Integrating the Healthcare Enterprise

IHE Cardiology
Technical Framework Supplement

Cardiac Imaging Report Content (CIRC)

Trial Implementation

Date: July 1, 2011
Editor: IHE Cardiology Technical Committee 2010-2011
Email: cardio@ihe.net

Foreword

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

This supplement is submitted for Trial Implementation as of July 1, 2011 and will 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 Cardiology Technical Framework. Comments are invited and may be submitted on the IHE forums at http://forums.rsna.org/forumdisplay.php?f=249 or by email to cardio@ihe.net.

This supplement describes changes to the existing technical framework documents and where indicated amends text by addition (**bold underline**) or removal (~~**bold strikethrough**~~), as well as addition of large new sections introduced by editor's instructions to "add new text" or similar, which for readability are not bolded or underlined.

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

Replace Section X.X by the following:

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

Information about the IHE Cardiology can be found at: http://www.ihe.net/Domains/index.cfm

Information about the structure of IHE Technical Frameworks and Supplements can be found at: http://www.ihe.net/About/process.cfm and http://www.ihe.net/profiles/index.cfm

The current version of the IHE Technical Framework can be found at: http://www.ihe.net/Technical_Framework/index.cfm

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Introduction

This Supplement introduces a new Profile to the IHE Cardiology Technical Framework, with the overall design in Volume 1 and specific content in Volume 2. This Profile relies heavily on Content Profile concepts specified in the IHE Patient Care Coordination Technical Framework.

This content profile is motivated by cardiologists, who face an increasing demand from patient-care, data-quality and legislative perspectives to increase the usefulness and actionability of (discrete) clinical data across the various care-settings and stakeholders.

A solution for such interoperability is, however, not a simple undertaking. Unstructured textual data forms remains the predominate mechanism for information exchange among health care providers, and a good majority of data needed by physicians and other health care providers to make good clinical decisions is embedded in this free text. Efficient and effective interoperability therefore begins by identifying the most relevant clinical data.

Clinically-relevant cardiac imaging data is the key value proposition of this profile. The approach is to:

1. reuse the distribution and structuring work from the XDS (ITI domain), Medical summaries (PCC domain), and exchangeable procedure notes (HL7)
2. extend it through adding and codifying the Key Data Elements for Cardiac Imaging[1] content identified by the American College of Cardiology (ACC) / American Heart Association (AHA) task-force on clinical data standards

The aim is to enable collection and distribution of the most clinically-relevant discrete data on the diagnostic imaging procedures common in cardiology. The usage of the discrete data is two-fold:

1. To enable individual test data to be more easily shared and used between care givers and systems
2. To enable population-based outcomes-based research on test effectiveness

These imaging procedures are used as key constituents of the patient's treatment during cardiac encounters and disease management. Allowing a means to extract and exchange key cardiac measures across providers and their systems will be a huge advantage to providing a complete, accessible and actionable cardiac data set in front of cardiologists.

There are very successful quality-improvement programs in place by the professional bodies such as the ACC, AHA, and state registries concentrating on the most invasive, and expensive

[1] ACC/AHA/ACR/ASE/ASNC/HRS/NASCI/RSNA/SAIP/SCAI/SCCT/SCMR/SIR 2008 Key Data Elements and Definitions for Cardiac Imaging. JACC Vol. 53, No. 1, 2009. (http://content.onlinejacc.org/cgi/content/full/53/1/91)

cardiac procedures. However, the vast majority of cardiology imaging usage is in the area of non-interventional diagnostic procedures. The aggregate volume and reimbursement level of these procedures mean that there must be significant automated collection/processing of key discrete data to make it economical to evaluate effectiveness of these procedures.

This supplement provides a framework to make progress on both these goals. This profile codifies extensive areas of diagnostic imaging indications, procedures, medications, observations, complications and findings and specifies how this discrete data can be exchanged to be used by both care-providers and automated data processing systems.

Future work is expected to extend the types of cardiac procedures that can be reported in a structured format to support existing population-based registries e.g., National Cardiovascular Data Registry (NCDR)-PCI for interventional procedures. Another key target of this future work includes electrophysiology, based on the forthcoming Electrophysiology (EP) key data elements recommendations from the Heart Rhythm Society (HRS).

Relationship to Workflow Profiles

Cardiac Imaging Report Content (CIRC) is a *content* profile – it is agnostic with respect to the workflow or data exchange mechanism in which the data is produced and handled.

Content Profiles define how the content used in a transaction is structured. The binding of the Content to an IHE transaction that is part of an IHE Workflow Profile specifies how this payload may influence the metadata or the behavior of the transaction. Content modules within the Content Profile then define the payloads. Content modules are transaction neutral, in that what they describe is independent of the transaction in which they are used, whereas content bindings explain how the payload influences the transaction metadata and/ or behavior.

The CIRC content is intended to be deployed, for example, in the Image Enabled Office (IEO) workflow profile for ambulatory care environments, the Displayable Reports (DRPT) workflow profile for in-patient environments, or the Cross-Enterprise Document Sharing (XDS) profile to propagate the content across organizational boundaries.

It is important to note that that key report-generation/distribution workflow aspects such as physician identification, insurance preauthorization, report routing and acknowledgement, and patient consent, are **out of scope** for this Content Profile.

Open Issues and Questions

#	Open Issue Description
11	A local extension <ihecard:accreditation> has been specified to allow physician or facility accreditation to be described. It there a more standard way to handle this?
12	LOINC code for a risk assessment document section is pending assignment.
13	Certain concepts represented by SNOMED compositions have been submitted for pre-coordinated codes.

Closed Issues

#	Closed Issue Description/ Resolution
1	The Supplement uses the convention that a content module cannot have more than one parent (section 6.1.2), yet in section 6.2.1.1.2 the Cardiac Imaging Report Template is described as being a specialization (descendant) of both the Medical Document template and the Procedure Note template. This inconsistency needs to be resolved prior to this profile being published for Trial Implementation. *Answer: The restriction of having no more than a single parent has been removed from the Trial Implementation version.*
2	There are a number of instances where codes are missing (or unaccounted for) in some of the value sets listed in the 6.3.x subsections. These gaps need to somehow be resolved prior to this profile being published for Trial Implementation. Examples of missing codes include: a. Missing code for pharma echo Stress tests (just exercise stress) b. Missing codes for some Echo and Cardiac MR procedure acquisition types c. Missing codes for a couple of contrast agents d. Missing codes for LVEF Assessment concepts e. Missing codes for Cardiac Risk Assessment scores (e.g., Framingham risk assessment score). List of concepts has been submitted for inclusion in LOINC. *Answer: Missing and unaccounted for codes have been assigned/ filled in in the necessary code set definitions.*
3	How should non-DICOM "images" (such as Bull's eye diagrams and coronary tree diagrams) be included in the Cardiac Imaging Report? *Answer: The supplement describes a method to inline encode non-DICOM images such as coronary trees or "bull's eye diagrams" using the CDA 'observationMedia' entry (see section 6.2.4.6.*
4	There are currently no specific requirements for Content Consumers with respect to having to handle multiple coding schemes. Should there be? *Answer: The use of specific coding schemes to codify the wide variety of concept included in the CIRC Content Profile is frequently a national, regional or even local decision based on regulation or legislation. Thus the Cardiology Technical Committee documented the most common, internationally applicable codes in the value sets defined, but stopped short of mandating specific coding scheme in this specification.*

#	Closed Issue Description/ Resolution
5	The current profile supplement does not describe how to identify profile conformance, especially as the template evolves. Is this something that should be covered in this Content Profile, and if so, how should that be done? *Answer: The profile will not describe an explicit method for conformance claims to specific templates or template elements. Rather it follows the existing convention used by other CDA implementation guides that substantive changes in requirements to a template at any level necessitates the creation of a new OID to identify the changed template as well as a new OID for any other template that invokes the changed template as a required element. (Changes to optional elements generally do not affect conformance.)*
6	The supplement currently does not describe how to reference the prior study referenced in the observation(s) within Comparison section. Assuming this referencing should be required if a comparison section exists, should that reference be done based on some DICOM identifier (e.g., study UID), or some human identifiable item (e.g., study date)? *Answer: The comparison study template has been updated to require that the narrative description of the comparison study include the exam date and the exam type in order to provide "human identifiable" information in the report.*
7	Does this supplement need to describe how the content data gets mapped into XDS meta-data (to see a similar situation, refer to medical summary)? Examples are format codes/code-lists that differentiate medical summary from cardiac report. It is believed that this is "covered" by the reference made to the PCC TF specification for XDS metadata mapping (specific reference is to XDS-MS). The Cardiology Technical Committee solicits feedback from the PCC Technical Committee on this approach. *Answer: No negative feedback was received during public comment, so no changes were made to the document.*
8	There are some missing details for describing Cardiac Findings in section 6.2.2.11. These gaps in detailed data modeling need to be resolved prior to this profile being published for Trial Implementation. Such missing information is highlighted in yellow. *Answer: All known gaps in the findings section template have been filled.*

#	Closed Issue Description/ Resolution
9	The supplement does not aim to be comprehensive for all downstream uses of discrete data - from next-level analysis, discrete data warehousing of clinical record, to registry submission. *Answer: The Cardiology Technical Committee believes this is acceptable for the following reasons:* *a. The intent of this content profile is to capture structure and codify the key discrete data that is today conveyed in cardiology imaging reports.* *b. There is no widely accepted standard for report composition across the broad range of imaging procedures in cardiology.* c. *Furthermore, registry-submission and clinical records have broader data scope than individual cardiac procedure reports. The work here is an initial attempt to support the communication of discrete cardiac data throughout and between enterprises, it will require extension and extensive collaboration in future updates to the IHE-TF.*
10	Should this Cardiac Imaging Report Template inherit its definition from both the Procedure Report Implementation Guide and the Basic Diagnostic Imaging Report Implementation Guide? *Answer: This document is not a specialization of the HL7 Basic Diagnostic Imaging Report template due to conflicts with two Procedure Note requirements (format of serviceEvent/effectiveTime, and title on DICOM Catalogue section). When and if these are resolved, an instance may also comply to the Diagnostic Imaging Report.*

Volume 1 – Integration Profiles

Add the following bullet to the end of the bullet list in section 1.7

1.7 Current Year Scope

- Added the Cardiac Imaging Report Content which describes the content and format of the clinical report created for a cardiac imaging procedure.

Add the following to Table 2-1. Update table number to 2.1-1

2.1 Dependencies among Integration Profiles

Table 2.1-1. Cardiology Integration Profiles Dependencies

Integration Profile	Depends on	Dependency Type	Comments
…			
Cardiac Imaging Report Content	Consistent Time	Content Creator is required to be grouped with Time Client actor	

Add the following section to section 2.2

2.2.11 Cardiac Imaging Report Content (CIRC)

The Cardiac Imaging Report Content (CIRC) Profile specifies the content structure for a clinical report of a cardiology imaging exam, recorded in a DICOM Study. Such exams include:

- Echocardiography (transthoracic - TTE, transesophageal - TEE, and TTE stress)
- Cardiac computed tomography (angiography - CCTA, and coronary artery calcium scoring - CACS)
- Cardiac magnetic resonance (angiography - MRA, and MR stress)
- Cardiovascular nuclear medicine (SPECT myocardial perfusion, positron emission tomography - PET)
- Diagnostic coronary catheter based fluoroscopy (interventional coronary angiography - ICA, and left ventriculography - LVG)

The CIRC Profile specifies the use of an HL7 Clinical Document Architecture (CDA) format for the report.

Not included in the scope of this profile are non-imaging studies (e.g., ECG), electrophysiology procedures, and non-cardiology procedures (e.g., peripheral angiography). Such use cases may be supported by other similar content profiles.

Add the following section to section 2.3

2.3 Actor Descriptions

…

Content Creator – a system that creates documents in accordance with a content profile

Content Consumer – a system that receives documents in accordance with a content profile

…

Table 2.3-1. Integration Profile Actors

Integration Profile / Actor	…	CIRC
…		
Content Creator		**X**
Content Consumer		**X**

Add Section 11

11 Cardiac Imaging Report Content (CIRC) Integration Profile

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- Echocardiography (transthoracic - TTE, transesophageal - TEE, and TTE stress)
- Cardiac computed tomography (angiography - CCTA, and coronary artery calcium scoring - CACS)
- Cardiac magnetic resonance (angiography - MRA, and MR stress)
- Cardiovascular nuclear medicine (SPECT myocardial perfusion, and positron emission tomography - PET)
- Diagnostic coronary catheter based fluoroscopy (interventional coronary angiography - ICA, and left ventriculography - LVG)

The CIRC Profile specifies the use of an HL7 Clinical Document Architecture (CDA) format for the report. This format supports both the human readable narrative historically used for clinical reports, as well as a substantial set of discrete data elements that may be used for longitudinal or population analysis or other computer processing.

Note: It is expected that future evolution of cardiology reporting will incorporate more robust and extensive sets of data elements. This Profile is a first step beyond simple narrative to interoperable discrete data elements.

Not included in the scope of this profile are non-imaging studies (e.g., ECG), electrophysiology procedures, interventional therapeutic procedures (e.g., angioplasty), and non-cardiology procedures (e.g., peripheral angiography). Such use cases may be supported by other similar content profiles.

It is assumed that there is a DICOM Study associated with the exam. If there is not a DICOM Study, this report content may not be appropriate. In addition to reference images, the DICOM Study data may include discrete data elements encoded in DICOM Structured Report information objects that may be transcoded into the discrete data elements specified in this Profile. (See the Evidence Documents Profile and its cardiology options in Section 7.)

The CIRC Profile does not presume to describe the complete content of an imaging study report. It does provide the framework of high level section titles and a set of discrete data elements. Within that framework reports can be created with the clinical content desired by their authors, including additional discrete data elements. In general, there are no constraints on the narrative text and figures that the cardiologist could include in the report document, although there are requirements on minimum data elements reflecting expert consensus (ACC/AHA/et al. 2008 Key Data Elements for Cardiac Imaging).

This profile also does not provide all of the details necessary to construct a CDA compliant document. Please refer to the HL7 CDA Release 2 Standard.

11.1 Actors/ Transactions

There are two actors in this profile, the Content Creator and the Content Consumer. Content is created by a Content Creator and is to be consumed by a Content Consumer. The sharing or transmission of content from one actor to the other is addressed by the appropriate use of other IHE profiles, and is out of scope of this profile; hence there is no transaction per se defined for this profile.

Figure 11.1-1 Cardiac Imaging Report Template Actor Diagram

Note: The primary intended transmission mechanism in the intra-institutional context is the IHE Displayable Reports Profile (DRPT), and in the inter-institutional context the IHE Cross Enterprise Document Sharing Profiles (XDS, XDM and XDR). A Report Creator, Document Source or a Portable Media Creator of those profiles may embody the Content Creator Actor. A Document Consumer, a Document Recipient or a Portable Media Importer may embody the Content Consumer Actor.

11.1.1 Actor Groupings

The Content Creator shall be grouped with Time Client actor of the IHE IT Infrastructure Consistent Time Profile, as specified in ITI TF-1:7. This allows the Legal Authentication timestamp to be accurate.

11.2 Cardiac Imaging Report Content Profile Options

Options that may be selected for this Content Profile are listed in Table 11.2-1 along with the Actors to which they apply. Dependencies between options when applicable are specified in notes.

Table 11.2-1 CIRC Profile Options

Actor	Option Name	Optionality	Section
Content Consumer	View Option	O (see 11.2.1)	PCC TF-2 :3.1.1
	Document Import Option	O (see 11.2.1)	PCC TF-2 :3.1.2
	Section Import Option	O (see 11.2.1)	PCC TF-2 :3.1.3
	Discrete Data Import Option	O (see 11.2.1)	PCC TF-2 :3.1.4
Content Creator	*No options defined*		

11.2.1 Content Consumer Options

The Content Consumer actor is required to support at least one of the View or Discrete Data Import options. The Document Import and Section Import options, if implemented, also require the View option. These options as specified in the PCC Technical Framework assume use of XDS or related profiles for transport; this Profile specifies bindings to other workflow profiles (see Section 11.5), and these options should be interpreted as applicable with any binding. See also Section 11.6.2.

11.3 Use Cases

11.3.1 Compile and transfer report of cardiac imaging procedure with use of key imaging data measures

This use case addresses the generation and transfer of a cardiac imaging report based on the ACC/AHA Key data Elements for Cardiac Imaging[1]. The initial content, structure and coding of the report to support this use case are detailed as part of this profile (see IHE CARD TF-2: 6 Content Modules). However various reporting system implementations, institute reporting guidelines and individual Reporting Physician usage may result in some variability in the specific report content provided.

Pre conditions

The systems underlying the data collection and management for the various elements of the procedure report has all the *mandatory* data elements identified using codes, and are expected to be the source for the information used in creating the *majority* of the structured imaging report document.

Main Flow

- Cardiologist reviews and/or records the codified
  - procedures and protocols used in the procedure
  - Image and related data generated from the various modalities and monitoring equipment used during the procedure so that they key physiological measures, acquired and derived are present in line with the ACC/AHA guidelines.
  - Other relevant patient characteristics
  - Medications documented for the patient both pre and during procedure.
  - Indications and observations/complications noticed during the procedure.
  - Findings, assessment and plan
- Cardiologist approves the procedure report and this marks it ready for distribution
- The content creator system will format the report appropriately (this profile) and send it via one of the IHE mechanisms to a content consumer system (an appropriate workflow profile).

Post conditions

The subsequent clinical stakeholder (system) receives the Document for import, processing and optionally viewing of the data.

11.3.2 Perform discrete data-analysis on procedure report content

The goal of this use case is to assist data collection for comparative and research purposes. Based on a report generated in the previous use cases an advanced medical data analysis system collects discrete data from multiple patients and their procedure, e.g., for cardiac Clinical Decision Support or for advance lifetime patient records.

Pre conditions

The content consumer (e.g., an advanced medical data analysis system) received a Cardiac Imaging Report with coded/structured content as defined in IHE CARD TF-2: 6.2 CDA Release 2 Content Modules.

