entries. Such business logic likely cannot be definitive and is typically based on 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 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 “scheduled” details in the response (e.g., an item in the Scheduled Procedure Step Sequence (0040,0100) or attributes in the Unified Procedure Step Scheduled Procedure Information Module) even though the encounter-based imaging procedure may not have been specifically scheduled.

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 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.

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 is permitted to provide a generic code or description such as "Perform Imaging".

4.130.4.2 Return Encounter Metadata

The Responder sends matching entries back to the Requester.

4.130.4.2.1 Trigger Events

The Responder receives a Request Encounter Metadata Message.

4.130.4.2.2 Message Semantics

The Responder shall support the matching and return keys as shown for the SCP in Table 4.130.4.1.2.1-1.

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 responses may include transcoding the metadata from HL7 fields into DICOM attributes.

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

4.130.4.2.2.1 Message Semantics (MWL)

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.

4.130.4.2.2.2 Message Semantics (UPS-RS)

The message is a Search Transaction Response Message of the DICOM Worklist Service (UPS-RS). The Requester is the User-Agent, and the Responder is the Origin-Server.

Both the Requester and Responder shall support application/dicom+json for the search results.

4.130.4.2.3 Expected Actions

The Requester shall accept the returned responses.

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 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.

Although the UPS Semantics are described above using HTTP, it is permitted to use HTTPS.

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 (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 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 / Image 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.

4.131.3 Referenced Standards

DICOM PS3.4 Annex B: Storage Service Class.

4.131.4 Messages

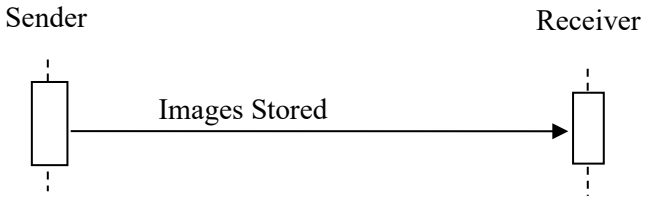


Figure 4.131.4-1: Interaction Diagram

4.131.4.1 Images Stored

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 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 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. Attributes with R+ and RC+ highlight additions to the DICOM Standard requirements for DICOM Storage SOP Class. See RAD TF-2: 2.2 DICOM Usage Conventions.

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

Attribute	Tag	Type	Notes
Institutional Department Name	(0008,1040)	R+	Important for organizing/finding images
Institutional Department Type Code Sequence	(0008,1041)	R+	Important for organizing/finding images
Admission ID	(0038,0010)	R+	Important for organizing/finding images
Issuer of Admission ID Sequence	(0038,0014)	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	
Referring Physician Identification Sequence	(0008,0096)	O	
Admitting Diagnoses Description	(0008,1080)	O	
Admitting Diagnoses Code Sequence	(0008,1084)	O	
Reason for Visit	(0032,1066)	O	
Reason for Visit Code Sequence	(0032,1067)	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-2x: Appendix O for potential codes.

Attribute	Tag	Type	Notes
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
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.

Attribute	Tag	Type	Notes
Primary Anatomic Structure Modifier Sequence	(0008,2230)	O	

4.131.4.1.2.1 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 comply 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 does not apply.

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

Similar issues around Study UIDs and Series UIDs are discussed in the context of Scheduled Workflow for order-based imaging. See RAD TF-2: 4.8.4.1.1.1 “Study UIDs and Series UIDs”.

4.131.4.1.2.2 POCUS Option

4.131.4.1.2.2.1 Required Modality Attributes

An Acquisition Modality supporting the POCUS Option shall conform to the requirements in Table 4.131.4.1.2.2.1-1 in addition to the requirements in Table 4.131.4.1.2-1.

Table 4.131.4.1.2.2.1-1: Required Modality Attributes

Attribute	Tag	Type	Notes
Physician(s) of Record Identification Sequence	(0008,1049)	RC+	Required if provided in the MWL response. Important to identify the supervising physician. E.g., for POCUS training and reporting.

Attribute	Tag	Type	Notes
Reason for Performed Procedure Code Sequence	(0040,1012)	RC+	Required if the study is a training study.

See RAD TF-2x: A.7 for other Acquisition Modality mapping requirements.

The Acquisition Modality shall ensure attribute consistency, as defined in RAD TF-2x: Appendix A.6, prior to transmitting images to the POCUS Manager.

The Acquisition Modality shall identify training studies using the code (129012, DCM, "Educational Intent") in the Reason for Performed Procedure Code Sequence (0040,1012). The Acquisition Modality will typically also include other codes from RAD TF-2x: Appendix O, as appropriate.

