ACC, HIMSS and RSNA

Integrating the Healthcare Enterprise

IHE Cardiology

Cardiology Data Handling White Paper

June 8, 2007

Rev 2.04

Introduction

The purpose of this white paper is to present background information to assist with understanding the requirements and potential solutions for improving methods for the gathering and collating medical information for supporting Clinical Documentation Systems for Cardiology. This white paper is a step toward publishing of a cross-domain IHE data handling approach in the 2008-2009 timeframe. Originally, this document took the form of a Profile Proposal from the IHE-Cardiology Planning Committee. It then became apparent that the "Query for Existing Data" (QED) profile from the Patient Care Coordination Committee would meet many of the requirements (see http://wiki.ihe.net/index.php?title=Query_for_Existing_Data). This document has undergone a major revision to detail the data-handling requirements for Cardiology, including use cases and the known relationship(s) with the QED Profile.

Comments on this document may be submitted to:

http://forums.rsna.org under the "*IHE - Integrating the Healthcare Enterprise*" forum

Select the "*Cardiology Technical Framework Supplements 2007-2008 for Trial Implementation*" sub-forum.

Topics of Particular Interest for Feedback

1. Five data-handling activities are described in the first section (below). Is this list complete? Correct?
2. The ability to specify the Definitions and Authorities is essential to assure data integrity and accuracy when exchanging clinical information among disparate systems (see the discussion in the *Concepts, Definitions and Authorities* section, and in Recommendation #3). How might this best be accomplished?
3. Clinical Documentation Systems are faced with determining and preserving the clinical context of an observation. There are pre-coordinated and post-coordinated approaches to this problem (see the discussion in the *Concepts, Definitions and Authorities* section, and also Recommendation #4). What approaches should be taken to address this issue?
4. Given the types of data-handling activities described and the use cases that we need to address, is the Query for Existing Data (QED) Profile the correct way to address the integration task?
5. Recommendation #2 calls for extending QED's Problem List and Allergy Profile to include a list of diagnoses and procedures performed. What problems, if any, can be anticipated in trying to implement these extensions?
6. The ability for a Clinical Documentation System to also function as an Information Source is potentially very powerful (see Recommendation #1). How might this be accomplished? Should this be done *only* by letting there be Query for an Evidence

Document? Should it be possible to Query "inside" of an Evidence Document for one or more of its elements? How important is it to handle the "clinical context" in which the observation was made?

7. The Data Correction activity that is described has the potential to greatly improve the accuracy and integrity of medical data if automated means to assist the process are developed. How important is this to accomplish? Since the data-handling activities described may occur concurrently within a Clinical Documentation environment, do we need to determine when these activities are mutually exclusive, chronologically sequential, asynchronous, iterative, etc?

Data-Handling Activities in Cardiology

There are several distinct data-related activities that are carried out by a typical Cardiology Clinical Documentation System. While these will be discussed separately, they typically co-exist to a greater or lesser extent within a single application. These include:

1. **Initial "Manual" Data Collection:** This refers to applications that assist with the initial collection of targeted and specifically-defined data about the patient. The data could be collected by any one of a variety of methods, including (but not limited to) interview, filling out forms (paper or electronic), through the performance of laboratory tests, imaging studies, or physician interpretation of any of these. A typical computer application for Data Collection has a Graphical User Interface (GUI) that allows the entry of information about the patient's history, physical examination findings, lab data, physiologic parameters, etc. Most vendors have proprietary software to accomplish this task, sometimes supplemented with interfaces to handle the import of evidence documents from a modality (for example, echocardiographic measurements via DICOM SR). This aspect of data collection is also addressed by the IHE Retrieve Form for Data Capture profile (RFD), as described in the Introduction of the RFD Technical Framework Supplement:

   > *The Retrieve Form for Data-capture Profile (RFD) provides a method for gathering data within a user's current application to meet the requirements of an external system. RFD supports the retrieval of forms from a form source, display and completion of a form, and return of instance data from the display application to the source application.*