Main Flow

The consuming system collects and processes the data from the various reports it receives and extracts those relevant data for either:

- A specific clinical concern for a population e.g., pre-populating a procedure-specific registry; extracting a data subset for a specific research question.
- A more comprehensive longitudinal patient record (e.g., an EMR) which can provide trending over time on an individual patient's key cardiac measures.

Post conditions

The content consumer generated new (derived) data for use by others. The type of data generated is out of the scope of this *profile.*

11.3.3 Review Procedure Report

A secondary use-case addressed by this profile involves the direct human use of the procedure report. In most practical cases this will be:

- The referring physician who instigated/ordered the procedure, and other healthcare providers who manage subsequent patient care activities
- Another person involved in downstream clinical or administrative data processing e.g., someone validating/source-checking for QA the original report as part of JCAHO audits, or pre-submission checking on the original reporting data against the case-data imported in the NCDR-PCI registry-submission application

Pre conditions

- The Reviewing Physician consumer has a system (EMR or other) capable of importing and displaying the received report in a clinically useful format
- The Cardiac Imaging Report has been received at this system

Note: This profile does not assume any explicitly specified relationship between the creator and consumer.

Main Flow

- The reviewing physician selects the report of his patient and opens it for review
- The system displays the human readable content for the reviewing physician to review

Post conditions

The Reviewer has extracted (visually) the necessary information from the report.

11.4 Security Considerations

Security considerations are dealt with by the transport mechanism (e.g., XDS, DRPT) and are outside the scope of this content profile. See PCC TF-1: 3.8

11.5 Grouping

Content modules describe the content of a payload found in an IHE transaction. Content profiles are transaction neutral. They do not have dependencies upon the transaction that they appear in.

A Content Creator or Content Consumer must be grouped with appropriate actors from workflow profiles that manage interchange of clinical data. Such groupings are described in this section.

Content profiles may impose additional requirements on the transactions used when grouped with actors from other IHE Profiles. The metadata sent in the document sharing or interchange messages has specific relationships to the content of the clinical document described in the

content profile. These mappings between the workflow metadata and the content attributes are described in Volume 2 of the Technical Framework.

11.5.1 Content Bindings for Displayable Reports (DRPT) and Image Enabled Office (IEO) Profiles

CDA documents using the CIRC content may be exchanged between a Report Creator and a Report Manager, as defined in the Displayable Reports (DRPT) and Image Enabled Office (IEO) Profiles using the Encapsulated Report Submission [CARD-7] transaction. In these cases, the CIRC Content Creator actor is grouped with the DRPT or IEO Report Creator actor, and the CIRC Content Consumer actor is grouped with the DRPT or IEO Report Manager actor.

11.5.2 Content Bindings for XDS, XDM, XDR, and XDS-I

It is expected that the transfers of care will occur in an environment where the physician offices and hospitals have a coordinated infrastructure that serves the information sharing needs of this community of care. Several mechanisms are supported by IHE profiles:

- A registry/repository-based infrastructure is defined by the IHE Cross Enterprise Document Sharing (XDS) and other IHE Integration Profiles such as patient identification (PIX & PDQ) and notification of availability of documents (NAV). An extension for imaging study exchange is Cross Enterprise Document Sharing for Imaging (XDS-I).
- A media-based infrastructure is defined by the IHE Cross Enterprise Document Media Interchange (XDM) profile.
- A reliable messaging-based infrastructure is defined by the IHE Cross Enterprise Document Reliable Interchange (XDR) profile.
- All of these infrastructures support Security and privacy through the use of the Consistent Time (CT) and Audit Trail and Node Authentication (ATNA) profiles.

For more details on these profiles, see the IHE IT Infrastructure Technical Framework, and the IHE Radiology Technical Framework for XDS-I.

Document Source and Document Consumer Actors from the ITI XDS, XDM and XDR profiles are logically grouped with the CIRC Content Creator and Content Consumer actors, respectively.

11.5.3 Content Binding for Portable Data for Imaging (PDI)

CDA documents using the CIRC content may be exchanged on interchange media in accordance with the Portable Data for Imaging (PDI) profile. Such documents may be encapsulated within DICOM SOP Instances, or may be native CDA documents, as described in the IHE Radiology Technical Framework. In this case, the CIRC Content Creator actor is grouped with the PDI Portable Media Creator actor, and the CIRC Content Consumer actor is grouped with the PDI Display or Portable Media Importer actors.

11.5.4 Content Binding for Retrieve Form for Data Capture (RFD)

A CDA document may be used for pre-population of a data entry form managed by actors of the Retrieve Form for Data Capture (RFD) Profile. In particular, the CIRC content, as a carrier of

discrete encoded data, may be used to prepopulate data entry forms for cardiovascular data registries. The CIRC profile has been developed with key data elements that support common research related data fields. This profile, however, does not provide mapping between CIRC field content and any specific registry field content. In this case, the CIRC Content Consumer actor is grouped with the RFD Form Manager actor for the purpose of extracting discrete data from the report to pre-populate the data capture form.

11.5.5 Relationship to Document Digital Signature (DSG)

When a Content Creator Actor needs to digitally sign a document in a submission set, it may support the Digital Signature (DSG) Content Profile as a Document Source. When a Content Consumer Actor needs to verify a Digital Signature, it may retrieve the digital signature document and may perform the verification against the signed document content.

11.6 Requirements of CIRC Actors

This section describes the specific requirements for each Actor defined within this profile. Specific details can be found in Volume 1 and Volume 2 of the technical framework.

Note: The IHE PCC Technical Framework includes additional requirements for actors associated with its Content Profiles. Those profiles are generally intended to be used in cross-enterprise exchanges of data, and therefore include actor requirements related to that environment. The CIRC profile has a significant intra-institutional intended use, and hence requirements not necessary for that environment have been excluded.

11.6.1 Content Creator

1. A Content Creator shall be able to create a Cardiac Imaging Report Document according to the specifications for that content profile found in CARD TF-2.
2. A Content Creator shall be grouped with the Time Client Actor, and shall synchronize its clock with a Time Server.

11.6.2 Content Consumer

1. A Content Consumer shall be able to consume (receive and process) a Cardiac Imaging Report document.
2. A Content Consumer shall implement the View Option or Discrete Data Import option, or both.
3. A Content Consumer that implements the Document Import or Section Import Option shall implement the View Option as well.
4. A Content Consumer that implements the View option shall be able to:
    a. Demonstrate rendering of the document for display.
    b. Print the document.
    c. Display the document with its original style sheet.
    d. Support traversal of any links contained within the document.

5. A Content Consumer that implements the Document Import Option shall:
    a. Store the document.
    b. Demonstrate the ability to access the document again from that storage.
6. A Content Consumer that implements the Section Import Option shall offer a means to import one or more document sections into the patient record as free text.
7. A Content Consumer that implements the Discrete Data Import Option shall offer a means to import structured data from one or more sections of the document.

Volume 2 – Transactions and Content Modules

Update section 3

3 Framework Overview

The IHE Technical Framework is based on actors that interact through transactions**; those transactions may be further qualified with respect to their content**.

3.1 Actors and Transactions

Actors are information systems or components of information systems that produce, manage, or act on information associated with operational activities in the enterprise.

Transactions are interactions between actors that transfer the required information through standards-based messages.

Specific sets of actors and transactions are specified in the Integration Profiles (see CARD TF-1). **While transactions are described in this volume (CARD TF-2), the role and implementation of these transactions require the understanding of the Integration profile they support.**

Add new section 3.2

3.2 Content Modules

There is often a very clear distinction between the transactions in a messaging framework used to package and transmit information, and the information content actually transmitted in those messages. This is especially true when the messaging framework begins to move towards mainstream computing infrastructures being adopted by the healthcare industry.

In these cases, the same transactions may be used to support a wide variety of use cases in healthcare, and so more and more the content and use of the message also needs to be profiled, sometimes separately from the transaction itself. Towards this end IHE has developed the concept of a Content Integration Profile.

Content Integration Profiles specify how the payload of a transaction fits into a specific use of that transaction. A content integration profile has three main parts. The first part describes the use case (this is found in Volume 1 in the definition of each Profile). The second part is a Content Module (found in this Volume 2), which describes the payload of the transaction; a content module is specified so as to be independent of the transaction in which it appears. The third part is binding to a specific IHE transaction, which describes how the content affects the

transaction. The binding of CDA-based medical documents to workflow transactions is described in the Profile definition in Volume 1 (e.g., see IHE CARD TF-1:11.5).

Add new section 5

5 Namespaces and Vocabularies

This section lists the namespaces and identifiers defined or referenced by the IHE Cardiology Technical Framework, and the vocabularies defined or referenced herein.

codeSystem	codeSystemName	Description
1.3.6.1.4.1.19376.1.5.3.1	IHE PCC Template Identifiers	This is the root OID for all IHE PCC Templates. A list of PCC templates can be found in IHE PCC TF-2:6.2 (CDA Release 2.0 Content Modules).
1.3.6.1.4.1.19376.1.4.1	IHE Cardiology Template Identifiers	This is the root OID for all IHE Cardiology Templates.
2.16.840.1.113883.5.112	RouteOfAdministration	The HL7 RouteOfAdministration coding scheme
2.16.840.1.113883.5.7	ActPriority	The HL7 ActPriority coding scheme
2.16.840.1.113883.6.1	LOINC	Logical Observation Identifier Names and Codes
2.16.840.1.113883.6.96	SNOMED CT	SNOMED Controlled Terminology
2.16.840.1.113883.6.88	RxNorm	RxNorm
1.2.840.10008.2.16.4	DCM	DICOM Controlled Terminology; PS 3.16 Content Mapping Resource, Annex D
2.16.840.1.113883.6.24	MDC	ISO/IEEE 11073 Medical Device Nomenclature
2.16.840.1.113883.3.26.1.5	NDF-RT	National Drug File Reference Terminology (NCI version)
2.16.840.1.113883.11.19465	nuccProviderCodes	National Uniform Codes Council Healthcare Provider Terminology
2.16.840.1.113883.6.255.1336	X12DE1336	Insurance Type Code (ASC X12 Data Element 1336)
2.16.840.1.113883.6.256	RadLex	RadLex (Radiological Society of North America)

5.1 IHE Format Codes

The table below lists the format codes, root template identifiers and media types used by the IHE Profiles specified in the Cardiology Technical Framework.

Note that the code system for these codes is **1.3.6.1.4.1.19376.1.2.3** as assigned by the ITI Domain for codes used for the purposes of cross-enterprise document sharing (XDS).

Profile	Format Code	Media Type	Template ID

Profile	Format Code	Media Type	Template ID
Cardiac Imaging Report	urn:ihe:card:imaging:2011	text/xml	1.3.6.1.4.1.19376.1.4.1.1.1

Add new section 6

6 Content Modules

6.1 Conventions

6.1.1 Content Module Conventions

6.1.1.1 Cardinality Constraints

Within Section 6, the following conventions are used to describe data element cardinality constraints.

The cardinality expresses the number of times an attribute or association may appear in a CDA document instance that conforms to the specifications described within section 6. Cardinality is expressed as a minimum and a maximum value separated by '..', and enclosed in '[ ]', e.g., '[0..1]'.

Minimum cardinality is expressed as an integer that is equal to or greater than zero. If the minimum cardinality is zero, the element need only appear in message instances when the sending application has data with which to value the element. Mandatory elements must have a minimum cardinality greater than zero.

The maximum cardinality is expressed either as a positive integer (greater than zero and greater than or equal to the minimum cardinality) or as unlimited using an asterisk ("*").

6.1.1.2 Data Element Optionality Constraints

Within Section 6, the following conventions are used to describe data element optionality constraints. Where applicable, the "interaction" between cardinality constraints and optionality constraints are also described below.

Table 6.1.1.2-1 Data Element Optionality Constraints

Optionality	Description
M	A "Mandatory" section, entry or data element is one that SHALL always be provided. If there is information available, the element must be present and non-null. If there is no information available, or it cannot be transmitted, the data element must contain a value indicating the reason for omission of the data. Note that any element declared to be "Mandatory" must also be "Required" and have a minimum cardinality of one.
R	A "Required" section, entry or element SHALL be included in the document if its minimum cardinality is one. If the data exists, the sending application SHALL send it as a non-null value or a non-empty element. If the data does not exist and if the minimum cardinality is greater than zero, then the sending application SHALL send an appropriate null value. Only if data does not exist for a required element and that element has a minimum cardinality of 0 MAY the required element be

Optionality	Description
	omitted in a document. In all cases, if a required element is present in a document received by an actor claiming support for the Profile, then it SHALL be correctly processed by the receiving actor. A receiving actor SHALL NOT raise an error due to the absence of a required element with a cardinality of 0, although it MAY issue a warning that required information is missing. For required elements, conforming applications must demonstrate their ability to provide and communicate not null values. Receiving applications must demonstrate their ability to receive and process (e.g., store, or display to users) not null values for required elements. This is equivalent to a SHOULD requirement.
O	An optional data element is one that MAY be provided, whether the information is available or not. If the implementation elects to support this optional section, then its support shall meet the requirement set forth for the "Required" or R.
C	A conditional data element is one that is required, or optional, depending upon other conditions. These will have further notes explaining when the data element is required.

Note: The definitions of M, R, and O are consistent with HL7 v3 Conformance profiles, but differ slightly from the 2010 and earlier versions of IHE Patient Care Coordination Content or Workflow profiles. It is expected that all IHE Technical Framework documents will converge to these HL7-based definitions.

6.1.1.3 Coded Terminology Values

Coded terminology values are used extensively, and are encoded in CDA documents using the CD (Concept Descriptor) data type. Generally, these values are specified in Profile requirements using a triplet of the code value (encoded in XML attribute `code`), the coding scheme (encoded in XML attribute `codeSystemName`), and the code meaning (encoded in XML attribute `displayName`). When necessary to disambiguate such a triplet from the rest of the specification text, it may be enclosed in curly braces, e.g., {160245001, SNOMED CT, “No current problems or disability”}.

Representation of a coded terminology value in the CD data type requires encoding of the coding scheme OID in XML attribute `codeSystem`. For readability, these OIDs are not elaborated in the specification text. Content Creator actors must use the appropriate OIDs from Section 5 in encoding CD data type values.

Unless otherwise specified, value sets are specified with STATIC stability and have CWE (Coded With Extensibility) coding strength, as defined in the HL7 Core Principles and Properties of v3 Models. That is, the version of the value set as of the date of publication of the Profile is binding, and an implementation may use coded concepts not present in the value set.

6.1.2 Structure of Content Modules

For CDA Release 2 the Content Modules are organized by document, section, entry, and header elements.

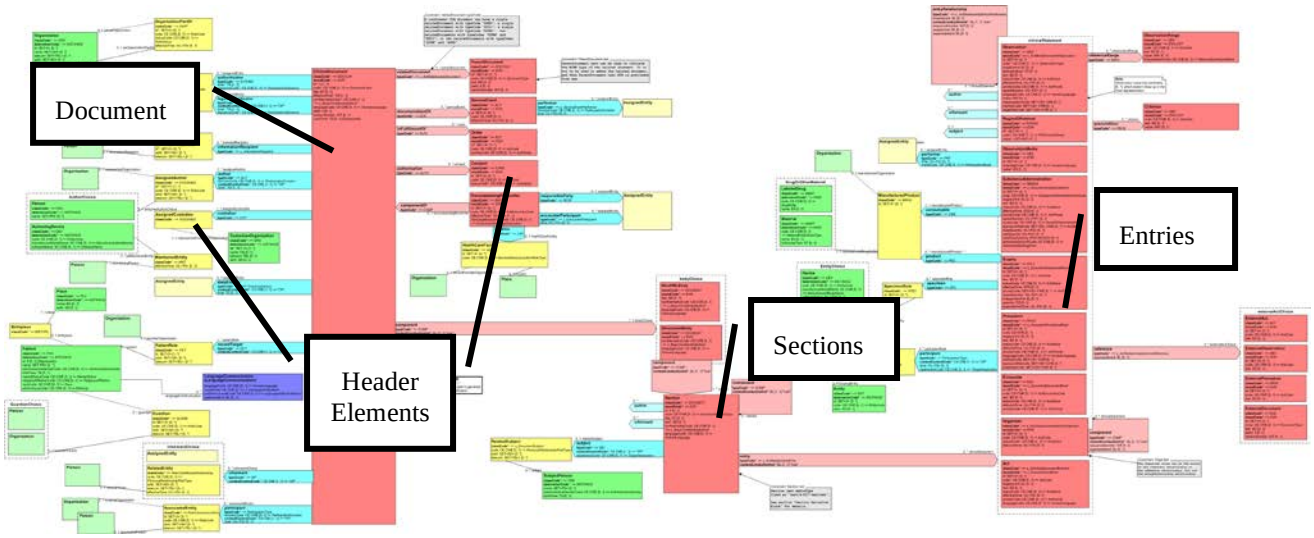

Figure 6.1.2-1 CDA R2 R-MIM with location of Document, Sections, and Entries

Each content module is defined in terms of constraints that must be obeyed by instances of that content module, in effect a contract between the Content Creator and the Content Consumer. Each content module has a name, also known as its template identifier. The template identifiers are used to identify the contract implied by the content module.

Content modules may inherit features of other content modules of the same type (Document, Section, or Entry) by defining the parent content module that they inherit from. They may not inherit features from a different type. Although information in the CDA Header is in a different location than information in a CDA Entry, these two content modules are considered to be of the same type, and so may inherit from each other when necessary.

Each content module has a list of data elements that are mandatory (M), required if known (R), optional (O), and conditional (C). The presentation of this information varies with the type of content module, and is described in more detail below. Additional data elements may be provided by the sender that are not defined by a specific content module, but the receiver is not required to interpret them. Thus, it is not an error to include more than is asked for, but it is an error to reject a content module because it contains more than is defined by the template. This allows values to be added to the content modules delivered in this framework, through extensions to it that are not defined or profiled by IHE. It further allows content modules to be defined later by IHE that are refinements or extensions over previous content modules.

In order to retain this capability, constraints that apply to any content module will always apply to any content modules that inherit from it. Thus, the "contracts" are always valid down the

inheritance hierarchy. Second, data elements of a content module will rarely be deprecated. This will usually occur only in the cases where they have been deprecated by the base standard. While any specific content module has a limited scope and set of use cases, deprecating the data element prevents any future content module from taking advantage of what has already been defined when a particular data element has been deprecated simply because it was not necessary in the original use case.