The Acquisition Modality shall copy the Physician(s) of Record Identification Sequence (0008,1049) from the MWL response, if present.

The Acquisition Modality shall populate the Operator Identification Sequence (0008,1072) with multiple items when multiple operators participated in the imaging workflow, ensuring that all involved operators are accurately recorded.

Note: If multiple IDs are known for an operator, the Operator Identification Sequence can contain multiple items for the same operator, e.g., a local employee ID and a national identifier, such as (12345,99SomeHospital,"Feelgood, Dr") and (678910,99NPI, "Feelgood, Dr").

4.131.4.1.2.2.2 POCUS Manager Coercion

As the Receiver of a Store Encounter Images [RAD-131] transaction from the modality, the POCUS Manager performs coercion (i.e., the process of replacing attribute values to ensure consistency) and study reorganization prior to acting as the Sender of a Store Encounter Images transaction to the Image Manager / Image Archive. This activity may be driven by information collected during creation of the worksheet(s). See Section 47.4.1.19

A POCUS Manager supporting the POCUS Option shall conform to the following requirements:

- The POCUS Manager shall ensure attribute consistency, as defined in RAD TF-2x: Appendix A.7, prior to transmitting images to the Image Manager / Image Archive.
- The POCUS Manager shall be able to split a single acquired study into multiple studies. This will require generating a unique Accession Number, Study Description, and Study Instance UID for each new study. The POCUS Manager shall update relevant attributes as noted in RAD TF-2x: Appendix A.7. This supports workflows where images acquired under a single Study Instance UID on the modality involves multiple study types, which may need to be reported separately to meet local policies, billing requirements, or procedural documentation needs. The worksheet may provide relevant information to populate these attributes. See RAD TF-1: 47.4.1 for an explanation of worksheets. In this scenario the POCUS Manager is generating additional Study Instance UIDs beyond those from the Encounter Manager described in Section 4.131.4.1.2.1. Whether the POCUS

Manager reuses the original Study Instance UID and Accession Number for one the split studies is left to the implementation.

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.

The POCUS Option repurposes this transaction to store reports.

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 / Image Archive POCUS Manager

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 Messages

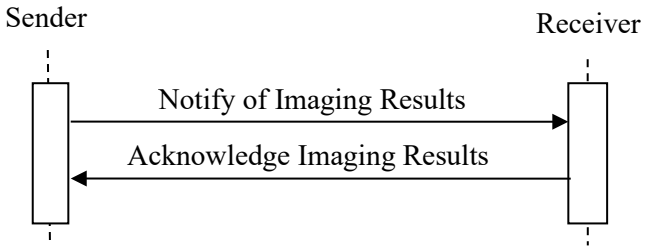


Figure 4.132.4-1: Interaction Diagram

4.132.4.1 Notify of Imaging Results

The Sender sends a notification to the Receiver.

The Receiver shall support handling such notification messages from more than one Sender. The Sender shall support sending notification messages to more than one Receiver.

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. The Sender shall send a notification at least once per study. The Sender may send additional notifications for the same study (e.g., when new instances are added), but that is left to the implementation and this behavior should be configurable.

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

It is relatively common for the Sender to notify the Receiver of both new encounter-based images and new order-based images; however, it is conceivable that in some environments the Sender might not send a notification for new order-based images under the assumption that the Receiver (in that case, the Order Placer in SWF.b) is already aware of the order driving the procedure. In that case the Sender would need to be able to distinguish between those types of images.

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 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.

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.

It is not expected that a Sender will send notifications when patient reconciliation is performed. The Sender will previously have notified the Receiver using placeholder demographics, and at reconciliation time the Receiver will be handling corresponding patient merges itself.

4.132.4.1.1.1 POCUS Option

A system needs to notify the Result Aggregator that a clinically relevant imaging study, along with its associated report, is available and should be cataloged in the patient’s electronic medical record.

The POCUS Manager sends a notification per study when the study meets the configured completeness criteria (e.g., the signing HCP has appropriate POCUS privileges, and both the report and images contain complete metadata, see RAD TF-1: 47.4.2.1). Typically, only a single notification would be sent per study; additional messages might be triggered by a Report Addendum.

The POCUS Manager shall not send this transaction to the Result Aggregator for training studies.

Note: This differs from the general EBIW case, where notifications may be sent immediately after image acquisition and potentially repeated as new series are added. In the POCUS Option, the notification is deferred until completion.

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.