2. **Query for Existing Data:** This refers to the process of performing a query/retrieve operation for information that already exists electronically in the enterprise for the purpose of incorporating that information into a clinical document. In the current standards and implementations, the data communication has existed largely as a "push" model. That is, a Data Source might make its information available as an Evidence Document (DICOM-SR, HL/7 CDA document, etc.) While this model works well for discrete well-circumscribed sets of data (for example measurements from an echo cart, or QCA/QVA analysis system), it is not practical when confronted with the massive amounts and variety of information that might be stored in an Electronic Health Record (EHR). Standardized methods for querying or "pulling" information have thus far been sparsely defined and rarely implemented, and lack sufficient mechanisms to incorporate the necessary data definitions and vocabularies. The "Query for Existing Data" (QED) Profile from the Patient Care Coordination domain can meet many of these requirements.

3. **Review of Imported Data:** Presenting data that is about to be imported into a data set is a commonly-implemented step in clinical workflow. This gives the clinician the opportunity to select one or more values from among multiple values (if present), resolve any conflicts that may appear with existing data and review decisions that may have been made by the import function of the Clinical Documentation System. This review step can be applied to data from either step #1 (for example, evidence documents) or step #2

above. This activity is most likely to be a feature of a clinical application, and is not likely to require being addressed by an IHE Profile.

4. **Data Correction:** This is a complex topic that is presented only briefly here. After data is gathered from potentially several different sources, the connection to the data source is typically lost. That is, no record is kept of the connection between the data source and data consumer. There may be an opportunity to improve data accuracy and integrity if this connection was preserved, keeping track of the source of the data and documents. If these sources are associated with a long-term archive, there is potential for "bi-directional" data correction and updating to occur:

    a. The original source of the data may get corrected or updated information, in which case it may be desirable to make the updates available to any system that has accessed the information. This could be implemented either as a "push" from the original data source (announcing the availability of the updated information), or as a "pull" from the consuming system. In this second case, the consuming system would not know ahead of time that there updates existed, but could do a final "double-check" of any data it has imported before finalizing a data set.

    b. The data my be created, updated or corrected in the Clinical Documentation system, in which case the originated data source may be interested to learn of the update.

5. **Data Submission:** This refers to the process of packaging and transmitting data to a registry. This might be done using web pages to enter and submit the data, or using specialized software that collects the information, checks it for suitability, and then prepares it for submission to the registry. Data submissions can be done on a patient-by-patient basis, or might be done in a batch mode on a periodic basis. Data Submission approaches vary based on the needs of the recipient organization. Since the requirements are well-defined and there are few clinical "pain points" in this aspect of data handling, Data Submission will not be addressed further in this document. Standardization of this process may prove useful to address with a new profile from the IHE Quality Domain to simplify the creating of new registries, and/or the maintenance of existing ones.

Use Cases

So what is the "pain point" we have been asked to address by the IHE-Cardiology Planning Committee? It is to provide methods to assist with the retrieval of data that *already exists electronically*, and to permit its collation and integration into information workflows. The two most common Cardiology use cases in this regard are described below. These use cases do not fully reflect all of the data handling activities described above, but rather, they have been selected as they directly address the charge provided by the IHE-Cardiology Planning Committee:

1. **The incorporation of data into clinical documentation systems:** A patient is scheduled for cardiac catheterization (either elective or emergent), and the process of creating the report of the procedure is begun ("cath report"). In many cases this starts before the procedure begins, other times not until afterward. While there are as yet no published

guidelines from professional societies to detail the components that should go into a cath report, one that is generally accepted as important is to document the review of factors that relate to the risk of the administration of contrast media. These risks include:

a. Non-modifiable risks: older age, diabetes mellitus, pre-existing renal failure, advanced congestive heart failure, low ejection fraction, acute myocardial infarction, cardiogenic shock and renal transplant

b. Modifiable risks: volume of contrast media, hypotension, anemia and blood loss, dehydration, low serum albumin level (<35 g/l), ACE inhibitors, diuretics, non-steroidal anti-inflammatory drugs, nephrotoxic antibiotics, intra-aortic balloon pump, and metformin administration

Note that while many of these factors exist in electronic form elsewhere in the hospital, the current practice is to review paper or electronic displays of the data and then type them back into the clinical documentation system that is creating the cath report. A system that facilitates this data interchange would impact 100% of the cath reports produced electronically, improving the quality of care and of the documentation, and reducing medical risk to the patient and legal liability of the physician.