6.1.2.1 Document Content Modules

Each **document** content module will define the appropriate codes used to classify the document, and will also describe the specific section and header data elements that are included. The code used to classify it is specified using an external vocabulary, typically LOINC in the case of CDA Release 2 documents. The set of data elements that make up the document are defined, including the whether these data elements must, should or may be included in the document. Each data element is mapped to a lower level content module via a template identifier, and the document content module will further indicate whether these data elements are mandatory, required if known or optional. Thus, a document content module contains as constraints:

- The template identifier of the parent content module when there is one.
- The LOINC code or codes that are used to classify the document.
- A possibly empty set of mandatory, required if known, and optional header content modules, and their template identifiers.
- A possibly empty set of mandatory, required if known, and optional section content modules, and their template identifiers.
- Other constraints as necessary.

The order of section content modules is not specified; sections may appear in any order, and may be nested, in accordance with local implementation style specifications.

6.1.2.1.1 Document Content Module Table

The Document Content Module is specified using the following table.

Template ID				
Parent Template				
General Description				
Document Code				
Opt	**Data Element or Section Name**	**Template ID**	**Specification Document**	**Constraint**
Header Elements				
Sections				

This table implies the following conformance statements:

1. The document SHALL include the specified Template ID in the <templateID> element of the <clinicalDocument> act element (the CDA root act).
2. The document SHALL conform to all the requirements of the specified Parent Template(s).
3. The document SHALL include the specified Document Code in the <code> element of the <clinicalDocument> act element, except if the specified Document Code includes the keyword “SHOULD or “MAY”; in the latter case, this requirement is relaxed to the requirement strength of those keywords.
4. The document SHALL include the specified Header Elements in accordance with their specified Cardinality and Optionality (Opt column value, as described in Section 6.1.1), in accordance with the specified Template ID and further constraints specified in the identified Technical Framework section.
5. The document SHALL include the specified Sections in accordance with their specified Cardinality and Optionality (Opt column value, as described in Section 6.1.1), in accordance with the specified Template ID and further constraints specified in the identified Technical Framework section.

Note: The further constraints are typically specific value sets to be applied to code elements in the template.

The Document Content Module table may be supplemented with additional specific conformance requirements.

6.1.2.2 Section Content Modules

Section content modules will define the content of a section of a clinical document. Sections will usually contain narrative text, and so this definition will often describe the information present in the narrative, although sections may be wholly comprised of subsections.

Sections may contain various subsections, and these may be mandatory, required if known or optional. Sections may also contain various entries, and again, these may be mandatory, required if known, or optional. A section may not contain just entries; it must have at least some narrative text or subsections to be considered to be valid content.

Sections can inherit constraints from another parent section content module. Sections are classified using an external vocabulary (again typically this would be LOINC, although in some cases DICOM), and so the list of possible section codes is also specified. Sections that inherit from another section module will specify the same section code(s) as its parent, unless it further restricts the type of section to smaller set of codes.

Thus, a section content module will contain as constraints:

- The template identifier of the parent content module when there is one.
- The code or codes that shall be used to classify the section.
- A possibly empty set of mandatory, required if known, and optional section content modules, and their template identifiers for the subsections of this section.
- A possibly empty set of mandatory, required if known, and optional entry content modules, and their template identifiers.
- Other constraints as necessary.

6.1.2.2.1 Section Content Module Table

The Section Content Module is specified using the following table.

Template ID				
Parent Template				
General Description				
Section Code				
Opt	**Data Element or Section Name**	**Template ID**	**Specification Document**	**Constraint**
Subsections				
Entries				

This table implies the following conformance statements:

1. The section SHALL include the specified Template ID in the <templateID> element of the <section> act element.
2. The section SHALL conform to all the requirements of the specified Parent Template.

3. The section SHALL include the specified Section Code in the <code> element of the <section> act element, except if the specified Section Code includes the keyword "SHOULD or "MAY"; in the latter case, this requirement is relaxed to the requirement strength of those keywords.
4. The section SHALL include the specified Subsections in accordance with their specified Cardinality and Optionality (Opt column value, as described in Section 6.1.1), in accordance with the specified Template ID and further constraints specified in the identified Technical Framework section.
5. The section SHALL include the specified Entries in accordance with their specified Cardinality and Optionality (Opt column value, as described in Section 6.1.1), in accordance with the specified Template ID and further constraints specified in the identified Technical Framework section.

The Section Content Module table may be supplemented with additional specific conformance requirements.

6.1.2.2.2 Observation Entry Constraint Table

Constraints on Entries may be further specified using the following table. The template for the entry (typically the IHE PCC Simple Observation template) is specified by the invoking table, for which this table provides additional constraint specifications. Multiple rows may be present in the table to specify constraints on multiple entries based on a template invoked with cardinality greater than 1.

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set

This table implies the following conformance statements:

1. There SHALL be entries in accordance with each row in the table in accordance with the specified Cardinality and Optionality (Opt column value, as described in Section 6.1.1).
2. Conditional (C) entries SHALL be present in accordance with the specified Exam Type Condition.

   Note: The exam type is specified in the CDA Header in the documentationOf / serviceEvent / code element.
3. The entry SHALL include the specified observation / code element value, and the specified targetSiteCode and/or methodCode elements if present in the table.

   Note: The codes may be specified as a value selected from an identified Value Set.
4. The entry SHALL include a value of the specified Data Type.
5. If Data Type is PQ, the entry value SHALL use the specified Unit of Measure.
6. If Data Type is CD, the entry value SHALL be selected from the specified Value Set.

   Notes: 1. The code may be specified as a single value, rather than as a selection from a Value Set.

2. The Value Set table entry may indicate the presence of additional constraints, e.g., for specification of severity, by a '+' and a constraint type. Such additional constraints will have specific requirements specified outside the table.

6.1.2.3 Entry and Header Content Modules

Entry and **Header** content modules are the lowest level of content for which content modules are defined. These content modules are associated with classes from the HL7 Reference Information Model (RIM). These "RIM" content modules will constrain a single RIM class. Entry content modules typically constrain an "Act" class or one of its subtypes, while header content modules will normally constrain "Participation", "Role" or "Entity" classes, but may also constrain an "Act" class.

Entry and Header content modules describe the mandatory, required if known, and optional XML elements and attributes that are present in the CDA Release 2 instance. Header and Entry content modules may also be built up using other Header and Entry content modules. An entry or header content module may also specify constraints on the vocabularies used for codes found in the entry, or data types for the values found in the entry. Thus, an entry or header content module will contain as constraints:

- The template identifier of the parent content module when there is one.
- A description of the XML elements and attributes used in the entry, along with explanations of their meaning.
- An indication of those XML elements or attributes that are mandatory, required if known, or optional.
- Vocabulary domains to use when coding the entry.
- Data types used to specify the value of the entry.
- Other constraints as necessary.

6.1.2.3.1 Header Content Module Table

A Header Content Module is specified using the following table.

Template ID	
Parent Template	
General Description	
Header Element	
Code	

Opt	Participation	Description	Template	Spec Document	Con-straint

This table implies the following conformance statements:

1. The specified Header Element SHALL be present in the CDA header.

Note: This is limited by the Cardinality and Optionality of the header data element as specified in the template that invokes this Content Module.

2. The header data element SHALL include the specified Template ID in the <templateID> element of the relevant act element.
3. The header data element SHALL conform to all the requirements of the specified Parent Template.
4. The header data element SHALL include the specified Code in the <code> element, except if the specified Code includes the keyword “SHOULD or “MAY”; in the latter case, this requirement is relaxed to the requirement strength of those keywords.
5. The header data element SHALL include the specified subsidiary Participation data elements in accordance with their specified Cardinality and Optionality (Opt column value, as described in Section 6.1.1), using the specified Participation <typeCode> element, and in accordance with the specified Template ID and further constraints specified in the identified Technical Framework section.

The Header Content Module table may be supplemented with additional specific conformance requirements.

6.1.2.3.2 Entry Content Module Table

An Entry Content Module is specified using the following table.

Template ID	
Parent Template	
General Description	

Class/Mood	**Code**	**Value Type**	**Value**

Opt	**entryRelationship**	**Description**	**Template**	**Spec Document**	**Con-straint**

This table implies the following conformance statements:

1. The entry SHALL include the specified Template ID in the <templateID> element of the clinical statement act element.
2. The entry SHALL conform to all the requirements of the specified Parent Template.
3. The entry SHALL include the specified classCode and moodCode values, and be conformant to the HL7 v3 requirements of that Act Class and Mood.

4. The entry SHALL include the specified entry Code in the <code> element of the clinical statement act element, except if the specified Section Code includes the keyword "SHOULD or "MAY"; in the latter case, this requirement is relaxed to the requirement strength of those keywords.
5. If of Class/Mood OBS/EVN, the entry SHALL include a value of the specified Data Type.
6. If Data Type is CD, the entry value SHALL be the specified Value.

   Note: The code may be specified as a value selected from an identified Value Set.

7. The entry SHALL include the specified subsidiary Entries in accordance with their specified Cardinality and Optionality (Opt column value, as described in Section 6.1.1), using the specified entryRelationship <typeCode> element, and in accordance with the specified Template ID and further constraints specified in the identified Technical Framework section.

The Entry Content Module table may be supplemented with additional specific conformance requirements.

6.1.2.4 Value Sets

Value sets, which are potentially reusable in a variety of contexts, are described separately from the content modules. Each value set is identified by name and OID, and its constituent concept values are listed in a table.

Value sets concepts may be drawn from multiple coding systems and some concepts may be represented in more than one coding system. When there is a choice of coding system, the content module that invokes the value set may establish constraints on when to use a particular system (e.g., based on local policy or national regulation). The content module that invokes the value set may also establish constraints on whether concepts not in the defined value set can be used (e.g., using the HL7 CWE [coded with exceptions] and CNE [coded no exceptions] domain qualifiers); unless otherwise specified, the value set is extensible (CWE). The HL7 v3 CD data type allows the representation of a concept by a code together with a translation code in a different coding system; when multiple codes are provided for a concept, use of such translation codes is recommended.

6.2 CDA Release 2 Content Modules

6.2.1 Document Modules

6.2.1.1 Cardiac Imaging Report Specification 1.3.6.1.4.1.19376.1.4.1.1.1

This is the template for Cardiac Imaging Reports with discrete data elements as described in the ACC/AHA/et al. 2008 Key Data Elements and Definitions for Cardiac Imaging. The Template ID for conformance to this template is OID = 1.3.6.1.4.1.19376.1.4.1.1.1.

6.2.1.1.1 Format Code

The XDSDocumentEntry format code for this content is **urn:ihe:card:imaging:2011**

The mapping of CDA header attributes to XDS metadata shall be identical to the XDS-MS mapping specified in PCC TF-2: 4.1.1.

6.2.1.1.2 Parent Template

This document is a specialization of the IHE PCC Medical Document template (OID = 1.3.6.1.4.1.19376.1.5.3.1.1.1).

Note: The Medical Document includes requirements for various header elements; name, addr and telecom elements for identified persons and organizations; and basic participations record target, author, and legal authenticator.

This document is a specialization of the HL7 Procedure Note template (OID = 2.16.840.1.113883.10.20.18.1).

Note: This document is not a specialization of the HL7 Basic Diagnostic Imaging Report template due to conflicts with two Procedure Note requirements (format of serviceEvent/effectiveTime, and title on DICOM Catalogue section). When and if these are resolved, an instance may also comply to the Diagnostic Imaging Report.

6.2.1.1.3 Clinical Document Code

The ClinicalDocument/code for this document MAY be **18748-4 Diagnostic Imaging Study report** 2.16.840.1.113883.6.1 LOINC STATIC.

Note: Procedure Note specifies a list of alternate document codes. The selection of an appropriate document type code will depend on the intended access workflow, and may vary by local policy. As a query key, the code should allow efficient access to all relevant reports, while minimizing the number of query key values from which a user must choose. The LOINC code identified here was selected under the assumption that a clinical user looking for a cardiac imaging report would typically be interested in seeing all diagnostic imaging reports for the patient.

Additional codes may be found in CDA-PN.

6.2.1.1.4 Standards

Table 6.2.1.1.4

KDECI	ACC/AHA/et al. 2008 Key Data Elements and Definitions for Cardiac Imaging	http://content.onlinejacc.org/cgi/content/full/53/1/91

CDAR2	HL7 CDA Release 2.0	http://www.hl7.org/documentcenter/private/standards/cda/r2/cda_r2_normativewebedition2010.zip
CDA-PN	HL7 Implementation Guide for CDA Release 2: Procedure Note (Universal Realm) (DSTU)	http://www.hl7.org/documentcenter/public/standards/dstu/CDAR2_IG_PROCNOTE_DSTU_R1_2010JUL.zip
CDA-DIR	Implementation Guide for CDA Release 2: Imaging Integration: Basic Imaging Reports in CDA and DICOM Diagnostic Imaging Reports (DIR) – Universal Realm (Informative)	http://www.hl7.org/documentcenter/private/standards/cda/igs/cdar2_ii_bimgrpts_r1_inf_2009mar.zip
CCD	ASTM/HL7 Continuity of Care Document Implementation Guide for CDAr2	http://www.hl7.org/documentcenter/private/standards/cda/igs/HL7_CCD_final.zip
PCC TF-2	IHE PCC Technical Framework Volume 2 Content Modules	http://www.ihe.net/Technical_Framework/upload/IHE_PCC_TF_Rev6-0_Vol_2_2010-08-30.pdf
DICOM	NEMA PS3.16 – DICOM Part 16: Content Mapping Resource	ftp://medical.nema.org/medical/dicom/2009/09_16pu.pdf

6.2.1.1.5 Data Element Requirements

Table 6.2.1.1.5-1 presents a summary of the data element requirements of KDECI, and their general mapping to sections in referenced CDA Implementation Guides. The data elements are summarized by category, and the number of discrete data elements in each category is listed. Implementation Guide sections listed in boldface are required in their respective standards.

Table 6.2.1.1.5-1 Summary of Data Element Requirements

KDECI	CDA-DIR	CDA-PN	CCD	PCC TF Medical Document
	DICOM Object Catalog (5)			
Administrative Facility (5) Data Source (1) Priority (1) Accreditation (2) Insurance (1)	**CDA Header** General (10) Document (19) Participants (20) Order (1) Service Event (12) Encounter (10)	**CDA Header**	**CDA Header**	**CDA Header**
Demographics (5)			Payers	
Study Referral Data (2)	Request			
History and Risk Factors	History	Medical History	Problems	

KDECI	CDA-DIR	CDA-PN	CCD	PCC TF Medical Document
Vital Signs (4) Labs (2) Problems (14) Chest Pain (5) Family History (1) Tobacco Use (1) Risk Estimates (6) Functional assessment (2) Prior Tests (2) Prior Procedures (4) Medications (2) Contrast Reaction (1)		History of Present Illness		
		Social History	Social History	
		Family History	Family History	
		Procedure History	Procedures	
	Patient Presentation	Physical Examination		
		Vital Signs	Vital Signs	
			Functional status	
	Previous Findings		Results	
		Medication History	Medications	
		Allergies	Alerts	
Study Description Identification (2) Indication (2) Physician (3) Procedure (1) Acquisition Parameters (14) Stress Method (4)		Planned Procedure		
	Current Procedure Descriptions	**Procedure Description**		
	Indications for Procedure	**Procedure Indications**		
		Medications Administered		
	Complications	**Complications**		
Study Findings—Ischemic Heart Disease (25)	**Findings**	Procedure Findings		
Study Findings—LV Function (6)				
Study Findings—Cardiac Morphology Chambers (6) Myocardium (5) Pulmonary Veins (1) Intracardiac Mass (1) Intracardiac Shunt (1) Pericardium (4) Valves (15) Aorta (3)				
Study Findings—Summary (6)	Summary	**Postprocedure Diagnosis**		
	Conclusions	**Assessment and/or Plan**		
	Recommendations			
	Key Images			

The data elements in KDECI are specified only as named concepts, with value sets as lists of terms. This document template (including its subsidiary section and entry templates) maps those concepts to appropriate coded concepts from SNOMED CT, LOINC, DICOM, or NDF-RT, using existing value sets from DICOM where applicable.

Note: In DICOM, value sets are known as Context Groups, and are identified by a Context Group ID (CID) as well by as an OID.

The "Recommended" data element requirement from KDECI is generally interpreted as a Required (R) data element optionality constraint in this profile (see Section 6.1.1.2).

6.2.1.1.6 Specification

This section specifies lower level content modules comprising the Cardiac Imaging Report, using Template ID as the key identifier.

Sections that are used according to the definitions in other specifications are identified with the relevant specification document. Additional constraints on vocabulary value sets, not specifically constrained within the section template, are also identified.