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 (See Note 1)
[ORC]	Order Common	4	Section 4.128.4.1.2.5 ORC Segment (See Note 1)
OBR	Order Detail	4	Section 4.132.4.1.2.1 OBR Segment (See Note 1)
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
[{OBX}]	Observation/Result	7	Section 4.132.4.1.2.3 OBX Segment (See Note 1)

Adapted from the HL7 Standard, version 2.5.1

Note 1: If the Sender supports the POCUS Option, see Section 4.132.4.1.2.3 for requirements.

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

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
7	26	TS	R		00241	Observation Date/Time
12	250	CE	X		00246	Danger Code
16	250	XCN	O		00226	Ordering Provider

SEQ	LEN	DT	OPT	TBL#	ITEM #	ELEMENT NAME
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

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: *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 LOINC RadLex Playbook, is recommended. In order of preference, the procedure code may be taken from:

- Procedure Code Sequence (0008,1032)
- Requested Procedure Code Sequence (0032,1064)
- 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 associated DICOM image objects:

- Study Date (0008,0020) & Study Time (0008,0030)
- Series Date (0008,0021) & Series Time (0008,0031)

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.

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 Type Code Sequence (0008,1041) in the associated DICOM image objects. This may require a mapping table to match locally used diagnostic service section IDs (which for 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

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 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:

- Reason for Performed Procedure Code Sequence (0040,1012)
- Reason for the Requested Procedure (0040,1002) or Code Sequence (0040,100A)
- Reason for Visit (0032,1066) or Code Sequence (0032,1066)
- 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 sometime 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.

4.132.4.1.2.3 POCUS Option

The POCUS Option defines specific adaptations to support workflows for Point of Care Ultrasound (POCUS) to accommodate POCUS-specific reporting and billing needs. See RAD TF-2x: A.7 for mappings that affect how the segments below are populated.

4.132.4.1.2.3.1 PV1 Segment

The PV1 Segment including the structure, coding, and usage is defined in Section 4.128.4.1.2.4 with these additional constraints.

Field *PV1-19 Visit Number*: The optionality for this field is modified from R2 to R. The PV1-19 field shall be valued with the Admission ID (0038,0010) from the images. This ensures the linkage of the point-of-care imaging results to the encounter record in the receiving system, maintaining consistency and enabling accurate correlation with the clinical context.

4.132.4.1.2.3.2 ORC Segment

The HL7 v2.5.1 ORC segment conveys common order information.

ORC Segment may be included to provide the information necessary for the Result Aggregator to create and manage an order associated with the imaging study.

All fields in ORC segment are optional, except those listed in Table 4.132.4.1.2.3.2-1.

Table 4.132.4.1.2.3.2-1: HL7 v2.5.1 ORU ORC Segment

SEQ	LEN	DT	OPT	TBL#	ITEM#	ELEMENT NAME
1	2	ID	R	0119	00215	Order Control
12	250	XCN	R2		00226	Ordering Provider

Field *ORC-1 Order Control*: shall have the value of RE.

Field *ORC-12 Ordering Provider*: This field shall be populated with the Physician of Record responsible for the order. In the United States, this may include the physician's National Provider Identifier (NPI) to ensure regulatory compliance and clear attribution of responsibility for the order.

Note: ORC-12 duplicates OBR-16. HL7 recommends transmitting the same value in both segments to avoid confusion and ensure consistent processing across systems.

4.132.4.1.2.3.3 OBR Segment

This section adds constraints to the OBR Segment definition in Section 4.132.4.1.2.1:

Field *OBR-4 Universal Service Identifier*: The optionality for this field is modified from R2 to R. The OBR-4 field shall contain a procedure code in the first three components: OBR-4.1 Identifier, OBR-4.2 Text Code Meaning, and OBR-4.3 Coding System. The procedure code used in this field is derived from the worksheet associated with the imaging study, ensuring alignment with the documented purpose and findings of the study. The use of a standardized coding system for procedures, such as LOINC RadLex Playbook codes, is recommended.

When multiple procedures are performed during the same imaging session, as with an extended Focused Assessment with Sonography for Trauma (eFAST), the OBR segment may repeat. Each repeating OBR segment shall include a distinct OBR-4 field to uniquely identify the specific procedure performed.

The OBR-4.4 Alternate Identifier, OBR-4.5 Alternate Text and OBR-4.6 Name of Alternate Coding System may include the CPT (Current Procedural Terminology) code when required for billing purposes in the United States. If the POCUS Manager is providing CPT codes, it shall implement a mechanism to map procedure codes (e.g., LOINC RadLex Playbook) to CPT codes. This mapping is typically performed by the Result Aggregator in broader imaging workflows. However, in the context of POCUS, the POCUS Manager may need to handle this mapping directly to ensure accurate billing.

