Specimen & AP-Workflow
APSR Procedure Step Section

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Background

• HL7- Domain Analysis Model: Specimen, Release 1, 2015, reflecting DICOM (prev. suppl. 122)

• CDA Reference Information Model: Procedure Steps Section and Entry for APSR evolution 2014

• IHE profile APW for Order Entry and Lab automation

• Code systems for specimen-centric procedures and specimen attributes with almost incomplete value sets
Specimen DAM & DICOM Suppl. 122

• HL7 Specimen DAM: for a general model of all specialties which deal with specimens and containers
  • more specific relations between single items
  • more consistent differentiation between CDA-RIM basic classes

• DICOM: for a specified (constrained) model of the hierarchy of Specimen / Container in AP (according to RAD)
  • part (specimen) ≈ study
  • block (specimen & container) ≈ series
  • slide (container) ≈ image
CDA RIM
### Specimen Procedure Steps <entry>

**Procedure Steps <section>**

1..1  
- <code>

1..1  
- <title>

1..1  
- <text>

0..*  
**Specimen procedure step <entry>**

- <procedure>

  1..1  
  - <code>  
  Type of step (**collection, sampling, processing**)

  1..1  
  - <effectiveTime>  
  When

  0..1  
  - <targetSite>  
  Anatomic or specimen site

  0..1  
  - <performer>  
  Who

  1..1  
  Specimen produced by the step (**part, block, (stained) section on slide**)

  1..1  
  - <id>

  1..1  
  Additional specimen information, see HL7-DAM

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14.03.15  
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<component typeCode="COMP">
  <procedure classCode="PROC" moodCode="EVN">
    <templateId root="1.3.6.1.4.1.19376.1.3.1.2"/>
    <templateId root="1.3.6.1.4.1.19376.1.8.1.4.28"/>
    <!-- type of the procedure step, here collection -->
    <code code="432550005" codeSystem="2.16.840.1.113883.6.96" codeSystemName="SNOMED-CT"
      displayName="Core needle biopsy of breast using ultrasound guidance (procedure)">
      <originalText>
        <reference value="#A71024000008"/>
      </originalText>
    </code>
    <effectiveTime>
    </effectiveTime>
  </procedure>
  <!-- Anatomic site -->
  <targetSiteCode code="664" codeSystem="1.3.6.1.4.1.19376.1.8.2.1"
    displayName="Lower outer quadrant"
    codeSystemName="PATHLEX">
    <qualifier>
    </qualifier>
  </targetSiteCode>
  <!-- Specimen collector: the surgeon in this case -->
  <performer>
    <!-- the specimen collected -->
    <participant typeCode="PRD">
      <participantRole classCode="SPEC">
        <!-- specimen ids -->
        <id root="1.3.6.1.4.1.19376.1.8.1.4.999999" extension="#A7102400008"/>
        <playingEntity>
          <!-- need a code in PATHLEX for "part obtained from a biopsy -->
          <code code="373102004" codeSystem="2.16.840.1.113883.6.96"
            displayName="Specimen from breast obtained by image guided core biopsy (specimen)"
            codeSystemName="SNOMED-CT"/>
          </playingEntity>
        </participantRole>
      </participant>
    </participant>
  </performer>
</component>
-- Child procedure step: Production of block A1

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<procedure classCode="PROC" moodCode="EVN">
  <templateId root="1.3.6.1.4.1.19376.1.3.1.2"/>
  <templateId root="1.3.6.1.4.1.19376.1.8.1.4.28"/>
  <!-- type of the procedure step, here sampling a tissue dice from the part for a block -->
  <code code="433465004" codeSystem="2.16.840.1.113883.6.96" codeSystemName="SNOMED-CT"
    displayName="Sampling of tissue specimen (procedure)"/>
  <originalText>
    <reference value="#block_A_1"/>
  </originalText>
</code>
</procedure>

<targetSiteCode code="85756007" codeSystem="2.16.840.1.113883.6.96"
  displayName="Body tissue structure (body structure)"
  codeSystemName="SNOMED CT">
  <qualifier>
    <!-- a series of codes in PATIENT would help to describe the exact topographic source of the tissue obtained by trimming and sampling -->
    <name code="118169006"
      codeSystem="2.16.840.1.113883.6.96"
      displayName="Specimen source topography (attribute)" codeSystemName="SNOMED-CT"/>
    <value code="255503000"
      codeSystem="2.16.840.1.113883.6.96"
      displayName="Entire (qualifier value)" codeSystemName="SNOMED-CT"/>
  </qualifier>
</targetSiteCode>