Table 6.2.1.1.6-1 Cardiac Imaging Report Content Specification

Template ID	1.3.6.1.4.1.19376.1.4.1.1.1
Parent Template	Medical Document 1.3.6.1.4.1.19376.1.5.3.1.1.1 [PCC TF-2] Procedure Note 2.16.840.1.113883.10.20.18.1 [CDA-PN]
General Description	The Cardiac Imaging Report Content template specifies the content structure for a clinical report of a cardiology imaging exam, recorded in a DICOM Study. Such exams include: • Echocardiography (transthoracic – TTE, transesophageal – TEE, and TTE stress) • Cardiac computed tomography (angiography – CTA, and coronary artery calcium scoring – CACS) • Cardiac magnetic resonance (angiography – MRA, and MR stress) • Cardiovascular nuclear medicine (SPECT myocardial perfusion, positron emission tomography – PET) • Diagnostic coronary catheter based fluoroscopy (interventional coronary angiography – ICA, and left ventriculography – LVG) The template uses discrete data elements as described in the ACC/AHA/et al. 2008 Key Data Elements and Definitions for Cardiac Imaging.
Document Code	MAY be 18748-4, LOINC, "Diagnostic Imaging Study report"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Header Elements				
M [1..1]	Encompassing Encounter	1.3.6.1.4.1.19376.1.4.1.3.1	CARD TF-2 6.2.3.1	
R [0..1]	Order	1.3.6.1.4.1.19376.1.4.1.3.2	CARD TF-2 6.2.3.2	

M [1..1]	Patient Demographics	1.3.6.1.4.1.19376.1.4.1.3.3	CARD TF-2 6.2.3.3	
M [1..1]	Service Event and Performer	1.3.6.1.4.1.19376.1.4.1.3.4	CARD TF-2 6.2.3.4	CARD TF-2 6.2.1.1.6.1
M [1..1]	Legal Authenticator	1.3.6.1.4.1.19376.1.4.1.3.5	CARD TF-2 6.2.3.5	
Sections				
M [1..1]	Medical History (Cardiac)	1.3.6.1.4.1.19376.1.4.1.2.1	CARD TF-2 6.2.2.1	
M [1..1]	Medications	1.3.6.1.4.1.19376.1.5.3.1.3.19	PCC TF-2	CARD TF-2 6.2.1.1.6.2
M [1..1]	Allergies and Other Adverse Reactions	1.3.6.1.4.1.19376.1.5.3.1.3.13	PCC TF-2	CARD TF-2 6.2.1.1.6.3
R [1..1]	Coded Social History	1.3.6.1.4.1.19376.1.5.3.1.3.16.1	PCC TF-2	CARD TF-2 6.2.1.1.6.4
R [1..1]	Family History (Cardiac)	1.3.6.1.4.1.19376.1.4.1.2.5	CARD TF-2 6.2.2.2	
O [0..1]	Physical Examination	2.16.840.1.113883.10.20.2.10	CDA-PN	
R [1..1]	Vital Signs	1.3.6.1.4.1.19376.1.5.3.1.3.25	PCC TF-2	
R [1..1]	Prior Results (Cardiac)	1.3.6.1.4.1.19376.1.4.1.2.6	CARD TF-2 6.2.2.3	
O [0..1]	Cardiac Risk Assessment	1.3.6.1.4.1.19376.1.4.1.2.7	CARD TF-2 6.2.2.4	
M [1..1]	Indications and Planned Procedure	1.3.6.1.4.1. 19376.1.4.1.2.8	CARD TF-2 6.2.2.5	CARD TF-2 6.2.1.1.6.5
R [1..1]	Cardiac Procedure Description	1.3.6.1.4.1.19376.1.4.1.2.9	CARD TF-2 6.2.2.6	
O [0..1]	Medications Administered	2.16.840.1.113883.10.20.18.2.8	CDA-PN	CARD TF-2 6.2.1.1.6.6
R [1..1]	Procedure Findings (Cardiac)	1.3.6.1.4.1.19376.1.4.1.2.11	CARD TF-2 6.2.2.7	
R [1..1]	Complications / Adverse Events	2.16.840.1.113883.10.20.18.2.4	CDA-PN	
R [1..1]	Postprocedure Diagnosis	2.16.840.1.113883.10.20.18.2.3	CDA-PN	
R [1..1]	Assessment And Plan (Cardiac)	1.3.6.1.4.1.19376.1.4.1.2.12	CARD TF-2 6.2.2.8	
O [0..1]	Key Images	1.3.6.1.4.1.19376.1.4.1.2.14	CARD TF-2 6.2.2.10	
C [1..1]	DICOM Object Catalog	1.3.6.1.4.1.19376.1.4.1.2.15	CARD TF-2 6.2.2.11	CARD TF-2 6.2.1.1.6.7
O [0..1]	Payer	1.3.6.1.4.1.19376.1.5.3.1.1.5.3.7	PCC TF-2	

6.2.1.1.6.1 Service Event Constraints

The value for serviceEvent / code SHOULD be drawn from value set 1.3.6.1.4.1.19376.1.4.1.5.2 Cardiac Imaging Procedures.

6.2.1.1.6.2 Medications Section Constraints

Within the Medications section the Content Creator SHALL be able to create a Medications entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.7 [PCC TF-2]) for each of the cardiac relevant medications identified in Value Set 1.3.6.1.4.1.19376.1.4.1.5.14 Cardiac Drug Classes, encoding the value in substanceAdministration/consumable/ManufacturedProduct/Material/code.

6.2.1.1.6.3 Allergies and Other Adverse Reactions Section Constraints

Within the Allergies and Other Adverse Reactions section the Content Creator SHALL be able to create an Allergies and Intolerances Concern Entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.5.3 [PCC TF-2]) for each of the cardiac imaging agent classes identified in Value Set 1.3.6.1.4.1.19376.1.4.1.5.10 Contrast Agents Classes for Adverse Reactions, encoding the value in observation/participant/participantRole/playingEntity/code.

6.2.1.1.6.4 Coded Social History Section Constraints

Within the Coded Social History section the Content Creator SHALL be able to create a Social History Observation Entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.13.4 [PCC TF-2]) with observation/code value {229819007, SNOMED CT, Tobacco use and exposure} and a CD data type observation/value from Value Set 1.2.840.10008.6.1.225 DICOM CID 3724 Smoking History.

Within the Coded Social History section the Content Creator SHALL be able to create a Social History Observation Entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.13.4 [PCC TF-2]) with observation/code value {363908000, SNOMED CT, Details of drug misuse behavior} and a CD data type observation/value of {78267003, SNOMED CT, Cocaine abuse}.

6.2.1.1.6.5 Indications and Planned Procedure Section Constraints

Within the Indications and Planned Procedure section the Content Creator SHALL be able to create a Problem Entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.5 [PCC TF-2]) for any of the cardiac relevant indications identified in Value Set 1.3.6.1.4.1.19376.1.4.1.5.27 Cardiac Imaging Procedure Indications.

6.2.1.1.6.6 Medications Administered Section Constraints

Within the Cardiac Procedure Description or the Medications Administered section the Content Creator SHALL be able to create a Medications entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.7 [PCC TF-2]) for each of the cardiac medication classes identified in Value Set 1.3.6.1.4.1.19376.1.4.1.5.15 Drug Classes Used in Cardiac Procedure, encoding the value in substanceAdministration/consumable/ManufacturedProduct/Material/code.

Within the Cardiac Procedure Description or the Medications Administered section the Content Creator SHALL be able to create a Medications entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.7 [PCC TF-2]) for the relevant cardiac contrast agents identified in Value Set 1.3.6.1.4.1.19376.1.4.1.5.11 Contrast Agents, encoding the value in substanceAdministration/consumable/ManufacturedProduct/Material/code.

Notes: 1. The set of contrast agents implemented may be limited to a subset of the Value Set, based on the types of procedures for which the Content Creator creates reports, hence the term "*relevant* cardiac contrast agents".

2. The Medications Administered section may be structured as a subsection of the Cardiac Procedure Description section.

6.2.1.1.6.7 DICOM Object Catalog Section Constraints

A DICOM Object Catalog Section SHALL be present if other document sections contain references to DICOM SOP Instances (images, structured report measurements, or other information objects), and MAY be present otherwise.

6.2.1.1.7 Conformance

CDA Release 2.0 documents that conform to the requirements of this document content module shall indicate their conformance by the inclusion of the <templateId> XML elements in the header of the document. A CDA Document may conform to more than one template. This content module inherits from the CDA-PN and the PCC TF Medical Document content modules, and so must conform to the requirements of those templates as well the Cardiac Imaging Report templates. This is shown in the sample document below, which includes <templateId> elements for the OIDs of all three templates.

```
<ClinicalDocument xmlns='urn:hl7-org:v3'>
 <typeId extension="POCD_HD000040" root="2.16.840.1.113883.1.3"/>
 <templateId root='1.3.6.1.4.1.19376.1.5.3.1.1.1'/>
 <templateId root='1.3.6.1.4.1.19376.1.4.1.1.1'/>
 <templateId root='2.16.840.1.113883.10.20.18.1'/>
 <id root=' ' extension=' '/>
 <code code='18748-4' displayName='Diagnostic Imaging Study report'
  codeSystem='2.16.840.1.113883.6.1' codeSystemName='LOINC'/>
 <title>Cardiac Imaging Report</title>
 <effectiveTime value='20111004012005'/>
 <confidentialityCode code='N' displayName='Normal'
  codeSystem='2.16.840.1.113883.5.25' codeSystemName='Confidentiality'/>
 <languageCode code='en-US'/>
:
 <component>
  <structuredBody>
:
  </structuredBody>
 </component>
</ClinicalDocument>
```

Figure 6.2.1.1.7-1 Cardiac Imaging Report Example Extract

6.2.2 Section Modules

6.2.2.1 Medical History (Cardiac) Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.1
Parent Template	Medical History 2.16.840.1.113883.10.20.18.2.5 [CDA-PN]
General Description	The Medical History Section shall record past and current problems relevant to the patient's cardiac presentation in the narrative block and in corresponding structured entries. Other non-cardiac medical history may also be recorded in the narrative, and may also be present in the entries.
Section Code	11329-0, LOINC, "Medical History"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Subsections				
O [0..1]	Active Problems	1.3.6.1.4.1.19376.1.5.3.1.3.6	PCC TF-2	
O [0..1]	History of Present Illness	1.3.6.1.4.1.19376.1.5.3.1.3.4	PCC TF-2	
O [0..1]	History of Past Illness	2.16.840.1.113883.10.20.2.9	CDA-PN	
Entries				
C [1..*]	Problem Concern Entry	1.3.6.1.4.1.19376.1.5.3.1.4.5.2	PCC TF-2	CARD TF-2 6.2.2.1.1
C [1..*]	Simple Observation	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.2.1.2

The Medical History Section SHALL contain at least one Problem Concern Entry or at least one Simple Observation.

Note: Problems MAY be recorded directly in the Medical History Section, or in one or more subsections such as Active Problems, History of Present Illness, or History of Past Illness.

6.2.2.1.1 Problem Concern Entry Constraints

A Content Creator SHALL be able to include a Problem Concern Entry for each of the conditions identified in Value Set 1.3.6.1.4.1.19376.1.4.1.5.4 Cardiac Problems/Concerns, encoding the value in act/entryRelationship/observation/code.

A Problem Concern Entry for {73211009, SNOMED CT, diabetes} SHALL use the specialized Diabetes Problem Entry (OID = 1.3.6.1.4.1.19376.1.4.1.4.1).

A Problem Concern Entry for {194828000, SNOMED CT, angina} SHALL use the specialized Angina Problem Entry (OID = 1.3.6.1.4.1.19376.1.4.1.4.2).

6.2.2.1.2 Simple Observation Entry Constraints

A Content Creator SHALL be able to include a Simple Observation Entry for each of the conditions listed in value set 1.3.6.1.4.1.19376.1.4.1.5.4 Cardiac Problems/Concerns indicating

absence of the condition for the patient, represented with a compositional SNOMED CT code with qualifier [408729009 | finding context | = 410516002 | known absent].

Note: For example, absence of angina is thus represented by code 194828000:408729009=410516002. Such negative findings are represented with Simple Observations, and are not observations subsidiary to a Problem Concern act entry.

A Content Creator SHALL be able to include a Simple Observation Entry with code {160245001, SNOMED CT, "No current problems or disability"}.

Note: Use of this "No current problems or disability" entry is mutually exclusive with Problem Concern entries.

6.2.2.2 Family History (Cardiac) Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.5			
Parent Template	Family History 1.3.6.1.4.1.19376.1.5.3.1.3.14 [PCC TF-2]			
General Description	The Family History (Cardiac) section shall include narrative and entries for family history of cardiac diseases.			
Section Code	10157-6, LOINC, "History of Family Member Diseases"			
Opt	**Data Element or Section Name**	**Template ID**	**Specification Document**	**Constraint**
Entries				
M [1..*]	Simple Observation	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.2.2.1

6.2.2.2.1 Simple Observation Entry Constraints

A Content Creator SHALL be able to create a Simple Observation Entry for each of the conditions listed in value set 1.2.840.10008.6.1.253 DICOM CID 3758 Cardiovascular Family History.

Notes: 1. These observations are organized by disease, not by family member; hence, this section template is not a child of Coded Family Medical History Section 1.3.6.1.4.1.19376.1.5.3.1.3.15 [PCC TF-2], which requires a person-based history.

2. The specified Value Set includes concepts for "no family history of .." and "unknown family history".

6.2.2.3 Prior Results (Cardiac) Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.6
Parent Template	Prior Results 1.3.6.1.4.1.19376.1.5.3.1.3.28 [PCC TF-2]
General Description	The results section shall contain a narrative description of the relevant diagnostic procedures the patient received in the past, including procedures (studies) used for comparison. It shall include entries for procedures and references to procedure reports when known as described in the Entry Content Modules.
Section Code	30954-2, LOINC, "Relevant Diagnostic Tests And/Or Laboratory Data"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Entries				
O [0..*]	Procedure Entry	1.3.6.1.4.1.19376.1.5.3.1.4.19	PCC TF-2	CARD TF-2 6.2.2.3.1
O [0..*]	External References Entry	1.3.6.1.4.1.19376.1.5.3.1.4.4	PCC TF-2	
O [0..*]	Simple Observation	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.2.3.2

The External References Entry allows reference to other documents, not necessarily linked to a specific identified procedure in a Procedure Entry.

6.2.2.3.1 Procedure Entry Constraints

Procedure Entries SHOULD use codes for cardiac related imaging procedures from Value Set 1.3.6.1.4.1.19376.1.4.1.5.2 Cardiac Imaging Procedures in the procedure/code element. The entry MAY include an actRelationship to an ExternalDocument act that is the report of the procedure.

The Procedure Entry of a study used for comparison (see Assessment and Plan (Cardiac) Section) SHALL include an ID attribute as a target for cross-reference.

6.2.2.3.2 Simple Observation Entry Constraints

Simple Observation Entries MAY use codes for cardiac related lab results from Value Set 1.3.6.1.4.1.19376.1.4.1.5.13 Cardiac Lab Results in the observation/code element.

Note: Depending on the method used for the lab test, a different LOINC code may be applicable, even though the test name is identical.

6.2.2.4 Cardiac Risk Assessment Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.7
Parent Template	none
General Description	The Cardiac Risk Assessment Section shall record risk calculations made prior to the procedure in the narrative block and in corresponding entries.
Section Code	X-CARDRISK, LOINC, “Assessment for risk of cardiovascular disease”

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Entries				
R [1..*]	Simple Observation	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.2.4.1

6.2.2.4.1 Simple Observation Entry Constraints

The section SHALL contain a Simple Observation Entry for each cardiac risk estimate or score reported. Example risk assessment codes are listed in value set 1.3.6.1.4.1.19376.1.4.1.5.26 Cardiac Risk Scores.

6.2.2.5 Indications and Planned Procedure Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.8
Parent Template	Procedure Indications 2.16.840.1.113883.10.20.18.2.1 [CDA-PN]
General Description	The Coded Procedure Indications section records details about the reason for the procedure. This section may include the pre-procedure diagnosis or diagnoses as well as one or more symptoms that contribute to the reason the procedure is being performed. Coded entries are required.
Section Code	59768-2, LOINC, "Procedure Indications"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Subsections				
O [0..1]	Planned Procedure	2.16.840.1.113883.10.20.18.2.6	CDA-PN	
Entries				
R [1..*]	Problem Entry	1.3.6.1.4.1.19376.1.5.3.1.4.5	PCC TF-2	
O [0..*]	Planned Procedure Activity	1.3.6.1.4.1.19376.1.4.1.4.8	CARD TF-2: 6.2.4.7	

The planned investigations of the current procedure, based on the clinical indications, MAY be recorded in Planned Procedure Activity entries directly in the Indications and Planned Procedure Section, or in a subsidiary Planned Procedure subsection.

The Problem Entries recording the indications for the procedure MAY be recorded directly in the Indications and Planned Procedure Section, or as reason observations subsidiary to a Planned Procedure Activity entry.

Note: Clinicians often do not clearly distinguish between the indications for a procedure (the patient condition that justifies its performance) and the investigation to be done by the procedure that further evaluates that indication. The Indications and Planned Procedure Section allows both the problem and the planned procedure to be recorded together at the beginning of the exam, similar to the Assessment and Plan Section that allows the diagnosis from the procedure and the associated care plan to be recorded together at the end of the exam.

6.2.2.6 Cardiac Procedure Description Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.9
Parent Template	Procedure Description 2.16.840.1.113883.10.20.18.2.2 [CDA-PN]
General Description	The Cardiac Procedure Description section shall include narrative and entries identifying the procedure performed and the details of the procedure such as contrast agent(s) used,

	imaging procedure protocol used, characteristics of the imaging equipment used, and medications administered during the exam.
Section Code	29554-3, LOINC, "Procedure Description"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Subsections				
O [0..1]	Medications administered	2.16.840.1.113883.10.20.18.2.8	CDA-PN	CARD TF-2: 6.2.2.6.2
Entries				
M [1..1]	Procedure Entry	1.3.6.1.4.1.19376.1.5.3.1.4.19	PCC TF-2	CARD TF-2: 6.2.2.6.1
C [1..*]	Medication (medications administered)	1.3.6.1.4.1.19376.1.5.3.1.4.7	PCC TF-2	CARD TF-2: 6.2.2.6.2
C [1..*]	Medication (contrast/imaging agents)	1.3.6.1.4.1.19376.1.5.3.1.4.7	PCC TF-2	CARD TF-2: 6.2.2.6.3
R [1..*]	Simple Observation (procedure protocol)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.2.6.4

Note: CDA conformance rules allow organization of content into implementation-defined subsections. For combined procedures (e.g., CACS and CCTA), each constituent procedure might be described in a subsection of Procedure Description. The conformance rules apply to any child subsections and entries of the main section.

6.2.2.6.1 Procedure Entry Constraints

The Procedure Entry SHOULD use codes for cardiac related imaging procedures from Value Set 1.3.6.1.4.1.19376.1.4.1.5.2 Cardiac Imaging Procedures in the procedure/code element.

6.2.2.6.2 Medication (medications administered) Constraints

If medications other than contrast were administered, they SHALL be documented in a Medication Entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.7 [PCC TF-2]).

Note: The Medication Entry may appear either directly in the Procedure Description Section or in a subsidiary Medications Administered subsection or in a constituent procedure subsection.

The Medication Entry SHOULD use the values of Value Set 1.3.6.1.4.1.19376.1.4.1.5.15 Drug Classes Used in Cardiac Procedure, with either the SNOMED CT or the NDF-RT coding system as required by local use, encoding the value in substanceAdministration/consumable/ManufacturedProduct/Material/code.