Field *OBR-16 Ordering Provider*: The optionality for this field is modified from O to R. The OBR-16 field shall be populated with the Physician of Record, including their NPI in the United States. This ensures clear identification of the provider responsible for the order, in alignment with regulatory and operational requirements.

Field *OBR-32 Principal Result Interpreter*: The optionality for this field is modified from R2 to R. This field shall also contain the Physician of Record, representing the individual who interprets and signs off on the results.

Field *OBR-33 Assistant Result Interpreter*: This field may be used to document a POCUS Learner, who assisted with or performed the imaging study under supervision.

Although R2 (Required if Relevant) fields such as OBR-12 (Danger Code), OBR-17 (Relevant Clinical Information), OBR-28 (Results Copies To), OBR-46 (Placer Supplementary Service Information), and OBR-48 (Filler Supplementary Service Information) are included in the base transaction definition, implementers may omit these fields unless required by a specific local configuration.

4.132.4.1.2.3.4 OBX Segment

This OBX segment is used to convey the specific, discrete findings which are part of imaging results. These findings may be plain text or coded.

The Observation/Result (OBX) Segment definition is based on HL7 Version 2.5.1 (Chapter 7, Observation Reporting, Section 7.4.2). This definition does not conflict with the OBX Segment as defined in ITI TF-2b: 3.30.5.7 OBX – Observation/Result Segment.

A summary of the OBX segments in this ORU message is provided in Table 4.132.4.1.2.3.4-1.

Optionality: This OBX segment shall be sent for POCUS reports.

Multiplicity: This OBX segment may repeat, one for each finding in the imaging result, since each Finding OBX segment shall only contain a single finding. It is common for an imaging result to have many findings.

For findings which are text, it is recommended that each discrete finding is included in a separate Finding OBX segment. In other words, for findings which are text, it is not recommended that multiple findings are included in a single text Finding OBX.

This OBX Segment shall be further constrained as specified in Table 4.132.4.1.2.3.4-1.

Table 4.132.4.1.2.3.4-1: HL7 v2.5.1 ORU OBX Segment - Finding

SEQ	LEN	DT	OPT	TBL#	ITEM #	ELEMENT NAME
1	4	SI	R		00569	Set ID – OBX
2	2	ID	R	0125	00570	Value Type = CE or TX
3	250	CE	R		00571	Observation Identifier
4	20	ST	C		00572	Observation Sub-ID
5	483 or 99999	CE or TX	R		00573	Observation Value
11	1	ID	R	0085	00579	Observation Result Status = R, F, C

Adapted from the HL7 Standard, version 2.5.1

See OBX Segment definition in Section 4.128.4.1.2.9 for Field specifications.

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.

4.132.4.1.3.1 POCUS Option

The Result Aggregator that supports the POCUS Option shall also perform the following actions:

The Result Aggregator shall link the report conveyed in the OBX segment to the Encounter identified in PV1-19 Admission ID.

If the Result Aggregator is grouped with an Image Display Invoker, it shall construct a hyperlink as specified in the Invoke Image Display [RAD-106] transaction that enables access to the POCUS study using the Study Instance UID obtained from the OBX segment. See RAD TF-2: 4.106.4.1.2.

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.

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.

Volume 2x – Appendices to Transactions

Add new Section A.6 to RAD TF Vol 2x after A.5: Imported Object Integration – Critical Attributes

A.6: DICOM Attribute Consistency between Modality Worklist Composite IODs and Evidence Documents for POCUS

This appendix defines attribute consistency requirements for the Acquisition Modality under the POCUS Option. It reflects the POCUS adoption of "Attribute Consistency between Modality Worklist, Composite IODs, Evidence Documents and Modality Performed Procedure Step" for Scheduled Workflow in Appendix A. This follows the same table structure and cell content conventions found in in prior tables in Appendix A.

Table A.6-1: Required Mapping of DICOM attributes for POCUS Modality

DICOM Attribute	Modality Worklist (return attribute values)	Filling values for: Original Image/ Standalone IOD	Filling values for: Append Image/ Standalone IOD See (IHE-A.6.1)
Patient's Name (0010,0010)	Source	Copy	Copy
Patient ID (0010,0020)	Source	Copy	Copy
Issuer of Patient ID (0010,0021)	Source	Copy	Copy
Other Patient IDs Sequence (0010,1002)	Source	Copy	Copy
Patients Birth Date (0010,0030)	Source	Copy	Copy
Patient's Sex (0010,0040)	Source	Copy	Copy
Institution Name (0008,0080)	Source	Copy	Copy
Institution Code Sequence (0008,0082)	Source	Copy	Copy
Institution Address (0008,0081)	Source	Copy	Copy
Institutional Department Name (0008,1040)	Source	Copy	Copy
Institutional Department Type Code Sequence (0008,1041)	Source	Copy	Copy
Admission ID (0038,0010)	Source	Copy	Copy
Issuer of Admission ID Sequence (0038,0014)	Source	Copy	Copy
Admitting Date (0038,0020)	Source	Copy	Copy