Here is how these data elements can to be addressed (or possibly not addressed) by QED and related profiles:

a. Age: from Patient Demographics Query (PDQ)

b. Diagnosis of diabetes mellitus, renal failure, congestive heart failure, acute MI, cardiogenic shock, renal transplantation, dehydration, blood loss: This could be done via QED/Query Problems and Allergies if this were expanded to handle coded procedures and diagnoses (see *Recommendation #2*).

c. Ejection Fraction: Not handled by current profiles unless the Ejection Fraction analysis was done by a Quantitative Ventricular Analysis (QVA) system that created an evidence document (DICOM-SR). Information from an ejection fraction from another source (nuclear study, echocardiogram, etc.) would not be available to be queried. Consideration should be given to having a clinical documentation system behave like a lab system, and be able to be queried via QED/Query Lab Results for something like this (see *Recommendation #1*).

d. Volume of contrast media administered: Not available as information that can be queried by current profiles. This information is not available until the end of the cath study)

e. Hypotension: QED/Query Vital Signs

f. Anemia, low serum albumin, BUN, creatinine: QED/Query Lab Results

g. Medications include ACE inhibitors, diuretics, non-steroidal anti-inflammatory drugs, nephrotoxic antibiotics, metformin: QED/Query Medications

h. Use of the intra-aortic balloon pump: Not available as information that can be queried by current profiles.

2. **Data Registries:** The task of collecting data for national registries, clinical trials and other related research activities is overwhelming for most hospitals. These activities are important not only to advance our clinical knowledge, but also directly impact a hospital's ability to provide the necessary documentation for pay-for-performance scenarios. In many states in the U.S., and in several other countries, participation in data registries is a requirement for cardiac catheterization laboratories. As with the use case for clinical documentation systems (above), it would be very helpful to improve the ability of computer systems to assist in this process. During the interaction with the software that is collecting and collating data for submission to the data registry, and physician or nurse would ask for all pertinent data from other clinical systems to be collected and presented on screen for review. Upon review, the appropriate data can be confirmed and imported into the data registry for that patient. This is a good fit with the QED profile intent.

Analysis of Data Handling Requirements

In order to help discover the kind of data handling challenges that might araise, a complete analysis of the entire set of data elements for the American College of Cardiology's National Cardiovascular Data Registry (NCDR) was done (see Appendix C). This data set was selected to be used as an example to show the kind of information that needs to be gathered and collated by a Clinical Documentation System ("Data Client"). The data elements in the NCDR are similar to those encountered in other Cardiology registries such as the European Society of Cardiology's "Cardiology Audit and Registration Data Standards" (CARDS), the French National Registry of Acute Coronary Syndromes, the National Cardiac Databases for Australia, etc. From the analysis, several challenges for data handling were discovered (see Appendix C for the full details), including:

1. Candidate data elements to be handled by QED. A query is sent to a data source. The Data Client is responsible for matching up the timestamp of the lab test with that of the procedure being document in order to provide the necessary context to the data elements.

2. Information that cannot be handled using existing profiles due to the need for specific data definitions. In some cases, the data element could be constructed from its individual components (see Query example for ST Elevation MI in Appendix B, for example). These are incompletely handled by the current QED Profile specification, but could be handled if QED is extended to handle an information source that deals with coded procedures and diagnoses.