6.2.2.6.3 Medication (contrast/imaging agents) Constraints

If contrast/imaging agents were used, they SHALL be documented in a Medication Entry.

Note: The Medication Activity Entry may appear either directly in the Procedure Description Section or in a subsidiary Medications Administered subsection or in a constituent procedure subsection.

The Medication Entry SHOULD use the values of Value Set 1.3.6.1.4.1.19376.1.4.1.5.11 Contrast Agents, encoding the value in substanceAdministration/consumable/ManufacturedProduct/Material/code.

Administered contrast agent volume or dose SHOULD be included in the entry in `substanceAdministration /doseQuantity` in accordance with the Medication Entry template.

6.2.2.6.4 Simple Observation (procedure protocol) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
C [1..1]	R: nuclear cardiology, CCTA, or CMR	RID11248, RadLex, "Cardiac Gating"	CD	n/a	1.3.6.1.4.1.19376.1.4.1.5.28 Cardiac Synchronization Techniques
C [1..1]	R: nuclear cardiology	122713, DCM, "Attenuation correction"	CD	n/a	1.2.840.10008.6.1.744 DICOM CID 3112 Attenuation Correction
C [1..1]	R: TTE, TEE	125203, DCM, "Acquisition Protocol"	CD	n/a	1.2.840.10008.6.1.616 DICOM CID 12224 Ultrasound Image Modes
C [1..1]	R: CMR	125203, DCM, "Acquisition Protocol"	ED (text/plain) or CD	n/a	Example values ● Morphology and function ● Delayed enhancement ● Flow/velocity quantification ● MR angiography ● Perfusion ● Other May use CD with value ● {419997008, SNOMED CT, MR Angiography} ● {419535008, SNOMED CT, MR Cardiac Perfusion}
C [1..1]	R: CCTA	8867-4, LOINC, Heart Rate	PQ	{HB}/min	n/a
C [1..1]	R: CCTA	RID12651, RadLex, "Number of CT detector rows"	PQ	{rows}	
C [1..1]	R: CCTA	RID12380, RadLex, "Gantry revolution time"	PQ	ms	
C [1..1]	R: CCTA	113813, DCM, "CT Dose Length Product Total"	PQ	mGy.cm	
C [1..1]	R: ICA, LVG	113722, DCM, "Dose Area Product Total"	PQ	Gy.m2	
C [1..1]	R: ICA, LVG	113730, DCM, "Total Fluoro Time"	PQ	s	
C [1..1]	R: stress CMR, stress TTE, stress SPECT, stress PET	121058, DCM, "Procedure reported"	CD		1.2.840.10008.6.1.755 DICOM CID 3200 Stress Test Procedure
C [1..1]	R: stress CMR, stress TTE, stress SPECT, stress PET	109056, DCM, "Stress Protocol"	CD		1.2.840.10008.6.1.57 DICOM CID 3261 Stress Protocols

C [1..1]	R: stress CMR, stress TTE, stress SPECT, stress PET	252130009, SNOMED CT, "Total Exercise duration"	PQ	min	
C [0..1]	R: stress CMR, stress TTE, stress SPECT, stress PET	246489000, SNOMED CT, "Pharmacological Stress Agent"	CD		1.2.840.10008.6.1.759 DICOM CID 3204 Stress Agents

6.2.2.7 Procedure Findings (Cardiac) Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.11
Parent Template	Procedure Findings 2.16.840.1.113883.10.20.18.2.15 [CDA-PN]
General Description	The Cardiac Procedure Findings section records clinically significant observations confirmed or discovered during the procedure.
Section Code	59776-5, LOINC, "Procedure Findings"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Subsections				
O [0..1]	Comparison to prior study (Cardiac)	1.3.6.1.4.1.19376.1.4.1.2.13	CARD TF-2: 6.2.2.9	
Entries				
R [1..*]	Simple Observation (ischemic heart disease)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.2.7.1
C [1..1]	Coronary Angiography Arterial Analysis	1.3.6.1.4.1.19376.1.4.1.4.5	CARD TF-2: 6.2.4.5	CARD TF-2: 6.2.2.7.2
R [1..*]	Simple Observation (LV function)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.2.7.3
C [1..1]	Segmental Wall Analysis	1.3.6.1.4.1.19376.1.4.1.4.3	CARD TF-2: 6.2.4.4	CARD TF-2: 6.2.2.7.4
R [1..*]	Simple Observation (cardiac morphology)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.2.7.5

Note: CDA conformance rules allow organization of content into implementation-defined subsections. For combined procedures (e.g., CACS and CCTA), each constituent procedure might be described in a subsection of Procedure Description. Alternatively, findings might be grouped into subsections by anatomy (e.g., a section for cardiac valve findings). The conformance rules apply to any child subsections and entries of the main section.

The Procedure Findings (Cardiac) Section MAY include a subsection Comparison to Prior Study (Cardiac).

The Procedure Findings (Cardiac) Section and its sub-sections SHALL include Simple Observation Entries dependent on the type of procedure performed.

Observation concepts for which the observation was not performed (or not assessed) MAY be represented in a Simple Observation Entry with a value using an HL7 Null Flavor. Explicit observations of conditions known to not be present SHALL be represented with a compositional SNOMED CT code with qualifier [408729009 | finding context | = 410516002 | known absent].

6.2.2.7.1 Simple Observation (ischemic heart disease) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
O [0..1]		102592004, SNOMED CT, "ECG Finding"	CD		164918000:246090004= 128974000, SNOMED CT, "pathologic Q waves at baseline"
C [1..1]	R: CCTA, SPECT, CMR	102592004, SNOMED CT, "ECG Finding"	CD		1.3.6.1.4.1.19376.1.4.1.5.17 Rhythm Findings
O [0..1]		102592004, SNOMED CT, "ECG Finding"	CD		26141007:246090004= 128974000, SNOMED CT, "ST-segment depression at baseline"
C [1..*]	R: stress TTE, stress SPECT, stress PET, CCTA, stress CMR	102592004, SNOMED CT, "ECG Finding"	CD		1.3.6.1.4.1.19376.1.4.1.5.18 ECG Findings
O [0..1]		122717, DCM, "Peak activity workload"	PQ	[MET]	
C [1..1]	R: stress TTE, stress SPECT	444981005, SNOMED CT, "Resting heart rate"	PQ	{HB}/min	
C [1..1]	R: stress TTE, stress SPECT	428420003, SNOMED CT, "Target heart rate"	PQ	{HB}/min	
C [1..1]	R: stress TTE, stress SPECT	428630002, SNOMED CT, "Maximum HR Achieved"	PQ	{HB}/min	
C [1..1]	R: stress TTE, stress SPECT	271649006:246090004= 128974000, SNOMED CT, "Baseline systolic blood pressure"	PQ	mm[Hg]	
C [1..1]	R: stress TTE, stress SPECT	271650006:246090004= 128974000, SNOMED CT, "Baseline diastolic blood pressure"	PQ	mm[Hg]	
C [1..1]	R: stress TTE, stress SPECT	314439003, SNOMED CT, "Maximum systolic blood pressure"	PQ	mm[Hg]	
C [1..1]	R: stress TTE, stress SPECT	314452008, SNOMED CT, "Maximum diastolic blood pressure"	PQ	mm[Hg]	
C [1..1]	R: exercise stress testing	122718, DCM, "Peak Double Product"	PQ	mm[Hg]. {HB}/min	
C [1..1]	R: exercise SPECT, exercise TTE, stress PET	418799008, SNOMED CT, "Symptom"	ED (text/plain)		Chest pain during exercise ● Limiting chest pain ● Nonlimiting chest pain ● Anginal equivalent
O [0..1]		102592004, SNOMED CT, "ECG Finding"	CD		26141007, SNOMED CT, "ST-segment depression"

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
O [0..1]		429622005, SNOMED CT, "ST depression"	PQ	mv	
C [1..1]	R: CACS	112058, DCM, "Calcium Score" methodCode= 112055, DCM, Agatston Scoring Method	PQ	[arb'U]	

Adapted from KDECI Table 6

6.2.2.7.2 Coronary Angiography Arterial Analysis Entry Constraints

The Coronary Angiography Arterial Analysis Entry SHALL be present if the procedure was a CCTA or ICA.

6.2.2.7.3 Simple Observation (LV function) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
R [1..1]		404684003, SNOMED CT, "Finding"	ED (text/plain) or CD		overall assessment of LV diastolic function. ● Normal for age ● Abnormal for age May use CD with value 395704004, SNOMED CT, "LV diastolic dysfunction" for finding of abnormal
R [1..1]		10230-1, LOINC, "LVEF" methodCode= ● 258083009, SNOMED CT, "Visual estimation" ● 258090004, SNOMED CT, "Calculated"	PQ or IVL<PQ>	%	

Adapted from KDECI Table 7

The LVEF numeric observation/value MAY be a categorical assessment using the HL7v3 Interval of Physical Quantities data type (IVL<PQ>), with preferred value ranges as shown in Table 6.2.2.7.3-1.

Table 6.2.2.7.3-1 Preferred LVEF categorical ranges

Preferred LVEF categorical ranges
<30 %
30-40 %

Preferred LVEF categorical ranges
40-50 %
50-70 %
>70 %

6.2.2.7.4 Segmental Wall Analysis Entry Constraints

The Segmental Wall Analysis Entry SHALL be present if the procedure was an ICA with left ventriculogram, stress SPECT, stress PET, stress TTE, or stress CMR.

For cath exams, the wall analysis observation targetSiteValue Set SHALL be 1.2.840.10008.6.1.219 DICOM CID 3718 Myocardial Wall Segments in Projection.

For stress exams, the wall analysis observation targetSiteValue Set SHALL be 1.2.840.10008.6.1.218 DICOM CID 3717 Myocardial Wall Segments.

6.2.2.7.5 Simple Observation (cardiac morphology) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
R [1..1]		250929008, SNOMED-CT, left ventricular cavity size	CD		1.3.6.1.4.1.19376.1.4.1.5.22 Cardiac Chamber Size Assessments
O [0..1]		8823-7, LOINC, left ventricle systolic volume	PQ	ml	
O [0..1]		8821-1, LOINC, Left ventricle diastolic volume	PQ	ml	
C [0..1]	R: TTE, TEE, CMR O: CCTA	250964004, SNOMED-CT, right ventricular cavity size	CD		1.3.6.1.4.1.19376.1.4.1.5.22 Cardiac Chamber Size Assessments
C [0..1]	R: TTE, TEE, CMR O: CCTA	399121005, SNOMED-CT, Left atrium cavity size	CD		1.3.6.1.4.1.19376.1.4.1.5.22 Cardiac Chamber Size Assessments
C [0..1]	R: TTE, TEE, CMR O: CCTA	439749006:363698007=73829009, SNOMED-CT, Right atrium volume by imaging	CD		1.3.6.1.4.1.19376.1.4.1.5.22 Cardiac Chamber Size Assessments
O [0..1]	R: TTE, TEE	18154-5, LOINC, Interventricular septum Thickness diastole by US	PQ	mm	
O [0..1]	R: TTE, TEE	18152-9, LOINC, Left Ventricle Posterior Wall Diastolic Thickness	PQ	mm	
O [0..1]	R: TTE, TEE	18153-7, LOINC, Right Ventricular Anterior Wall Diastolic Thickness	PQ	mm	

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
O [0..1]		18087-7, LOINC, Left Ventricle Mass	CD		260395002, SNOMED CT, "normal" 35105006, SNOMED CT, "Increased"
O [0..1]	R: CMR, CCTA	304522008, SNOMED CT, Pulmonary vein finding	CD		1.3.6.1.4.1.19376.1.4.1.5.23 Pulmonary Veins Assessments
O [0..1]		404684003, SNOMED CT, "Finding"	ED (text/plain) or CD		indicate the type of intracardiac mass if present. ● Vegetation ● Thrombus ● Neoplasm ● Mass of Unknown Etiology May use CD with value ● 387842002, SNOMED CT, "neoplasm of heart" ● 309519009, SNOMED CT, "LV Thrombus"
O [0..*]		442119001, SNOMED CT, "Cardiac shunt finding"			1.3.6.1.4.1.19376.1.4.1.5.29 Cardiac Shunt Types
C [1..1]	R: TTE, TEE, CMR, CCTA, ICA, LVG	301123005, SNOMED CT, "Pericardial finding"	CD		373945007, SNOMED CT, "Pericardial effusion" + size [CARD TF-2: 6.2.2.7.5.1]
O [0..1]		301123005, SNOMED CT, "Pericardial finding"	CD		35304003, SNOMED CT, "Tamponade"
O [0..1]		301123005, SNOMED CT, "Pericardial finding"	ED text/plain or CD		Indicate the thickness of the pericardium. ● Normal ● Thickened ● Calcified May use CD with value 42653000, SNOMED CT, "Calcified pericardium"
C [1..1]	R: TTE, TEE, CCTA, CMR	301099004, SNOMED CT, "Aortic valve finding"	CD		301100007, SNOMED CT, "Aortic valve normal" 84683006, SNOMED CT, "Aortic valve prosthesis" 8722008, SNOMED CT, "Aortic valve disorder"
O [0..*]		301099004, SNOMED CT, "Aortic valve finding"	CD		253612007, SNOMED CT, aortic valve cusp prolapse 301184001, SNOMED CT, aortic valve vegetations 13689005, SNOMED CT, congenital anomaly of aortic

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
					valve
C [1..1]	R: TTE, TEE, CCTA, CMR, ICA, LVG	301099004, SNOMED CT, "Aortic valve finding"	CD		60573004, SNOMED CT, aortic valve stenosis + severity [CARD TF-2: 6.2.2.7.5.2]
C [1..1]	R: TTE, TEE, CCTA, CMR, ICA, LVG	301099004, SNOMED CT, "Aortic valve finding"	CD		60234000, SNOMED CT, Aortic regurgitation + severity [CARD TF-2: 6.2.2.7.5.2]
C [1..1]	R: TTE, TEE, CCTA, CMR	301101006, SNOMED CT, "Mitral valve finding"	CD		301103009, SNOMED CT, "Mitral valve normal" 11851006, SNOMED CT, "Mitral valve disorder" 17107009, SNOMED CT, "Mitral valve prosthesis" 360063009, SNOMED CT, "Annuloplasty ring"
O [0..*]	R: TTE, TEE, CCTA, CMR	301101006, SNOMED CT, "Mitral valve finding"	CD		409712001, SNOMED CT, Mitral valve prolapse 270906004, SNOMED CT, mitral chordae rupture 301185000, SNOMED CT, Mitral valve vegetations 75372006, SNOMED CT, congenital anomaly of Mitral valve
C [1..1]	R: TTE, TEE, CCTA, CMR, ICA, LVG	301101006, SNOMED CT, "Mitral valve finding"	CD		251002009, SNOMED CT, mitral valve annular calcification
C [1..1]	R: TTE, TEE, CCTA, CMR, ICA, LVG	301101006, SNOMED CT, "Mitral valve finding"	CD		79619009, SNOMED CT, Mitral valve stenosis + severity [CARD TF-2: 6.2.2.7.5.2]
C [1..1]	R: TTE, TEE, CCTA, CMR, ICA, LVG	301101006, SNOMED CT, "Mitral valve finding"	CD		48724000, SNOMED CT, Mitral regurgitation + severity [CARD TF-2: 6.2.2.7.5.2]
C [1..1]	R: TTE, TEE, CMR	301108000, SNOMED CT, "Tricuspid valve finding"	CD		301111004, SNOMED CT, "Tricuspid valve normal" 20721001, SNOMED CT, "Tricuspid valve disorder" 25510005, SNOMED CT, "Cardiac valve prosthesis" 360063009, SNOMED CT,

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
					"Annuloplasty ring"
C [1..1]	R: TTE, TEE, CMR	301108000, SNOMED CT, "Tricuspid valve finding"	CD		49915006, SNOMED CT, Tricuspid valve stenosis + severity [CARD TF-2: 6.2.2.7.5.2]
C [1..1]	R: TTE, TEE, CMR	301108000, SNOMED CT, "Tricuspid valve finding"	CD		111287006, SNOMED CT, Tricuspid regurgitation + severity [CARD TF-2: 6.2.2.7.5.2]
C [1..1]	R: TTE, TEE, CMR	301104003, SNOMED CT, "Pulmonic valve finding"	CD		301107005, SNOMED CT, "Pulmonic valve normal" 76267008, SNOMED CT, "Pulmonic valve disorder" 423449009, SNOMED CT, "Pulmonary valve prosthesis"
C [1..1]	R: TTE, TEE, CMR	301104003, SNOMED CT, "Pulmonic valve finding"	CD		56786000, SNOMED CT, Pulmonic valve stenosis + severity [CARD TF-2: 6.2.2.7.5.2]
O [0..1]		301104003, SNOMED CT, "Pulmonic valve finding"	CD		91434003, SNOMED CT, Pulmonic regurgitation + severity [CARD TF-2: 6.2.2.7.5.2]
C [1..1]	R: TTE, TEE, CCTA, CMR, ICA, LVG	404684003, SNOMED CT, "Finding" + targetSiteCode [CARD TF-2: 6.2.2.7.5.3]	CD		308546005, SNOMED CT, "Dissection of aorta"
C [1..1]	R: TTE, TEE, CCTA, CMR, ICA, LVG	404684003, SNOMED CT, "Finding"	CD		251036003, SNOMED CT, "Aortic root dilation"

Adapted from KDECI Table 8

6.2.2.7.5.1 Pericardial Effusion Size Observation

An observation of pericardial effusion MAY include a post-coordinated interpretation code from the values of Table 6.2.2.7.5-1.

Table 6.2.2.7.5-1 Pericardial Effusion post-coordinated codes

SNOMED CT expression	Meaning
373945007	Pericardial effusion
373945007:408729009=410516002	Pericardial effusion absent
373945007:363713009=371929004	Pericardial effusion – minimally significant
373945007:363713009=255507004	Pericardial effusion – small

SNOMED CT expression	Meaning
373945007:363713009=371927002	Pericardial effusion – moderate
373945007:363713009=255509001	Pericardial effusion – large

6.2.2.7.5.2 Severity Observation

An observation of valve stenosis or valve regurgitation MAY include an optional entryRelationship element indicating the severity of the finding. When present, this entryRelationship element SHALL contain an observation conforming to the Severity entry (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.1 [PCC TF]). The entryRelationship typeCode SHALL be "SUBJ" and inversionInd SHALL be "true".