DICOM Attribute	Modality Worklist (return attribute values)	Filling values for: Original Image/ Standalone IOD	Filling values for: Append Image/ Standalone IOD See (IHE-A.6.1)
Admitting Time (0038,0021)	Source	Copy	Copy
Reason for Visit (0032,1066)	Source	Copy	Copy
Reason for Visit Code Sequence (0032,1067)	Source	Copy	Copy
Physician(s) of Record Identification Sequence (0008,1049)	Source	Copy	Copy
Accession Number (0008,0050)	Source	Copy	Copy
Issuer of Accession Number Sequence (0008,0051)	Source	Copy	Copy
Requested Procedure Description (0032,1060)	Source	n.a.	n.a.
Requested Procedure Code Sequence (0032,1064)	Source	n.a.	n.a.
Scheduled Procedure Step Sequence (0040,0100)	Source	n.a.	n.a.
>Scheduled Station AE Title (0040,0001)	Source	n.a.	n.a.
>Scheduled Procedure Step Start Date (0040,0002)	Source	n.a.	n.a.
>Scheduled Procedure Step Start Time (0040,0003)	Source	n.a.	n.a.
>Modality (0008,0060)	Source	n.a.	n.a.
>Scheduled Procedure Step Description (0040,0007)	Source	n.a.	n.a.
Study Instance UID (0020,000D)	Source	Copy	Copy
Operators' Name (0008,1070)	n.a.	Source	Copy
Operator Identification Sequence (0008,1072)	n.a.	Source	Copy
Study Date (0008,0020)	n.a.	Source	Copy
Study Time (0008,0030)	n.a.	Source	Copy
Study Description (0008,1030)	n.a.	Source	Copy
Reason for Performed Procedure Code Sequence (0040,1012)	n.a.	Source	Copy
Body Part Examined (0018,0015)	n.a.	Source	Copy
Series Date (0008,0021)	n.a.	Source	Copy See (IHE-A.6.2)

DICOM Attribute	Modality Worklist (return attribute values)	Filling values for: Original Image/ Standalone IOD	Filling values for: Append Image/ Standalone IOD See (IHE-A.6.1)
Series Time (0008,0031)	n.a.	Source	Copy See (IHE-A.6.2)
Series Description (0008,103E)	n.a.	Source	Copy See (IHE-A.6.2)

- (IHE-A.6.1) for attributes where the MWL is the source and the original image is the copy, the append image value may be copied from the original image.
- (IHE-A.6.2) the Append case will generate one or more new series with its own Series Date (0008,0021), Series Time (0008,0031) and Series Description (0008,103E).

A.7: Critical POCUS Attributes

The POCUS Manager shall use the table below to identify and set critical DICOM attributes prior to transferring instances to the Image Manager / Image Archive (see RAD TF-2: 4.131.4.1.2.2.2), and map relevant data elements from the worksheet and acquired instances into the HL7 ORU Report prior to transferring to the Result Aggregator (see RAD TF-2: 4.132.4.1.2.3).

The table specifies the default requirements. Notes provide explanations and identify cases where coercion of values is permitted.

Table structure:

- The 1st column denotes the DICOM attributes whose values shall be mapped between DICOM objects, the Worksheet and the Report.
- The 2nd to 5th columns define sources of the DICOM attribute values, with all values in the same row required to be consistent, except where noted.
- The 6th column maps the attribute values to the corresponding HL7 v2.5.1 segment in the Unsolicited Observation (ORU) message.

See Section A.1 for cell content conventions.

Notes:

1. Although the Worksheet is not transferred, it serves as the primary unit of work and interaction for the healthcare provider (HCP), and is essential for driving attribute value mapping and ensuring alignment across representations. See RAD TF-1: 47.4.1.19.
2. Although the Worksheet and Report are not DICOM objects, the same cell content conventions as DICOM are applied in Table A.7-1.