3. Information available through Patient Demographic Query (PDQ).

4. Information that can be obtained from the Patient Care Coordination profiles for Pre-Procedure History and Physical (PPHP) and/or the Medical Summaries Profiles. The local application is responsible for matching up timestamps with the procedure being documented to select the *most recent* procedures for PCI and CABG, and for CABG this admission (that is what the NCDR data elements call for). Alternatively, these data elements could be handled as part of the Data Interchange profile, as the definitions are reasonably universal.

5. Information that might be obtained directly from evidence documents (by querying an Evidence/Image manager) or easily derived from the information in the evidence document. The local application is responsible to assure that the data being returned matches the procedure being reported on. These might be handled by QED/Query for Lab Data if the scope of "Lab" is extended.

6. Information that is specific to the local application, and not handled by using Data Interchange to collect the information from other Data Sources. In many cases, however, the information may be interesting to other Data Clients (that is, might be necessary to make it available to a query response).

Concepts, Definitions and Authorities

Current medical information standards do not provide a mechanism for specifying the definition used for a term. Such a capability is vital for the proper interpretation of information that is exchanged among disparate systems. The classic example in Cardiology is "Unstable Angina". While this concept has a unique SNOMED identifier (4557003), there are a large number of definitions that have been used for this concept over the years. It is often helpful to know, not only that the patient had "unstable angina", but also to know the definition that was used to make that determination. A formal way of specifying this "concept modifier" is needed.

Here is another simple example of the importance of definitions to assure data accuracy and integrity. A hemodynamics system may provide a way to entering data about the patient's history. A data element, for example, might specify if the patient is a Cigarette Smoker (YES or NO). But the data registry that is ultimately to receive this information has a different set of choices for Cigarette Smoker: YES, NO, or FORMER. A "NO" value selected from the choices "YES or NO" has a very different meaning than a "NO" value selected from "YES, NO, or FORMER". It is very important to be able to qualify the "Cigarette Smoker" concept with its definition (either the list of choices from which the answer is selected, or the Authority that created the definition, for example, NCDR).

It should be possible to address pre-coordinated terms (fully qualified concepts, information model, etc.) as well as terms that exist inside of a clinical context (post-coordinated).

Clinical laboratory systems typically return a numeric value corresponding to the result of the test that was performed, for example, a serum creatinine level. This lab result is identified with a date-time stamp in a Hospital Information System reflecting the time that the sample was collected. A Clinical Documentation System might extend it further with information about the clinical context associated with the value (in the creatinine example, it might be identified as the last creatinine value obtained before the cardiac catheterization).

A "pre-coordinated" term could be created that fully reflects the concept of "The Last Creatinine Obtained Before the Cardiac Catheterization". While this eases the burden to the Clinical Documentation System of interpreting the significance of the value, the list of such terms obviously expands rapidly and is not likely to be practical. A "post-coordinated" approach provides some structure to the information, so that the clinical context in which the observation was made is defined. This is highly flexible, but does impose some degree of a burden on a clinical system that might have to traverse the branches of an information model to figure it out.

Another example may help to clarify this further. There are SNOMED terms that define (in increasing level of specificity) Intracardiac Pressure (165077006), Ventricular Pressure (251069003), Left Ventricular Pressure (276769008), and Left Ventricular End-Diastolic Pressure ("LVEDP", 276781007). These might be considered pre-coordinated terms in that very high levels of detail can be specified based on the identifier used. Clinically, however, it is often desirable to describe the LVEDP at baseline and again after the performance of the left ventriculogram. This is a "clinical context" that does not currently have a pre-coordinated term that fully describes it. One approach would be to add "baseline" and "post-contrast" descendants to LVEDP and create unique SNOMED identifiers for them. The alternative is to provide a post-coordination mechanism to describe the clinical context ("baseline" and "post-contrast") for the LVEDP observations.