6.2.2.7.5.3 Dissection targetSite Observation

An observation of Dissection of aorta SHALL include a targetSiteCode of {54247002, SNOMED CT, "Ascending aorta"} for Stanford Type A dissections (involving the ascending aorta regardless of site of origin).

6.2.2.8 Assessment And Plan (Cardiac) Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.12
Parent Template	Assessment And Plan 2.16.840.1.113883.10.20.18.2.14 [CDA-PN]
General Description	The assessment and plan section shall contain a narrative description of the assessment of the patient condition and expectations for care including proposals, goals, and order requests for monitoring, tracking, or improving the condition of the patient. This cardiac specialization requires coded entries for specific findings; and specifies use of the combined assessment and plan section, not the separate sections for assessment and for plan.
Section Code	51847-2, LOINC, "Assessment and Plan"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Subsections				
O [0..1]	Comparison to prior study (Cardiac)	1.3.6.1.4.1.19376.1.4.1.2.13	CARD TF-2: 6.2.2.9	
Entries				
R [1..*]	Simple Observation (summary)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.2.8.1
O [0..*]	Plan of Care Activities	2.16.840.1.113883.10.20.1.25	CCD	

The Assessment and Plan (Cardiac) Section MAY include a subsection Comparison to Prior Study (Cardiac).

6.2.2.8.1 Simple Observation (summary) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
C [1..1]	R: CCTA, ICA, LVG, stress SPECT, stress TTE	271925006:363702006=414 545008, SNOMED CT, "Ischemic heart disease assessment"	CD		1.3.6.1.4.1.19376.1.4.1.5.24 Imaging Findings
R [1..1]		250907009, SNOMED CT, "left ventricular function"	CD		1.3.6.1.4.1.19376.1.4.1.5.24 Imaging Findings
R [1..1]		271921002 SNOMED CT "ECG Finding"	CD		1.3.6.1.4.1.19376.1.4.1.5.30 ECG Summary Findings

6.2.2.9 Comparison to Prior Study (Cardiac) Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.13
Parent Template	none
General Description	The Comparison to Prior Study (Cardiac) Section identifies a prior exam used for comparison, and describes any significant changes from that exam to the current exam.
Section Code	111424, DICOM, "Comparison to Previous Exams"

Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Entries				
R [1..*]	Simple Observation (comparison)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.2.9.1

The Comparison to Prior Study (Cardiac) Section SHALL reference a prior study identified in the Prior Results (Cardiac) Section using the ID attribute in a <reference> element in section / text. The narrative SHALL include the date and type of the comparison exam.

6.2.2.9.1 Simple Observation (comparison) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
R [1..1]		111424, DCM, "Comparison to previous exams"	CD	n/a	1.2.840.10008.6.1.770 DICOM CID 3217 Comparison Finding
O [0..1]	R: Stress	248243004, SNOMED CT, "Exercise tolerance"	CD	n/a	1.2.840.10008.6.1.782 DICOM CID 3236 Tolerance Comparison Findings
O [0..1]		251053005, SNOMED CT, "Myocardial Perfusion"	CD	n/a	1.2.840.10008.6.1.781 DICOM CID 3235 Perfusion Comparison Findings

O [0..1]	R: TTE, TEE. LVG	250909007, SNOMED CT, "LV Wall motion"	CD	n/a	1.2.840.10008.6.1.783 DICOM CID 3237 Wall Motion Comparison Findings

6.2.2.10 Key Images Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.14			
Parent Template	CDA-DIR: 3.1.1 (no Template OID)			
General Description	The Key Images section contains narrative description of and references to DICOM Image Information Objects that illustrate the findings of the procedure reported.			
Section Code	55113-5, LOINC, "Key Images"			
Opt	**Data Element or Section Name**	**Template ID**	**Specification Document**	**Constraint**
Entries				
O [0..*]	SOP Instance Observation	2.16.840.1.113883.10.20.6.2.8	CDA-DIR	

The Key Images section `text` SHALL contain image references using `linkHtml` elements, where `@href` is a valid Web Access to DICOM Persistent Object (WADO) URL and the text content of `linkHtml` is the either visible text of the hyperlink or a descriptor or identifier of the image.

The Key Images section MAY include SOP Instance Observation entries equivalent to the `linkHtml` image references.

6.2.2.11 DICOM Object Catalog Section

Template ID	1.3.6.1.4.1.19376.1.4.1.2.15			
Parent Template	none			
General Description	DICOM Object Catalog lists all referenced objects and their parent Series and Studies, plus other DICOM attributes required for retrieving the objects.			
Section Code	121181, DCM, "DICOM Object Catalog"			
Opt	**Data Element or Section Name**	**Template ID**	**Specification Document**	**Constraint**
Entries				
M [1..*]	Study Act	2.16.840.1.113883.10.20.6.2.6	CDA-DIR	

The DICOM Object Catalog Section SHALL provide Study Act Entries, including subsidiary Series and SOPInstance Acts, that identify all SOP Instances referenced in other document

sections. It MAY provide Study Act Entries for the DICOM studies associated with the documented procedure, even if no SOP Instances are explicitly referenced.

The DICOM Object Catalog Section MAY include section text that indicates in human readable form that the content of the section is computer-processable links to DICOM information objects, and there is no other attestable report content.

Note: CIRC and its parent Procedure Note require a section/title attribute for all document sections. CDA-DIR r1 forbids section/title for the DICOM Object Catalog Section, hence this template is distinct from the CDA-DIR DICOM Object Catalog Section template.

6.2.3 Header Content Modules

6.2.3.1 Encompassing Encounter

Template ID	1.3.6.1.4.1.19376.1.4.1.3.1
Parent Template	none
General Description	The setting of the clinical encounter during which the documented act(s) or ServiceEvent occurred. This template includes specializations of Responsible Party, Health Care Facility, Referring Provider, and Physician of Record.
Header Element	componentOf / encompassingEncounter
Code	Not constrained

Opt	Participation	Description	Template	Spec Document	Con-straint
O [0..1]	RESP	Responsible Party		CARD TF-2: 6.2.3.1.1	
R [1..1]	LOC	Health Care Facility		CARD TF-2: 6.2.3.1.2	
O [0..1]	REF	Referring Provider		CARD TF-2: 6.2.3.1.3	
C [0..1]	ATND	Physician of Record	2.16.840.1.113883.10.20.6.2.2	CDA-DIR	CARD TF-2: 6.2.3.1.4

The `encompassingEncounter` / `effectiveTime` value SHALL be accurate to the day, and MAY be accurate to the second.

1200

```
<componentOf>
  <encompassingEncounter xmlns:ihecard='urn:ihe:card'>
    <templateId root='1.3.6.1.4.1.19376.1.4.1.3.1'/>
    <effectiveTime value="20110407"/>
    <responsibleParty>
      <assignedEntity>
        <id root="2.16.840.1.113883.4.6" extension="physician NPI" />
        <code code=" " codeSystem="2.16.840.1.113883.6.101"
         codeSystemName="nuccProviderCodes" displayName=" ">
        <ihecard:accreditation accreditation descriptive string />
        <assignedPerson>
          <name>responsible physician name</name>
        </assignedPerson>
      </assignedEntity>
    </responsibleParty>
    <encounterParticipant typeCode="REF">
      <assignedEntity>
        <id root="2.16.840.1.113883.4.6" extension=" " />
        <code code=" " codeSystem="2.16.840.1.113883.6.101"
         codeSystemName="nuccProviderCodes" displayName=" ">
        <addr>referring physician address</addr>
        <telecom>referring physician phone</telecom >
        <assignedPerson>
          <name>referring physician name</name>
        </assignedPerson>
      </assignedEntity>
    </encounterParticipant>
    <location>
      <healthCareFacility>
        <id root="  " extension=" " />
        <code code="CARD" codeSystem="2.16.840.1.113883.5.111"
         codeSystemName="roleCode" displayName="Cardiology Clinic">
        <ihecard:accreditation accreditation descriptive string />
        <serviceProviderOrganization>
          <name>organization name</name>
          <addr>organization address</addr>
          <telecom>organization phone, web, other telecom access</telecom >
        </serviceProviderOrganization>
        <location>
          <name>service location name</name>
          <addr>service location address</addr>
        </location>
      </healthCareFacility>
    </location>
    …
  </encompassingEncounter >
</componentOf>
```

Figure 6.2.3.1-1 Encompassing Encounter Example

6.2.3.1.1 Responsible Party

The responsible party element represents only the party responsible for the encounter, not necessarily the entire episode of care.

The `responsibleParty` element MAY be present. If present, `responsibleParty/assignedEntity` SHALL have at least one `assignedPerson` or `representedOrganization` element present.

Note: This is identical to CDA-DIR CONF-DIR-67

`responsibleParty assignedEntity id` SHALL be present with the responsible physician's identifier.

`assignedEntity code` SHOULD be present with the responsible physician's specialty.

`assignedEntity` MAY include an `accreditation` element from the **urn:ihe:card** namespace to provide physician accreditation status.

The `accreditation` element SHALL use the character string (ST) data type.

The `accreditation` element SHALL appear after the defined elements of the Role class, and before any scoper or player entity elements.

`assignedEntity assignedPerson name` SHALL be present with the responsible physician's name.

6.2.3.1.2 Health Care Facility

Conformance requirements for encoding of information about the Health Care Facility are provided in the Procedure Note Implementation Guide, and are reproduced here for reference:

> CONF-PN-18: A Procedure Note SHOULD contain information about where the procedure was performed.
>
> CONF-PN-19: If present, the physical location of the procedure SHALL be represented with `componentOf/encompassingEncounter/location/ healthCareFacility/id` element.
>
> CONF-PN-20: If present, the `location/healthCareFacility` element SHALL contain a `code` element representing the type of location.

Copied from CDA-PN

`Location/ healthCareFacility/ serviceProviderOrganization` SHOULD be present with `name`, `addr` and `telecom` elements.

`Location/ healthCareFacility/ location` (Place Entity) MAY be present with `name` and/or `addr` elements identifying the place of the encounter.

`healthCareFacility` MAY include an `accreditation` element from the **urn:ihe:card** namespace to provide facility accreditation status.

The `accreditation` element SHALL use the character string (ST) data type.

The `accreditation` element SHALL appear after the defined elements of the Role class, and before any scoper or player entity elements.

6.2.3.1.3 Referring Provider

Conformance requirements for encoding of information about the referring provider are provided in the Procedure Note Implementation Guide, and are reproduced here for reference:

> CONF-PN-21: A Procedure Note MAY contain information about the referring provider.

CONF-PN-22: If present, the referring provider SHALL be represented with a `componentOf/encompassingEncounter/encounterParticipant` element.

CONF-PN-23: When an `encompassingEncounter/encounterParticipant` representing the referring provider is present, the `encounterParticipant/@typeCode` SHALL be `REF` (referrer) and an `assignedEntity` SHALL be present.

CONF-PN-24: If elements required in `componentOf/encompassingEncounter/encounterParticipant` are unknown, these elements SHALL be represented with the appropriate HL7 null value.

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If present, the referring provider `assignedEntity id` SHALL be present with one value of the set being the Performer's National Provider Identifier (root OID = 2.16.840.1.113883.4.6) (in the US) or the equivalent.

The referring provider `assignedEntity code` SHOULD be present with the referring provider's specialty.

6.2.3.1.4 Physician of Record

The Physician of Record participation SHOULD be present if the procedure is performed in an in-patient context; it MAY be present otherwise.

Conformance requirements for encoding of information about the Physician of Record are taken from the Diagnostic Imaging Report Implementation Guide.

CONF-DIR-68: A Physician of Record Participant (`templateId` 2.16.840.1.113883.10.20.6.2.2) SHOULD be present.

CONF-DIR-69: The `templateId` for a Physician of Record Participant SHALL be 2.16.840.1.113883.10.20.6.2.2.

CONF-DIR-70: A Physician of Record Participant SHALL be represented with an `encounterParticipant` element where `@typeCode` is `ATND.`

CONF-DIR-71: An `encounterParticipant/assignedEntity/id` element SHALL be present containing the ID of the physician of record.

CONF-DIR-72: An `encounterParticipant/assignedEntity/code` element SHALL be present and SHALL contain … an appropriate national health care provider coding system (e.g., NUCC in the U.S., where `@codeSystem` is 2.16.840.1.113883.11.19465).

CONF-DIR-73: An `assignedPerson/name` element SHOULD be present containing the name of the physician of record.

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6.2.3.2 Order

Template ID	1.3.6.1.4.1.19376.1.4.1.3.2
Parent Template	none
General Description	Identification of orders that are fulfilled by this document.
Header Element	inFulfillmentOf / order
Code	Not constrained

The element `order` / `priorityCode` SHALL be present, with values from coding system HL7 ActPriority (OID = 2.16.840.1.113883.5.7).

One value within the set of `order` / `id` values SHALL be the Accession Number used in the DICOM imaging data, with the root representing the Assigning Authority (Issuer of Accession Number).

```
< inFulfillmentOf>
  <order>
    <templateId root='1.3.6.1.4.1.19376.1.4.1.3.2'/>
    <id root="assigning authority" extension="accession number" />
    <code code=" " codeSystem=""
     codeSystemName=" " displayName=" ">
    <priorityCode code=" " codeSystem=" 2.16.840.1.113883.5.7"
     codeSystemName="ActPriority" displayName=" ">
  </order>
</ inFulfillmentOf>
```

Figure 6.2.3.2-1 Order

6.2.3.3 Patient Demographics

Template ID	1.3.6.1.4.1.19376.1.4.1.3.3
Parent Template	none
General Description	Identification of the patient demographics.
Header Element	recordTarget / patientRole
Code	n/a

The CDA Header SHALL include a `Patient` Entity.

The CDA Header `Patient` Entity SHOULD include the elements `birthTime`, `administrativeGenderCode`, `raceCode` and `ethnicGroupCode`. Note that these elements may be encoded with a “flavor of null” if the information is unknown or collection is prohibited by local regulation.


```
<recordTarget>
  <patientRole>
    <id root="2.16.840.1.113883.19.5" extension="12345"/>
    <patient>
      <name>Charles David Anderson II</name>
      <administrativeGenderCode code="M" codeSystem="2.16.840.1.113883.5.1"/>
      <birthTime value="19320924"/>
      <raceCode code=" 2076-8" codeSystem="2.16.840.1.113883.5.104"
        codeSystemName="Race" displayName="Native Hawaiian or Other Pacific Islander">
      <ethnicGroupCode code=" 2186-5" codeSystem="2.16.840.1.113883.5.50"
        codeSystemName="Ethnicity" displayName="Not Hispanic">
    </patient>
    <providerOrganization>
      <name>Maui Healthcare</name>
      <addr>Pukalani, Maui, HI<addr>
    </providerOrganization>
  </patientRole>
</recordTarget>
```

Figure 6.2.3.3-1 Demographics

6.2.3.4 Service Event and Performer

Template ID	1.3.6.1.4.1.19376.1.4.1.3.4
Parent Template	none
General Description	Description of the procedure being documented
Header Element	documentationOf/ serviceEvent
Code	SHOULD be selected from code system 2.16.840.1.113883.6.96 SNOMED CT and MAY be selected from a localized procedure coding system for a given country such as 2.16.840.1.113883.6.104 ICD9 CM Procedures or 2.16.840.1.113883.6.12 CPT-4 in the U.S.

Opt	Participation	Description	Template	Spec Document	Con-straint
M [1..*]	PPRF	Primary Performer		CARD TF-2: 6.2.3.4	

Conformance requirements for encoding of information about the Service Event and Performer are provided in the Procedure Note Implementation Guide, and are reproduced here for reference:

> CONF-PN-31: A Procedure Note SHALL contain one or more `documentationOf/ serviceEvent` elements.
>
> CONF-PN-32: The value for `serviceEvent/code` SHOULD be selected from code system 2.16.840.1.113883.6.96 SNOMED CT and MAY be selected from a localized procedure coding system for a given country such as 2.16.840.1.113883.6.104 ICD9 CM Procedures or 2.16.840.1.113883.6.12 CPT-4 in the U.S.
>
> CONF-PN-33: The `serviceEvent/effectiveTime` SHALL be present with `effectiveTime/low` and SHALL include `effectiveTime/high` if

`effectiveTime/width` is not present. The `serviceEvent/effectiveTime` SHALL be accurate to the day, and MAY be accurate to the second.

CONF-PN-34: If the date and only the general length of the procedure are known, the `serviceEvent/effectiveTime/low` SHALL be present with an `effectiveTime/width` element. The `serviceEvent/effectiveTime/low` SHALL be accurate to the day, and MAY be accurate to the second.

CONF-PN-35: If only the date is known and the duration of the procedure is unknown, the `serviceEvent/effectiveTime/width` element SHALL contain the appropriate HL7 null value.

CONF-PN-36: The primary performers (`PPRF`) SHALL be identified.

CONF-PN-37: For all performers, `serviceEvent/performer/assignedEntity/code` SHALL be present.

CONF-PN-38: The value for `serviceEvent/performer/assignedEntity/code` SHOULD be selected from a localized `assignedEntity` coding system for a given country and MAY be selected from code system 2.16.840.1.113883.11.19465 Healthcare Provider Taxonomy Code (NUCC).

CONF-PN-39: Any assistants SHALL be identified and SHALL be identified as secondary performers (`SPRF`).

Copied from CDA-PN

The value for `serviceEvent code` SHOULD be drawn from value set 1.3.6.1.4.1.19376.1.4.1.5.1 Cardiac Imaging Services.

The set of `serviceEvent id` values SHALL include the Study Instance UID used in the DICOM imaging data, with the UID value in the root attribute.

If the performer is a physician, `assignedEntity id` SHALL be present with the Performer's National Provider Identifier (root OID = 2.16.840.1.113883.4.6) (in the US) or the equivalent.

`assignedEntity` MAY include an `accreditation` element from the **urn:ihe:card** namespace to provide physician accreditation status.

The `accreditation` element SHALL use the character string (ST) data type.