Table A.7-1: POCUS Manager Integration – Critical Attributes

DICOM attribute	Objects from Modality	Filling values for:			
		Worksheet	Original Images sent to Image Manager	Append Images sent to Image Manager	HL7 v2.5.1 ORU Report sent to Result Aggregator
Patient's Name (0010,0010)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PID-5)
Patient ID (0010,0020)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PID-3)
Issuer of Patient ID (0010,0021)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PID-3)
Other Patient IDs Sequence (0010,1002)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PID-4)

DICOM attribute	Objects from Modality	Filling values for:			
		Worksheet	Original Images sent to Image Manager	Append Images sent to Image Manager	HL7 v2.5.1 ORU Report sent to Result Aggregator
Patients Birth Date (0010,0030)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PID-7)
Patient's Sex (0010,0040)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PID-8)
Institution Name (0008,0080)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-39)
Institution Code Sequence (0008,0082)	Source	Copy See (IHE-A.7.9)	Copy	Copy	n.a.
Institution Address (0008,0081)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-3) See (IHE-A.7.1)
Institutional Department Name (0008,1040)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-3)
Institutional Department Type Code Sequence (0008,1041)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-3)
Admission ID (0038,0010)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-19)
Issuer of Admission ID Sequence (0038,0014)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-19)
Admitting Date (0038,0020)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-44)
Admitting Time (0038,0021)	Source	Copy See (IHE-A.7.9)	Copy	Copy	Copy (PV1-44)
Reason for Visit (0032,1066)	Source	Copy See (IHE-A.7.9)	Copy	Copy	n.a.
Reason for Visit Code Sequence (0032,1067)	Source	Copy See (IHE-A.7.9)	Copy	Copy	n.a.
Physician(s) of Record Identification Sequence (0008,1049)	Source	Copy See (IHE-A.7.2)	Copy	Copy	Copy (ORC-12)
Accession Number (0008,0050)	Source	Copy See (IHE-A.7.3)	Copy	Copy	Copy (OBR-18) See (IHE-A.7.4)
Issuer of Accession Number Sequence (0008,0051)	Source	Copy See (IHE-A.7.5)	Copy	Copy	Copy (OBR-18) See (IHE-A.7.4)

DICOM attribute	Objects from Modality	Filling values for:			
		Worksheet	Original Images sent to Image Manager	Append Images sent to Image Manager	HL7 v2.5.1 ORU Report sent to Result Aggregator
Study Instance UID (0020,000D)	Source	Copy See (IHE-A.7.3)	Copy	Copy	Copy (OBX-5)
Operators' Name (0008,1070)	Source	Copy See (IHE-A.7.8)	Copy	Copy	Copy (ORC-1 and OBR-32 or OBR-33) See (IHE-A.7.8)
Operator Identification Sequence (0008,1072)	Source	Copy See (IHE-A.7.8)	Copy	Copy	Equal (ORC-1 and OBR-32 or OBR-33) See (IHE-A.7.8)
Study Date (0008,0020)	Source	Copy	Copy	Copy	Copy (OBR-7)
Study Time (0008,0030)	Source	Copy	Copy	Copy	Copy (OBR-7)
Study Description (0008,1030)	Source	Copy See (IHE-A.7.3)	Copy	Copy	Copy (OBR-4)
Reason for Performed Procedure Code Sequence (0040,1012)	Source	Copy See (IHE-A.7.7)	Source	Source	Copy (OBR-31)
Body Part Examined (0018,0015)	Source	Copy See (IHE-A.7.6)	Copy	Copy	n.a.
Series Date (0008,0021)	Source	n.a.	Copy	Source See (IHE-A.7.10)	n.a.
Series Time (0008,0031)	Source	n.a.	Copy	Source See (IHE-A.7.10)	n.a.
Series Description (0008,103E)	Source	n.a.	Copy	Source See (IHE-A.7.10)	n.a.
Modality (0008,0060)	Source	Copy	Copy	Copy	n.a.

- (IHE-A.7.1) Assigned Patient Location specifies the patient's location within a healthcare facility using a hierarchical structure. It includes components such as the point of care, room, bed, facility, location status, person location type, building, floor, and location description. This structured information helps ensure accurate identification of the patient's physical location within the institution.
- (IHE-A.7.2) Physician(s) of Record Identification Sequence (0008,1049) may be coerced by the POCUS Manager in the worksheet if not present in the MWL response.
- (IHE-A.7.3) When multiple worksheets are initiated, the POCUS Manager shall split a single acquired study into multiple studies and generate one or more new Accession

Number, Study Description, and Study Instance UID as described in RAD TF-2: 4.131.4.1.2.2.2.