Recommendations

1. A formalization should be established for an approach that treats a Clinical Documentation System like a lab system with regards to being an Information Source? In this manner, it could be an actor to respond to a QED/Query for Lab Data (for example, to respond with an Ejection Fraction). This would be a major expansion in the scope of "Lab" information, extending beyond clinical chemistries and to now include any clinical laboratory (whoever the results are obtained).
2. QED Problem List & Allergies profile should be expanded to include diagnoses and procedures (for example, to gather a list of procedures performed, such as PCI's and CABG's). What coding scheme should be used for this? Again, a simple concept that would be a powerful extension of the QED approach.
3. A mechanism needs to be established to better handle concept definitions (like "Unstable Angina") so that it could take into account the definition used for the data element (see the discussion in this white paper on **Concepts, Definitions and Authorities**).
4. A consistent approach for the use of "pre-coordinated" and "post-coordinated" terms should be established.

Appendix A: Different Levels of Data Complexity

It is instructive to look at some of the information that might be of interest to a Data Client, and the queries needed to retrieve the information from Data Sources. For this discussion, several levels of query complexity can be derived:

- **Simple:** Queries for lab results. The response includes units, value, and DATETIME of collection. Examples: BUN, creatinine, hemoglobin, hematocrit
- **Definition-Based:** Need to specify the desired aspects of the data element definition. Response includes DATETIME of the finding as well as its value. Examples: ST Elevation MI, Unstable Angina.
- **Intermediate:** All of Simple, plus the need to specify the "normal range" or "diagnostic limit" for the lab (and possibly the specific specimen). Example: cardiac enzymes (CK, troponin, etc.)
- **Derived:** A data value derived from two or more other data elements. Example: Body Surface Area ("BSA"). Actually, the Data Source may have this value already available for a Simple Query, or alternatively, the Data Client could request Patient Height and Patient Weight and compute the BSA from that. In the case that the Data Source has a BSA value available directly, it might optionally say how it was derived (there are several possible formulas that could be used to derive BSA from Height and Weight). In this case there are elements of "Definition-Based" queries/responses that could be used.
- **Complex:** There are, of course, all levels of "Complex Queries" that could be needed. One straight-forward example can illustrate the concept, though, and that is "Ejection Fraction from Any Source". What is needed here by the Data Client is an Ejection Fraction value that could be derived from any one of a number of sources. This is similar to the Derived example (above), in that a Data Source might provide an Ejection Fraction response directly (because it either had the value already stored and responded as a Naïve Data Source, or it understood an Information Model and put a response together itself responding as an Intelligent Data Source).. Alternatively, the Data Client might query for many simple Ejection Fraction (EF) values (EF determined by echocardiography, EF determined by ventriculography, EF determined radionuclide angiography, etc.) and apply the logic itself to derive the "Ejection Fraction from Any Source" value.

Appendix B: Sample Data Derivations

Last Creatinine

The Data Client would like to know the last creatinine prior to day of the cath procedure (NCDR.3 data element #440)

- ✓ Query for all available serum creatinine levels (TIMEDATE of the result along with the actual lab value should be returned).
- ✓ Combine the responses to this query with information about the procedure date and make a determination if the data meets the data element definitions
- ✓ Present the information for human review before allowing the data element to be populated with this information

Derived Findings: STEMI and non-STEMI

This logic shows how to determine if the patient had a STEMI or non-STEMI

- ✓ Query for the "raw data" that is used to make the diagnosis of STEMI or non-STEMI (EKG findings, biochemical markers)
- ✓ Combine the responses to this query and determine which definition(s) are met by the data
- ✓ Present the information for human review before allowing the data element to be populated with this information

Prior Myocardial Infarction (MI)

The Data Client would like to know if the patient has had a prior MI (more than 7 days before this admission; NCDR.3 data element #420)

- ✓ Query directly for STEMI or non-STEMI (the date of the diagnoses should be returned)
- ✓ Alternative: Attempt to make the diagnosis using the STEMI and non-STEMI as per the STEMI logic example above
- ✓ Combine the responses this query with the admission date and make a determination if the data meets the data element definitions
- ✓ As always, present the information for human review before allowing the data element to be populated with this information

Appendix C: Analysis of NCDR 3.0 Data Elements

The section shows a comprehensive analysis of all of the current data elements in NCDR 3.0, and how they could be handling could be facilitated by a Data Interchange approach. The NCDR was chosen to serve as a prototype, as the types of data elements gathered are typical of those in many other international registries of clinical problems in Cardiology.