The `accreditation` element SHALL appear after the defined elements of the Role class, and before any scoper or player entity elements.

```
<performer typeCode=" ">
  <templateId root=' '/>
  <assignedEntity>
    <id root="2.16.840.1.113883.4.6" extension=" " />
    <code code=" " codeSystem="2.16.840.1.113883.6.101"
     codeSystemName="nuccProviderCodes" displayName=" ">
    <assignedPerson>
      <name>performer name</name>
    </assignedPerson>
  </assignedEntity>
</performer>
```

Figure 6.2.3.4-1 Performer

6.2.3.5 Legal Authenticator

Template ID	1.3.6.1.4.1.19376.1.4.1.3.5
Parent Template	none
General Description	Description of the document's legal authenticator, identifying the person signing the report
Header Element	legalAuthenticator / assignedEntity
Code	SHOULD be present with the Legal Authenticator's specialty, with values from coding system NUCC Health Care Provider Taxonomy (in the US) or the equivalent

One value within the set of `assignedEntity` `id` values SHOULD be the Legal Authenticator's National Provider Identifier (in the US) or the equivalent.

6.2.4 Entry Content Modules

6.2.4.1 Diabetes Problem Entry

Template ID	1.3.6.1.4.1.19376.1.4.1.4.1		
Parent Template	Problem Entry 1.3.6.1.4.1.19376.1.5.3.1.4.5 [PCC TF-2]		
General Description	The Diabetes Problem Entry is a problem observation with a required subsidiary entry that further describes the diabetic therapy.		
Class/Mood	**Code**	**Value Type**	**Value**
OBS / EVN	404684003, SNOMED CT, "Finding"	CD	73211009, SNOMED CT, "Diabetes"

Opt	entryRelationship	Description	Template	Spec Document	Con-straint
R [1..*]	RSON inversionInd = "true"	Diabetic Therapy	1.3.6.1.4.1.19376.1.4.1.4.1.1	CARD TF-2: 6.2.4.2	
O [0..1]	SUBJ inversionInd = "true"	Severity	1.3.6.1.4.1.19376.1.5.3.1.4.1	PCC TF-2	
O [0..1]	REFR	Problem Status Observation	1.3.6.1.4.1.19376.1.5.3.1.4.1.1	PCC TF-2	
O [0..1]	REFR	Health Status Observation	1.3.6.1.4.1.19376.1.5.3.1.4.1.2	PCC TF-2	
O [0..*]	SUBJ inversionInd = "true"	Comment	1.3.6.1.4.1.19376.1.5.3.1.4.2	PCC TF-2	

The Problem Entry template provides additional guidance regarding observation elements templateId, id, text, statusCode, effectiveTime, and originalText.

6.2.4.2 Diabetes Therapy Entry

Template ID	1.3.6.1.4.1.19376.1.4.1.4.1.1		
Parent Template	none		
General Description	The Diabetes Therapy Entry is a procedure act that describes the therapy.		
Class/Mood	**Code**	**Value Type**	**Value**
PROC / EVN	from 1.2.840.10008.6.1.223 DICOM CID 3722 Diabetic Therapy	n/a	

6.2.4.3 Angina Problem Entry

Template ID	1.3.6.1.4.1.19376.1.4.1.4.2
Parent Template	Problem Entry 1.3.6.1.4.1.19376.1.5.3.1.4.5 [PCC TF-2]
General Description	The Angina Problem Entry is a problem observation with subsidiary entries that further describe the problem.

Class/Mood	Code	Value Type	Value
OBS / EVN	404684003, SNOMED CT, “Finding”	CD	194828000, SNOMED CT, “Angina”

Opt	entryRelationship	Description	Template ID	Spec Document	Con-straint
R [1..1]	COMP	Simple Observation (angina stability)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.4.3.1
O [0..*]	REFR	Simple Observation (angina characteristics)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2: 6.2.4.3.2
O [0..1]	SUBJ inversionInd = “true”	Severity	1.3.6.1.4.1.19376.1.5.3.1.4.1	PCC TF-2	
O [0..1]	REFR	Problem Status Observation	1.3.6.1.4.1.19376.1.5.3.1.4.1.1	PCC TF-2	
O [0..1]	REFR	Health Status Observation	1.3.6.1.4.1.19376.1.5.3.1.4.1.2	PCC TF-2	
O [0..*]	SUBJ inversionInd = “true”	Comment	1.3.6.1.4.1.19376.1.5.3.1.4.2	PCC TF-2	

The Problem Entry template provides additional guidance regarding observation elements templateId, id, text, statusCode, effectiveTime, and originalText.

6.2.4.3.1 Simple Observation (angina stability) Constraint

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
R [1..1]		404684003, SNOMED CT, “Finding”	CD	n/a	1.3.6.1.4.1.19376.1.4.1.5.7 Angina Type

6.2.4.3.2 Simple Observation (angina characteristics) Constraint

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
O [1..*]		404684003, SNOMED CT, “Finding”	CD	n/a	1.3.6.1.4.1.19376.1.4.1.5.25 Angina Characteristics

6.2.4.4 Segmental Wall Analysis

Template ID	1.3.6.1.4.1.19376.1.4.1.4.3
Parent Template	none
General Description	The Segmental Wall Analysis Entry is an Organizer with subsidiary entries that further describe the wall motion findings.

Class/Mood	Code	Value Type	Value
BATTERY / EVN	18118-0, LOINC, "LV Wall Motion Segmental Findings"		

Opt	entryRelationship	Description	Template ID	Spec Document	Con-straint
C [1..*]	COMP	Simple Observation (wall motion)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.4.4.1
C [1..*]	COMP	Simple Observation (wall morphology)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.4.4.2
O [0..1]	COMP	Simple Observation (viability)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.4.4.3
O [0..1]	COMP	observationMedia Entry	1.3.6.1.4.1.19376.1.4.1.4.7	CARD TF-2 6.2.4.6	CARD TF-2 6.2.4.4

The organizer Battery `Act/statusCode` value shall be 'completed'.

For each of the values in the targetSite Value Set for which a wall motion assessment is made, there SHALL be a Simple Observation (wall motion) or a Simple Observation (wall morphology), or both.

There MAY be one `ObservationMedia` entry, whose `value` of type ED shall contain an in-line encoding of a graphic depiction of the wall analysis, e.g., a bull's-eye diagram.

6.2.4.4.1 Simple Observation (wall motion) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
C [1..*]	R: LVG	60797005, SNOMED CT, "Cardiac Wall Motion" targetSiteCode from 1.2.840.10008.6.1.219 DICOM CID 3718 Myocardial Wall Segments in Projection	CD	n/a	1.3.6.1.4.1.19376.1.4.1.5.20 Wall motion
C [1..*]	R: SPECT, TTE, TEE, CMR O:CCTA	60797005, SNOMED CT, "Cardiac Wall Motion" targetSiteCode from 1.2.840.10008.6.1.218 DICOM CID 3717 Myocardial Wall Segments	CD	n/a	1.3.6.1.4.1.19376.1.4.1.5.20 Wall motion

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6.2.4.4.2 Simple Observation (wall morphology) Constraints

OPT	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
C [1..*]	R: Cath with LVG	72724002, SNOMED CT, "Morphology findings" targetSiteCode from 1.2.840.10008.6.1.219 DICOM CID 3718 Myocardial Wall Segments in Projection	CD	n/a	1.3.6.1.4.1.19376.1.4.1.5.19 Myocardium Assessments
C [1..*]	R: SPECT, echo, CMR O:CCTA	72724002, SNOMED CT, "Morphology findings" targetSiteCode from 1.2.840.10008.6.1.218 DICOM CID 3717 Myocardial Wall Segments	CD	n/a	1.3.6.1.4.1.19376.1.4.1.5.19 Myocardium Assessments

The `observation/value` MAY be a null flavor.

A morphological assessment observation MAY have a subsidiary Severity observation (templateID 1.3.6.1.4.1.19376.1.5.3.1.4.1 [PCC TF-2]).

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6.2.4.4.3 Simple Observation (viability) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
O [0..1]		404684003, SNOMED CT, "Finding"	ED (text/plain)		degree of viability in the infarct zone ● Small ● Moderate ● Large ● None

6.2.4.5 Coronary Angiography Arterial Analysis

Template ID	1.3.6.1.4.1.19376.1.4.1.4.5		
Parent Template	none		
General Description	The Coronary Angiography Arterial Analysis Entry is an Organizer with subsidiary entries that describe the findings for each arterial segment.		
Class/Mood	**Code**	**Value Type**	**Value**
BATTERY / EVN	33367005, SNOMED CT, "Coronary Angiography"		

Opt	entryRelationship	Description	Template ID	Spec Document	Con-straint
R [1..*]	COMP	Simple Observation (stenosis)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.4.5.1
R [1..2]	COMP	Simple Observation (coronary findings)	1.3.6.1.4.1.19376.1.5.3.1.4.13	PCC TF-2	CARD TF-2 6.2.4.5.2
O [0..1]	COMP	observationMedia Entry	1.3.6.1.4.1.19376.1.4.1.4.7	CARD TF-2 6.2.4.6	CARD TF-2 6.2.4.5

The organizer Battery `Act/statusCode` value shall be 'completed'.

There SHALL be one ActRelationship with typeCode COMP with a target of an observation for each arterial segment visualized.

There SHOULD be one ActRelationship from the Organizer with typeCode COMP with a target of an ObservationMedia, whose value is a graphic depiction of the coronary analysis (e.g., a coronary tree diagram).

6.2.4.5.1 Simple Observation (stenosis) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
C [1..*]	R: ICA, CCTA	408715008, SNOMED CT, "Lumen Diameter Stenosis" targetSiteCode from 1.2.840.10008.6.1.48 DICOM CID 3015 Coronary Arteries	PQ or IVL<PQ>	%	

The Simple Observations Entry template provides additional guidance regarding observation elements templateId, id, text, statusCode, effectiveTime, and text.

The stenosis observation/value MAY be a categorical assessment using the HL7v3 Interval of Physical Quantities data type (IVL<PQ>), with preferred value ranges as shown in Table 6.2.4.5-1.

Note: The observation/value may be a null flavor.

Table 6.2.4.5-1 Preferred stenosis categorical ranges

Preferred stenosis categorical ranges
<10 %
10-50 %
50-70 %
70-90 %
>90 %

6.2.4.5.2 Simple Observation (coronary findings) Constraints

Opt	Exam Type Condition	observation/code	Data Type	Unit of Measure	Value Set
R [1..1]		404684003, SNOMED CT, "Finding"	CD		1.2.840.10008.6.1.211 DICOM CID 3710 Coronary Dominance
O [0..1]		414024009, SNOMED CT, "Disorder of coronary artery"	ED text/plain		indicate whether coronary anomalies, such as abnormal origin or location, are present

6.2.4.6 observationMedia Entry

Template ID	1.3.6.1.4.1.19376.1.4.1.4.7
Parent Template	none
General Description	The observationMedia Entry provides an in-line graphic depiction of the section findings. It is referenced by a `<renderMultiMedia>` element in the section text.

Class/Mood	Code	Value Type	Value
OBS / EVN		ED	`<tel>` element SHALL NOT be present

The value of type ED SHALL contain an in-line encoding of a graphic (i.e., the <tel> element shall not be present).

The ObservationMedia entry SHALL include an XML IDREFS `ID` attribute used as a target of a `<renderMultiMedia>` element in the `section/text` narrative block of the parent section.

6.2.4.7 Planned Procedure Activity Entry

Template ID	1.3.6.1.4.1.19376.1.4.1.4.8
Parent Template	none
General Description	The Planned Procedure Activity Entry is a description of a planned activity, with subsidiary optional entries that further describe the reasons for the activity.

Class/Mood	Code	Value Type	Value
PROC / INT	unconstrained		

Opt	entryRelationship	Description	Template ID	Spec Document	Con-straint
O [0..*]	RSON	Problem Entry	1.3.6.1.4.1.19376.1.5.3.1.4.5	PCC TF-2	

The Planned Procedure Activity entry SHALL describe the planned activity in either the act / code element, or in the act / text element.

6.3 Value Sets

1.3.6.1.4.1.19376.1.4.1.5.1 Cardiac imaging services

Concept \ Coding Scheme	SNOMED CT
Echocardiography	40701008
CCT (cardiac computed tomography)	241547009
CMR (cardiac magnetic resonance)	241620005
Cardiovascular NM	108294005
Cardiac PET (positron emission tomography)	241439007
coronary angiography and left ventriculography	418903008

1.3.6.1.4.1.19376.1.4.1.5.2 Cardiac imaging procedures

Concept \ Coding Scheme	SNOMED CT	Abbreviation
radionuclide myocardial perfusion study	252432008	SPECT
PET heart study	241439007	PET
radionuclide angiocardiography	426940008	RNA
exercise stress echocardiography	433233004	Stress TTE
transthoracic echocardiography	433236007	TTE
transesophageal echocardiography	105376000	TEE
cardiac CT for calcium scoring	426005005	CACS
CT angiography of coronary arteries	419545005	CCTA
CACS and CCTA	426005005+419545005	
cardiac MRI	241620005	CMR
MRI stress study of cardiac function	431609005	Stress CMR
fluoroscopic angiography of coronary arteries	419416005	ICA
fluoroscopic angiography of left ventricle and coronary arteries	418903008	ICA+LVG

1.3.6.1.4.1.19376.1.4.1.5.3 Referring Physician Specialty

Concept \ Coding Scheme	nuccProviderCodes	SNOMED CT
Cardiologist	207RC0000X	17561000
Family practice	207Q00000X	62247001
Internal medicine	207R00000X	39677007
OB/GYN	207V00000X	309367003
Hospitalist	208M00000X	309395003

Concept \ Coding Scheme	nuccProviderCodes	SNOMED CT
Surgeon	208600000X	304292004
Anesthesiologist	207L00000X	88189002
Radiologist	2085R0202X	66862007
Emergency department physician	207P00000X	309294001
Physician extender		

Note: As described in Section 6.1.2.4, the selection of the appropriate coding system for use may be based on local policy or national regulation.

1.3.6.1.4.1.19376.1.4.1.5.4 Cardiac problems/concerns

Concept \ Coding Scheme	SNOMED CT
Hypertension	38341003
Dyslipidemia	370992007
Diabetes	73211009
Acute renal failure	14669001
Chronic kidney disease	236425005
Peripheral arterial disease	399957001
Cerebrovascular disease	62914000
Erectile dysfunction	398175007
Cardiac arrhythmia	44808001
Asthma	195967001
Bronchospasm	4386001
Implanted pacemaker	371821000
Heart failure	84114007
Myocardial infarction	22298006
Angina	194828000

1.3.6.1.4.1.19376.1.4.1.5.5 Cardiac interventions

Concept \ Coding Scheme	SNOMED CT
Percutaneous coronary intervention	415070008
Coronary artery bypass graft	232717009
Implantation of cardiac pacemaker	307280005

1.3.6.1.4.1.19376.1.4.1.5.7 Angina Type

Concept \ Coding Scheme	SNOMED CT
Stable angina	233819005
Unstable angina	4557003
Atypical chest pain	371807002
Myocardial infarction	22298006

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1.3.6.1.4.1.19376.1.4.1.5.10 Contrast Agents Classes for Adverse Reactions

Concept \ Coding Scheme	SNOMED CT
Iodinated contrast agent	426722004
Gadolinium compound	105879004
Echocardiography agent	409290009
radiopharmaceutical	349358000

1.3.6.1.4.1.19376.1.4.1.5.11 Contrast Agents

Concept \ Coding Scheme	SNOMED CT	NDC
Radionuclide: F-18 FDG for viability	422975006	
Radionuclide: Rubidium-82 perfusion	79197006	
Radionuclide: Nitrogen-13 ammonia perfusion	21576001	
Radionuclide: Tc-99m tetrofosmin (Myoview)	404707004	
Radionuclide: Tc-99m sestamibi (Cardiolite)	404706008	
Radionuclide: Tl-201	353842007	
Echo Contrast: Optison (Perflutren)	409291008	00019-2707-03
Echo Contrast: Definity (Perflutren Lipid Microsphere)		11994-*011-04
Echo Contrast: Agitated saline	373757009	
Echo Contrast: Iodinated contrast	426722004	
High Osmolar Ionic Contrast: Diatrizoate meglumine and diatrizoate sodium (Renografin, etc.)	416688007	
High Osmolar Ionic Contrast: Iothalamate dimeglumine (Conray)	109221002	
Low osmolar non-ionic contrast: Iopamidol (Isovue)	109219007	
Low osmolar non-ionic contrast: Iohexol (Omnipaque)	109218004	
Low osmolar non-ionic contrast: Ioversol (Optiray)	109222009	
Low osmolar non-ionic contrast: Ioxaglate (Hexabrix)	353924001	
Low osmolar non-ionic contrast: Iomeprol (Iomeron)	356671000	
Low osmolar non-ionic contrast: Iopromide (Ultravist)	353903006	
Iso-osmolar nonionic contrast: Iodixanol (VisiPaque)	353962003	

Concept \ Coding Scheme	SNOMED CT	NDC
Paramagnetic agent: Gadopentetate dimeglumine (Magnevist)	404846007	
Paramagnetic agent: Gadodiamide (Omniscan)	354088005	
Paramagnetic agent: Gadoversetamide (Optimark)	409477004	
Paramagnetic agent: Gadobenate dimeglumine (MultiHance)	414307008	

1.3.6.1.4.1.19376.1.4.1.5.13 Cardiac Lab Results

Concept \ Coding Scheme	LOINC
Cholesterol.in HDL	2085-9
Cholesterol.in LDL	2089-1
Cholesterol	2093-3
Triglyceride	2571-8
High sensitivity C reactive protein	30522-7
Creatine kinase.MB	13969-1
Natriuretic peptide.B	30934-4
Natriuretic peptide.B prohormone	33762-6
Troponin T.cardiac	6598-7
Creatinine	2160-0
Hemoglobin A1c	41995-2
Urea nitrogen	3094-0
Fasting glucose	1557-8

1.3.6.1.4.1.19376.1.4.1.5.14 Cardiac Drug Classes

Concept \ Coding Scheme	SNOMED CT	NDF-RT
ACE inhibitor	69306018	N0000029130
Angiotensin receptor blocker	96308008	N0000175561
Aspirin, other antiplatelet agents	7947003	N0000145918
Calcium channel blockers	48698004	N0000029119
Beta-blockers	33252009	N0000029118
Erectile dysfunction medication	407315009	
Nitrates	31970009	N0000007647
Warfarin	48603004	N0000148057
Antiarrhythmics	67507000	N0000029121
Digitalis	65774009	N0000147198
Metformin	109081006	N0000021984

Concept \ Coding Scheme	SNOMED CT	NDF-RT
Lipid-lowering medication	57952007	N0000029122
Other antihypertensives		N0000029427
Aminophylline	55867006	N0000146397
Theophylline	66493003	N0000146467
Dipyridamole	66859009	N0000146237
Inhaler		N0000177906
Diabetic medications	384953001	

Note: As described in Section 6.1.2.4, the selection of the appropriate coding system for use may be based on local policy or national regulation.