- (IHE-A.7.4) OBR-3 Filler Order Number may also contain the Accession Number if appropriate for local usage.
- (IHE-A.7.5) When the Accession Number is coerced by the POCUS Manager, the Issuer of Accession Number Sequence (0008,0051) corresponds to the Assigning Authority of the POCUS Manager.
- (IHE-A.7.6) May be coerced by the POCUS Manager if modified in the worksheet. In the case of a split, the POCUS Manager may assign a different value to each resulting study based on the corresponding worksheet.
- (IHE-A.7.7) Populated by the modality for training studies. May be present otherwise. When the POCUS Manager splits a study, it may need to reassign or modify the original sequence items as appropriate and/or coerce this attribute based on the corresponding worksheet.
- (IHE-A.7.8) in case of multiple operators, the contents of the worksheet will distinguish the Physician of Record from the POCUS learners.
- (IHE-A.7.9) When the POCUS Manager is grouped with the Encounter Manager, it may choose to perform coercion. In this case, the value would be considered "Equal," since the actor already knows the value.
- (IHE-A.7.10) the Append case will generate one or more new series with its own Series Date (0008,0021), Series Time (0008,0031) and Series Description (0008,103E).

Add new Appendix O to RAD TF-2x:

Appendix O – Reason for Procedure Codesets (Informative)

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

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

Coding Scheme Designator	Code Value	Code Meaning
DCM	129012	Educational Intent
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

Coding Scheme Designator	Code Value	Code Meaning
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)

For a detailed review of the Focused Assessment with Sonography in Trauma (FAST) examination, see Richards, J.R. & McGahan, J.P., *Radiology* (2017). https://doi.org/10.1148/radiol.2017160107

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

- Evaluate Breast Lump
- Evaluate Reduction of Fracture or Dislocation
- Localize/Evaluate Fluid or Abscess
- Detect/Evaluate Detached Retina
- Detect/Evaluate Gallstones
- Detect/Evaluate Internal Bleeding
- 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
- Collect Procedural Evidence
- Evaluate Success of Procedure

Table O-2: Digital Photography Procedure Reasons

Coding Scheme Designator	Code Value	Code Meaning
LN	46212-7	Pre-operative Photo
LN	46211-9	Post-operative Photo
LN	29112-0	Photo documentation Left eye
LN	29111-2	Photo documentation Right eye
SCT	446080005	Photography of wound
SCT	252983000	Skin Lesion Photography

Add the following Appendix to RAD TF-2x:

Appendix U: HL7 ADT Mapping to DICOM MWL for POCUS (Informative)

Editorial Note: This section addresses CP-RAD-480 Add HL7 mapping to EBIW

This appendix defines the mapping of details from HL7 ADT messages to the DICOM Modality Worklist in the context of an encounter-based imaging workflow. See RAD TF-2: 4.130 for a more thorough definition of field lengths, value representations, and attribute types. Mappings between HL7 and DICOM are illustrated in the following manner:

- Element Name (HL7 item #/ DICOM (group, element))
- Multiple HL7 items may be relevant and included below

Table U-1: HL7 ADT Mapping to DICOM MWL for POCUS

DICOM Description /Module	DICOM Tag	DICOM SCP Return Key Type	HL7 Description	HL7 Item #	HL7 v2.5.1 Segment	Notes
Patient Metadata						
Patient Identification						
Patient's Name	(0010,0010)	1	Patient Name	00108	PID-5	
Patient ID	(0010,0020)	1	Patient Identifier List	00106	PID-3	
Issuer of Patient ID	(0010,0021)	3	Patient Identifier List	00106	PID-3	
Other Patient IDs Sequence	(0010,1002)	3	Alternate Patient ID	00017	PID-4	
Patient Demographic						
Patients Birth Date	(0010,0030)	2	Date/Time of Birth	00110	PID-7	
Patient's Sex	(0010,0040)	2	Administrative Sex	00111	PID-8	
Confidentiality constraint on patient data	(0040,3001)	2	VIP Indicator Protection Indicator Visit Protection Indicator	00146 00744 00723	PV1-16 PD1-12 PV2-22	
Encounter Metadata						
Visit Identification						
Institution Name	(0008,0080)	3	Assigned Patient Location	00133	PV1-3	
Institution Code Sequence	(0008,0082)	3	Assigned Patient Location	00133	PV1-3	From DICOM PS3.16: CID 5002 Organizations
Institution Address	(0008,0081)	3	Assigned Patient Location	00133	PV1-3	
Institutional Department Name	(0008,1040)	3	Assigned Patient Location	00133	PV1-3	