1. Laboratory data to be handled by QED:

439	Creatinine Assessed on Admission
440	Last Creatinine
1112	CK-MB Pre-Procedure Baseline Assessed
1113	CK-MB Pre-Procedure Baseline
1114	CK-MB Post-Procedure Peak Assessed
1115	CK-MB Post-Procedure Peak
1116	Troponin - Pre-Procedure Baseline Assessed
1117	Troponin - Pre-Procedure Baseline
1118	Troponin - Post-Procedure Peak Assessed
1119	Troponin - Post-Procedure Peak
1120	Post Procedure Creatinine Assessed
1122	Post Procedure Creatinine Level

2. Non-lab data to be handled by Data Interchange:

454	Chronic Lung Disease
420	Previous MI (>7 Days)
424	CHF - Previous History
442	Renal Failure
444	Renal Failure – Dialysis (to distinguish other indications for the patient having undergone dialysis)
450	Cerebrovascular Disease
452	Peripheral Vascular Disease
456	Hypertension
460	History of Tobacco Use
470	Dyslipidemia
480	Family History of CAD age <55
500	CHF - Current Status

3. Information available through Patient Demographic Query (PDQ):

210	Patient First Name
220	Patient M.I.
230	Patient Last Name
240	Patient Social Security Number
250	Patient DOB
252	Patient Age (derivable from #250)
260	Gender (??)

270	Race/Ethnicity (??)
1156	Date of Death

4. Information that can be obtained from the Patient Care Coordination profiles:

410	Height (cm)
412	Weight (kg) (should be from a recent point in time)
426	Previous Valvular Surgery
428	Cardiac Transplant
430	Diabetes
490	Previous PCI
492	Previous PCI - Date
494	Previous CABG
496	Previous CABG - Date
510	NYHA
520	Cardiogenic Shock
530	Non-Invasive Test
540	Non-Invasive Test - Outcome
550	Admission Sx Presentation
560	Time Period: Sx Onset to Admission
1100	CABG During This Admission - Status
1102	CABG During This Admission - Date

5. Information that might be obtained directly from evidence documents:

600	Date of Procedure
610	Right Heart Cath Procedure
612	Left Heart Cath Procedure
614	PCI Procedure
632	Fluoroscopy Time
650	Left Ventricular Function Assessed
652	Left Ventricular Wall Motion
654	Ejection Fraction Done
656	Ejection Fraction Percentage
658	Ejection Fraction Method
660	LM Assessed
661	LM Stenosis Percent
662	Proximal LAD Assessed
663	Proximal LAD Stenosis Percent
664	Mid/Distal LAD Assessed
665	Mid/Distal LAD Stenosis Percent
666	CIRC Assessed
667	CIRC Stenosis Percent
668	RCA Assessed
669	RCA Stenosis Percent
670	Ramus Assessed

671	Ramus Stenosis Percent
674	Proximal LAD Graft Assessed
675	Proximal LAD Graft Stenosis Percent
676	Mid/Distal LAD Graft Assessed
677	Mid/Distal LAD Graft Stenosis Percent
678	CIRC Graft Assessed
679	CIRC Graft Stenosis Percent
680	RCA Graft Assessed
681	RCA Graft Stenosis Percent
682	Ramus Graft Assessed
683	Ramus Graft Stenosis Percent
740	Mitral Valve Disease - Stenosis
744	Mitral Valve Disease - Insufficiency
746	Aortic Valve Disease - Stenosis
750	Aortic Valve Disease - Insufficiency
810	Coronary Lesion >=50% in a Major Artery
900	Lesion Counter
902	Segment Number
910	Segment Pre-Stenosis Percent
912	Segment Post-Stenosis Percent
920	Pre-Procedure TIMI Flow
922	Post-Procedure TIMI Flow
950	Lesion Risk
952	Lesion Length