<!-- Specimen preparer: a member staff of the pathology lab -->

<performer>
  <participant typeCode="PRD">
    <!-- specimen ids -->
    <id root="1.3.6.1.4.1.19376.1.8.1.4.999999" extension="block_A_1"/>
    <parentID root="1.3.6.1.4.1.19376.1.8.1.4.999999" extension="A7102600008"/>
    <playingEntity>
      <!-- need a code in PATIENT for "block extracted from a part -->
      <code code="41652009" codeSystem="2.16.840.1.113883.6.96"
        displayName="Formalin-fixed paraffin-embedded tissue specimen (specimen)"
        codeSystemName="SNOMED CT"/>
    </playingEntity>
  </participant>
</performer>
</component>
Constraints for APSR in Specimen DAM:

- **Specimen**
  - specimenIdentifier
  - parentIdentifier
  - classCode → HL7?
  - typeCode → HL7, table 0487, DICOM CID 8103
  - subTypeCode → HL7?
  - riskCode → HL7, table 0489
  - isDerived
  - description
  - specimenRole → HL7?
  - specimenPurity → ?
  - specimenConcentration
  - numberOfContainers
  - specimenChildRole → HL7, table 0494
  - specimenGroupCount
Constraints for APSR in Specimen DAM:

- **SpecimenContainers**
  - containerIdentifier
  - containerTypeCode $\rightarrow$ DICOM, CID 8101
  - (containerComponentTypeCode) $\rightarrow$ DICOM, CID 8101
  - containerCondition $\rightarrow$ ?
  - additive $\rightarrow$ DICOM?, HL7 ?
  - position
Constraints for APSR in Specimen DAM:

- **PerformedSpecimenCollection**
  - performerIdentifier
  - reasonCode → ?
  - comment
  - actualCollectionDateRange
  - methodCode → OPS, PathLex, DICOM CID 8109, etc.
  - targetAnatomicSiteCode → OPS, PathLex, etc.
  - targetAnatomicSiteQualifierCode → OPS, PathLex, HL7
Constraints for APSR in Specimen DAM:

- SpecimenProcessingActivity
  - description
  - processingProcedure → HL7v3ActClasses, DICOM CID 8111
  - processingAdditive → DICOM?
  - statusCode → HL7
  - processingDateTime
  - temperature

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Open Questions from Specimen DAM

- Missing concept of a „grid“ for
  - Position of different specimens on a container
  - Target site for child specimens in sampling process (grossing with „slices“, from which the tissue dices are taken)
- DICOM C.7.6.22.1.4 as possible approach?
- Attributes for SpecimenSampling
  - are contained in DICOM CID 8110 !!
- Attributes for specimen stains and preparation steps
  - only in DICOM CID 8112 & 8113
CDA Reference Information Model: Procedure steps Section and Entry for APSR evolution 2014

- Is the Specimen procedure step <entry> compatible with the Specimen DAM?
- Can the relation between a multitude of specimens and containers be sufficiently reflected?
- Should (and could) the DICOM specimen module completely be expressed by a CDA construct??
- Do we need a special model with special codes and value sets) for immunohistochemistry and in-situ-molecular processes?
IHE profile APW for Order Entry and Lab automation

• Can IHE APW use CDA constructs?
• Should (and could) the DICOM specimen module be used instead?
Code systems for specimen-centric procedures with almost incomplete value sets

• with (postcoordinated) SNOMED-CT all codes could be built!
• LOINC with missing codes and values for most procedures
• DICOM with most complete value sets for a few codes in specimen processing & staining
• PathLex with few generic codes and value sets for specimen collection
• OPS (German version of ICPM) for specimen collection
Code systems for specimen information with incomplete value sets

- with (postcoordinated) SNOMED-CT all codes could be built!
- LOINC with missing codes and values for most of the specimen related information
- HL7 with (incomplete) codes for specimen types
- PathLex with almost missing generic codes and value sets for specimens itself
exemplary HL7 value sets for specimen type and risk (APSR constrained)

• Value set 2.16.840.1.113883.12.487, specimen type codes
  - ASP
  - BRSH
  - CST
  - EFFUS
  - EXUDTE
  - FLU
  - KELOI
  - SPT
  - TISS
  - UR

  • Aspirate
  • Brush
  • Fluid, Cyst
  • Effusion
  • Exsudate
  • Fluid, Body unsp.
  • Lavage
  • Sputum
  • Tissue
  • Urine

• Value set 2.16.840.1.113883.12.489, risk codes
  - BHZ
  - INF
  - RAD

  • Biohazard
  • MaterialDangerInfectious
  • Radioactive
Conclusion

For Procedure Step Section

• 3-Level-Hierarchy (part, block, slide) fixed

• Continue constraining the HL7 Specimen DAM and checking existent codes and value sets from different sources

  or

• Transfer DICOM (Specimen Identification and Revised Pathology) into CDA as developed in APSR evolution 2014, compatible with RIM

• Identify still further lacking process items, esp. in immunohistochemistry and FISH/CISH

• Exemplary solutions for CDA on ArtDecor HL7 Germany, (https://art-decor.org/art-decor/decor-project--psr-)

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