DICOM Description /Module	DICOM Tag	DICOM SCP Return Key Type	HL7 Description	HL7 Item #	HL7 v2.5.1 Segment	Notes
Institutional Department Type Code Sequence	(0008,1041)	3	Assigned Patient Location	00133	PV1-3	From DICOM PS3.16: CID 7030 Institutional Departments, Units and Services
Admission ID	(0038,0010)	2	Visit Number	00149	PV1-19	
Issuer of Admission ID Sequence	(0038,0014)	3	Visit Number	00149	PV1-19	
Visit Admission						
Admitting Date	(0038,0020)	3	Admit Date/Time	00174	PV1-44	
Admitting Time	(0038,0021)	3	Admit Date/Time	00174	PV1-44	
Admitting Diagnoses Description	(0008,1080)	3	Diagnosis Description	00378	DG1-4	
Admitting Diagnoses Code Sequence	(0008,1084)	3	Diagnosis Code	00377	DG1-3	
Reason for Visit	(0032,1066)	3	Diagnosis Description Visit Description	00378 00713	DG1-4 PV2-12	
Reason for Visit Code Sequence	(0032,1067)	3	Diagnosis Code Admit Reason	00377 00183	DG1-3 PV2-3	
Referring Physician's Name	(0008,0090)	3	Referring Doctor	00138	PV1-8	
Referring Physician Identification Sequence	(0008,0096)	3	Referring Doctor	00138	PV1-8	
Referring Physician's Telephone Numbers	(0008,0094)	3	Referring Doctor	00138	PV1-8	
Physician(s) of Record	(0008,1048)	3	Attending Doctor	00137	PV1-7	
Physician(s) of Record Identification Sequence	(0008,009D)	3	Attending Doctor	00137	PV1-7	
Visit Status						
Current Patient Location	(0038,0300)	3	Assigned Patient Location	00133	PV1-3	

DICOM Description /Module	DICOM Tag	DICOM SCP Return Key Type	HL7 Description	HL7 Item #	HL7 v2.5.1 Segment	Notes
Procedure Metadata						
Imaging Service Request						
Accession Number	(0008,0050)	2	n.a.	n.a.	n.a.	Generated by the Encounter Manager
Issuer of Accession Number Sequence	(0008,0051)	3	n.a.	n.a.	n.a.	From the Encounter Manager namespace
Requesting Service	(0032,1033)	3	Hospital Service Clinic Organization Name	00140 00724	PV-1.10 PV2-23	
Requesting Service Code Sequence	(0032,1034)	3	n.a.	n.a.	n.a.	From DICOM PS3.16: CID 7030 Institutional Departments, Units and Services
Requested Procedure						
Requested Procedure Description	(0032,1060)	1C	n.a.	n.a.	n.a.	From DICOM PS3.16: CID 101 Imaging Procedures or (0032,1064)
Requested Procedure Code Sequence	(0032,1064)	1C	n.a.	n.a.	n.a.	From DICOM PS3.16: CID 101 Imaging Procedures or (0032,1060)
Reason for the Requested Procedure	(0040,1002)	3	Visit Description	00713	PV2-12	
Reason for Requested Procedure Code Sequence	(0040,100A)	3	Admit Reason	00183	PV2-3	
Study Instance UID	(0020,000D)	1	n.a.	n.a.	n.a.	Generated by the Encounter Manager
Scheduled Procedure Step Sequence	(0040,0100)	1	n.a.	n.a.	n.a.	Generated by the Encounter Manager
>Scheduled Station AE Title	(0040,0001)	1	n.a.	n.a.	n.a.	Generated by the Encounter Manager
>Scheduled Procedure Step Start Date	(0040,0002)	1	Expected Admit Date/Time Date/Time of Message	00188 00007	PV2-8 MSH-7	Generated by the Encounter Manager

DICOM Description /Module	DICOM Tag	DICOM SCP Return Key Type	HL7 Description	HL7 Item #	HL7 v2.5.1 Segment	Notes
>Scheduled Procedure Step Start Time	(0040,0003)	1	n.a.	n.a.	n.a.	Generated by the Encounter Manager
>Scheduled Procedure Step Location	(0040,0011)	2	Assigned Patient Location	00133	PV1-3	
>Modality	(0008,0060)	1	n.a.	n.a.	n.a.	Generated by the Encounter Manager
>Scheduled Performing Physician's Name	(0040,0006)	2	Attending Doctor	00137	PV1-7	
>Scheduled Protocol Code Sequence	(0040,0008)	1C	n.a.	n.a.	n.a.	Generated by the Encounter Manager
>Scheduled Procedure Step Description	(0040,0007)	1C	n.a.	n.a.	n.a.	Generated by the Encounter Manager

Volume 3 – Cross-Transaction Specifications

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 Grouped with Secure Node or Secure Application
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, POCUS Manager – when transmitting instances to the Image Manager / Image Archive**
	Instances-Stored	**Receiver: Image Manager / Image Archive, POCUS Manager – when storing Modality instances**
Notify of Imaging Results [RAD-132]	**Procedure-record-event**	**Sender: Image Manager / Image Archive, POCUS Manager**