1.3.6.1.4.1.19376.1.4.1.5.15 Drug Classes Used in Cardiac Procedure

Concept \ Coding Scheme	SNOMED CT	NDF-RT
Calcium channel blockers	48698004	N0000029119
Beta-blockers	33252009	N0000029118
Nitrates	31970009	N0000007647
Aminophylline	55867006	N0000146397

Note: As described in Section 6.1.2.4, the selection of the appropriate coding system for use may be based on local policy or national regulation.

1.3.6.1.4.1.19376.1.4.1.5.17 Rhythm Findings

Concept \ Coding Scheme	SNOMED	MDC Code	MDC Ref
Normal sinus rhythm	64730000	10:9232	MDC_ECG_RHY_SINUS_NORMAL_RHY
Atrial fibrillation	49436004	10:9472	MDC_ECG_RHY_ATR_FIB
Premature atrial contractions	425880007	10:8272	MDC_ECG_BEAT_ATR_P_C
Premature ventricular contractions	427172004	10:8336	MDC_ECG_BEAT_V_P_C
Paced rhythm	426453001	10:8704	MDC_ECG_BEAT_PACED
Atrial flutter	164890007	10:9456	MDC_ECG_RHY_ATR_FLUT
Sinus tachycardia	427084000	10:9264	MDC_ECG_RHY_SINUS_TACHY
Sinus bradycardia	426177001	10:9248	MDC_ECG_RHY_SINUS_BRADY

Note: As described in Section 6.1.2.4, the selection of the appropriate coding system for use may be based on local policy or national regulation.

1.3.6.1.4.1.19376.1.4.1.5.18 ECG Findings

Concept \ Coding Scheme	SNOMED	MDC Code	MDC Ref

Left bundle branch block	64730000	10:9232	MDC_ECG_BEAT_LBB_BLK_COMP
Right bundle branch block	49436004	10:9472	MDC_ECG_BEAT_RBB_BLK_COMP
Ventricular paced rhythm	61552005	10:5120	MDC_ECG_WAVP_PACE_V
Pre-excitation	195060002	10:10096	MDC_ECG_RHY_PREX

Note: As described in Section 6.1.2.4, the selection of the appropriate coding system for use may be based on local policy or national regulation.

1.3.6.1.4.1.19376.1.4.1.5.19 Myocardium Assessments

Concept / Coding Scheme	SNOMED CT
normal wall motion	373122000
Scar	12402003
Myocardial ischemia	414795007
Myocardial infarction	22298006
Mixed myocardial ischemia and infarction	428196007
Mixed scar and ischemia	12402003+414795007
Ventricular aneurysm	90539001

1.3.6.1.4.1.19376.1.4.1.5.20 Wall motion

Concept / Coding Scheme	SNOMED CT
Normal wall motion	373122000
Hyperkinetic region	373123005
Hypokinesis	37706002
Akinesis	195675009
Dyskinesis	25437005

1.3.6.1.4.1.19376.1.4.1.5.22 Cardiac Chamber Size Assessments

Concept / Coding Scheme	SNOMED CT
normal size cardiac chamber	373124004
abnormally small cardiac chamber	373125003
mildly enlarged cardiac chamber	373126002
moderately enlarged cardiac chamber	373127006
markedly enlarged cardiac chamber	373128001

1.3.6.1.4.1.19376.1.4.1.5.23 Pulmonary Veins Assessments

Concept \ Coding Scheme	SNOMED CT
pulmonary venous connections normal	446158009
variant number of pulmonary veins (usually 3 or 5), but with normal pulmonary venous drainage into left atrium	
anomalous pulmonary venous drainage	59631007

1.3.6.1.4.1.19376.1.4.1.5.24 Imaging Findings

Concept \ Coding Scheme	SNOMED CT
Imaging result normal	408573005
Imaging result abnormal	408574004
Imaging result equivocal	408379005

1.3.6.1.4.1.19376.1.4.1.5.25 Angina Characteristics

Concept \ Coding Scheme	SNOMED CT
Substernal chest pain	4568003
Provoked by exertion	427341007
Relieved by rest	427935006
Relieved by medication - nitroglycerin	428346000:363701004=71759000

1.3.6.1.4.1.19376.1.4.1.5.26 Cardiac risk scores

Concept \ Coding Scheme	LOINC
Hard coronary heart disease 10Y risk, Framingham	65850-0
Coronary heart disease 10Y risk, Framingham	65851-8
Coronary heart disease 2Y risk, Framingham	65852-6
General cardiovascular disease 10Y risk, Framingham	65853-4
Intermittent claudication 4Y risk, Framingham	65854-2
Recurring coronary heart disease 2Y risk, Framingham	65862-5
Stroke 10Y risk, Framingham	65855-9
Stroke after atrial fibrillation 5Y risk, Framingham	65864-1
Stroke or death after atrial fibrillation 5Y risk, Framingham	65865-8
Atrial fibrillation 10Y risk, Framingham	65856-7
Heart failure 4Y risk, Framingham	65863-3
Coronary heart disease 10Y risk, Reynolds	65857-5

Concept \ Coding Scheme	LOINC
Coronary event 10Y risk, PROCAM QuickCheck	65858-3
Coronary event 10Y risk, PROCAM HealthCheck	65859-1
Cardiovascular disease 10Y risk, SCORE PC	65860-9
Cardiovascular disease 10Y risk, SCORE Quick	65861-7

1.3.6.1.4.1.19376.1.4.1.5.27 Cardiac Imaging Procedure Indications

Concept \ Coding Scheme	SNOMED-CT
Chest Pain	29857009
Pre-operative	262068006
Coronary Artery Disease	53741008
Heart failure	84114007
Heart disease risk factors	171224000
Dyspnea	267036007
Post PTCA	373108000
History of CABG	399261000
Abnormal exercise tolerance test	165084003
Abnormal ECG	102594003
Arrhythmia	44808001
Angina pectoris	194828000
Hypertension	38341003
Palpitations	80313002
Supraventricular tachycardia	6456007
Syncope	271594007
History of Myocardial Infarction	399211009
Left bundle branch block	63467002
Valvular heart disease	368009
Occupational requirement	429060002
cardiogenic shock	89138009
ischemic heart disease	414545008
cardiac function test abnormal	165076002
heart transplant	32413006
heart disease - congenital	13213009
cardiomyopathy	85898001
heart disease	56265001
structural disorder of heart	128599005
Pericardial disease	55855009

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1.3.6.1.4.1.19376.1.4.1.5.28 Cardiac Synchronization Techniques

Concept \ Coding Scheme	DCM
Real time acquisition	109080
Prospective gating	109081
Retrospective gating	109082
Paced	109083

1.3.6.1.4.1.19376.1.4.1.5.29 Cardiac Shunt Types

Concept \ Coding Scheme	SNOMED CT
patent foramen ovale	204317008
atrial septal defect	70142008
ventricular septal defect	30288003
patent ductus arteriosus	83330001

1.3.6.1.4.1.19376.1.4.1.5.30 ECG Summary Findings

Concept \ Coding Scheme	SNOMED CT	DCM
ECG Ischemia	164861001	
ECG Abnormal	102594003	
ECG Equivocal	370359005	
ECG Normal	164854000	
ECG Nondiagnostic		122753

1.2.840.10008.6.1.48 DICOM CID 3015 - Coronary Arteries

Concept \ Coding Scheme	SNOMED CT
Left Main Coronary Artery	3227004
Left Main Coronary Artery Ostium	76862008
Left Anterior Descending Coronary Artery	59438005
Proximal Left Anterior Descending Coronary Artery	68787002
Mid Left Anterior Descending Coronary Artery	91748002
Distal Left Anterior Descending Coronary Artery	36672000
Left Posterior Descending Artery	56322004

Concept \ Coding Scheme	SNOMED CT
Left Posterior Descending Circumflex Coronary Artery	91760001
Left Posterolateral Circumflex Coronary Artery	57823005
Right Coronary Artery	13647002
Right Coronary Artery Ostium	56789007
Proximal Right Coronary Artery	91083009
Mid Right Coronary Artery	13647002+255562008
Distal Right Coronary Artery	41879009
Circumflex Coronary Artery	57396003
Proximal Circumflex Coronary Artery	52433000
Mid Circumflex Coronary Artery	91753007
Distal Circumflex Coronary Artery	6511003
Posterior Descending Right Coronary Artery	53655008
Intermediate Artery (Ramus)	244252004
Right posterior AV Coronary Artery	12800002
1st Diagonal Coronary Artery	91750005
1st Left Posterolateral Coronary Artery	91757008
1st Marginal Coronary Artery	91754001
1st Right posterolateral Coronary Artery	91761002
1st Septal Coronary Artery	244251006
2nd Diagonal Coronary Artery	91751009
2nd Left Posterolateral Coronary Artery	91758003
2nd Marginal Coronary Artery	91755000
2nd Right Posterolateral Coronary Artery	91762009
3rd Diagonal Coronary Artery	91752002
3rd Left Posterolateral Coronary Artery	91759006
3rd Marginal Coronary Artery	91756004
3rd Right posterolateral Coronary Artery	91763004
Marginal Right Coronary Artery	22765000
AV groove continuation of Circumflex Artery	75902001

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.57 DICOM CID 3261 - Stress Protocols

Concept \ Coding Scheme	SNOMED-CT
Balke protocol	129097005

Concept \ Coding Scheme	SNOMED-CT
Bruce protocol	129095002
Ellestad protocol	129098000
Modified Bruce protocol	129096001
Modified Naughton protocol	129102008
Naughton protocol	129101001
Pepper protocol	129100000
Ramp protocol	129099008
Exercise stress ECG test	46136006
Stress test using Bicycle Ergometer	26046004
Pharmacologic Stress protocol	424064009
Dipyridamole Stress protocol	422685009
Adenosine Stress protocol	424444005
Dobutamine Stress protocol	424225000
Pharmacologic and exercise stress test	428813002
Stress test using cardiac pacing	428685003

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.211 DICOM CID 3710 - Coronary Dominance

Concept \ Coding Scheme	SNOMED CT
Left Coronary Dominance	253729004
Right Coronary Dominance	253728007
Balanced Coronary Dominance	253730009

Adapted from DICOM PS3.16-2009

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1.2.840.10008.6.1.218 DICOM CID 3717 - Myocardial Wall Segments

Concept \ Coding Scheme	SNOMED CT
left ventricle basal anterior segment	264850008
left ventricle basal anteroseptal segment	396482007
left ventricle basal inferoseptal segment	396646008
left ventricle basal inferior segment	264846001
left ventricle basal inferolateral segment	396652009
left ventricle basal anterolateral segment	396654005

Concept \ Coding Scheme	SNOMED CT
left ventricle mid anterior segment	264848000
left ventricle mid anteroseptal segment	396647004
left ventricle mid inferoseptal segment	396649001
left ventricle mid inferior segment	264847005
left ventricle mid inferolateral segment	396655006
left ventricle mid anterolateral segment	396656007
left ventricle apical anterior segment	264844003
left ventricle apical septal segment	264845002
left ventricle apical inferior segment	264849008
left ventricle apical lateral segment	264853005
apex of left ventricle	128564006

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.219 DICOM CID 3718 - Myocardial Wall Segments in Projection

Concept \ Coding Scheme	SNOMED CT
left ventricle basal anterior segment	264850008
myocardium of anterolateral region	73050001
myocardium of apex of heart	47962008
myocardium of diaphragmatic region	72542009
left ventricle basal inferior segment	264846001
left ventricle basal lateral segment	277631004
myocardium of posterolateral region	33272004
myocardium of inferolateral region	16239001
left ventricle apical septal segment	264845002
left ventricular basal septal segment	277630003
left ventricular posterobasal segment	408720008

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.223 DICOM CID 3722 - Diabetic Therapy

Concept \ Coding Scheme	SNOMED CT
Dietary Treatment	284071006
Oral Treatment	170746002
Insulin Regime	225302006

Adapted from DICOM PS3.16-2009

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1.2.840.10008.6.1.225 DICOM CID 3724 - Smoking History

Concept \ Coding Scheme	SNOMED CT
No History of Smoking	266919005
Current Smoker	77176002
Former Smoker	8517006

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.227 DICOM CID 3727 - Indications for Catheterization

Concept \ Coding Scheme	SNOMED CT
cardiogenic shock	89138009
valvular heart disease	368009
Arrhythmia	44808001
ischemic heart disease	414545008
cardiac function test abnormal	165076002
heart transplant	32413006
heart disease - congenital	13213009
cardiomyopathy	85898001
heart disease	56265001

1585 *Adapted from DICOM PS3.16-2009*

1.2.840.10008.6.1.253 DICOM CID 3758 - Cardiovascular Family History

Concept \ Coding Scheme	SNOMED CT
Family history of coronary artery disease	430091005
Family history: Diabetes mellitus	160303001
Family history of myocardial infarction	266897007
No Family history of Diabetes	160274005
No Family history of Cardiovascular disease	160270001
Family History Unknown	407559004

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.616 DICOM CID 12224 - Ultrasound Image Modes

Concept \ Coding Scheme	SNOMED CT
2D mode	399064001
Doppler Color Flow	261197005
M mode	399155008
Doppler Pulsed	261199008
Doppler Continuous Wave	261198000
Power Doppler	425704008
3D mode	426865009

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.744 DICOM CID 3112 - Attenuation Correction

Concept \ Coding Scheme	DCM
Algorithmic Attenuation Correction	122726
NM Transmission Attenuation Correction	122727
CT–based Attenuation Correction	122728
No Attenuation Correction	122729

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.755 DICOM CID 3200 - Stress Test Procedure

Concept \ Coding Scheme	SNOMED-CT
Exercise stress test	165079009
Pharmacologic stress test	424064009
Pharmacologic and exercise stress test	428813002
Paced stress test	428685003

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.759 DICOM CID 3204 - Stress Agents

Concept \ Coding Scheme	SNOMED-CT
Dipyridamole	66859009
Dobutamine	26523005

Concept \ Coding Scheme	SNOMED-CT
Adenosine	108502004
Atropine	73949004
Adenosine A2 receptor agonist	432062000

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.770 DICOM CID 3217 - Comparison Finding

Concept \ Coding Scheme	DCM
Agreement with prior findings	122775
Disagreement with prior findings	122776

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.781 DICOM CID 3235 - Perfusion Comparison Findings

Concept \ Coding Scheme	SNOMED-CT
No change	260388006
New ischemia	428927006
Less ischemia	429232006
Resolution of ischemia	428824000
More ischemia	429477006
New infarction	429391004

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.782 DICOM CID 3236 - Tolerance Comparison Findings

Concept \ Coding Scheme	SNOMED-CT
No change	260388006
Decreased tolerance	102460003
Increased tolerance	102459008

Adapted from DICOM PS3.16-2009

1.2.840.10008.6.1.783 DICOM CID 3237 - Wall Motion Comparison Findings

Concept \ Coding Scheme	SNOMED-CT
No change	260388006
New wall motion abnormality	429058004
Improvement of wall motion	428825004

Adapted from DICOM PS3.16-2009

2.16.840.1.113883.3.88.12.3221.5.2 HITSP Health Insurance Type

1615 This value set uses the ASC X12 vocabulary for Insurance Type Code (ASC X12 Data Element 1336) and identifies the type of health plan covering the individual (e.g., an HMO, PPO, POS, etc.). The use of this value set is limited to the United States.

Concept \ Coding Scheme	X12DE1336
Medicare Secondary Working Aged Beneficiary or Spouse with Employer Group Health Plan	12
Medicare Secondary End-Stage Renal Disease Beneficiary in the 12 month coordination period with an employer's group health plan	13
Medicare Secondary, No-fault Insurance including Auto is Primary	14
Medicare Secondary Worker's Compensation	15
Medicare Secondary Public Health Service (PHS)or Other Federal Agency	16
Medicare Secondary Black Lung	41
Medicare Secondary Veteran's Administration	42
Medicare Secondary Disabled Beneficiary Under Age 65 with Large Group Health Plan (LGHP)	43
Medicare Secondary, Other Liability Insurance is Primary	47
Auto Insurance Policy	AP
Commercial	C1
Consolidated Omnibus Budget Reconciliation Act (COBRA)	CO
Medicare Conditionally Primary	CP
Disability	D
Disability Benefits	DB
Exclusive Provider Organization	EP
Family or Friends	FF
Group Policy	GP
Health Maintenance Organization (HMO)	HM
Health Maintenance Organization (HMO) - Medicare Risk	HN

Concept / Coding Scheme	X12DE1336
Special Low Income Medicare Beneficiary	HS
Indemnity	IN
Individual Policy	IP
Long Term Care	LC
Long Term Policy	LD
Life Insurance	LI
Litigation	LT
Medicare Part A	MA
Medicare Part B	MB
Medicaid	MC
Medigap Part A	MH
Medigap Part B	MI
Medicare Primary	MP
Other	OT
Property Insurance – Personal	PE
Personal	PL
Personal Payment (Cash - No Insurance)	PP
Preferred Provider Organization (PPO)	PR
Point of Service (POS)	PS
Qualified Medicare Beneficiary	QM
Property Insurance – Real	RP
Supplemental Policy	SP
Tax Equity Fiscal Responsibility Act (TEFRA)	TF
Workers Compensation	WC
Wrap Up Policy	WU

Adapted from HITSP C80 Clinical Document and Message Terminology Component V2.0.1

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