6. Information that is specific to the local application:

100	Transmission Number
110	Participant ID
120	Participant Name
130	Timeframe of data submission
140	Software Vendor's Name Identification
150	Vendor's software version (name and number)
160	NCDR Version
170	Diagnostic Cath - Minimum Data Set
180	Data Submission File Password
242	Unique Patient ID
310	Date of Admission (available from ADT)
320	Admission Status (available from ADT)
321	Inpatient Status (available from ADT)
330	Insurance Payer (available from ADT)
350	Medication ID (a future profile could obtain from a Medical Administration Records, MARS)
352	Medication Administration (see #340 comment)
360	Reserved 1
361	Reserved 2

362	Reserved 3
432	Diabetes Control
602	Procedure Counter
634	Contrast Volume
640	IABP
642	IABP Timing
695	Percutaneous Entry Location
696	Closure Device Counter
697	Closure Device
698	Closure Device - Successful
702	Catheterization Operator's UPIN
703	Catheterization Operator's Name
704	Cardiac Cath Status
710	Valvular Heart Disease
712	Arrhythmia
714	R/O CAD
724	Positive Stress Test
726	Other Diagnostic Cath Indications
728	Other Cardiac Indications
730	Other Miscellaneous Indications
732	Transplant Indications
802	PCI Primary Operator's UPIN
803	PCI Primary Operator's Name
804	PCI Status
812	Acute PCI
814	Date/Time of Arrival
816	Reperfusion Date/Time
818	Transfer for Primary PCI
820	Date/Time ED Presentation at Referring Facility
930	Previously Treated Lesion
932	Previously Treated -Balloon
934	Previously Treated -Stent
936	Previously Treated -Radiation
938	Previously Treated -Other/Unknown Device
940	Previously Treated -Date Available
941	Previously Treated Lesion Date
942	Segment In Graft
944	Location in Graft
954	Bifurcation Lesion
960	Intracoronary Device Counter
962	Intracoronary Devices Used
964	Intracoronary Devices Diameter
965	Intracoronary Device Length
966	Intracoronary Device Primary Indicator
967	Intracoronary Devices Barcode

970	Transient No Reflow Phenomenon During Procedure
972	Dissection in Segment
974	Acute Closure In Segment
976	Successful Reopening
978	Perforation in Segment
1130	Blood Products
1140	Smoking Cessation Counseling
1141	Cardiac Rehab Referral
1150	Date of Discharge (also available from ADT)
1152	Discharge Status
1154	Discharge Location
1158	Primary Cause of Death
1160	Death in Lab
1000	Comp-Periprocedural MI
1010	Comp-Cardiogenic Shock
1020	Comp-Congestive Heart Failure
1030	Comp-CVA/Stroke
1040	Comp-Tamponade
1050	Comp-Thrombocytopenia
1060	Comp-Contrast Reaction
1070	Comp-Renal Failure
1080	Comp-Emergency PCI
1081	Comp-Letely Useless Code
1085	Comp-Bleeding - Percutaneous Entry Site
1086	Comp-Bleeding - Retroperitoneal
1087	Comp-Bleeding - Gastrointestinal
1088	Comp-Bleeding - Genital/Urinary
1089	Comp-Bleeding - Other/Unknown
1092	Comp-Vascular - Access Site Occlusion
1094	Comp-Vascular - Peripheral Embolization
1096	Comp-Vascular - Dissection
1097	Comp-Vascular - Pseudoaneurysm
1098	Pseudoaneurysm Treatment
1099	Comp-Vascular - AV Fistula

Appendix D: Sample Definitions

The following definitions are taken from the NCDR 3.0 documentation, and are included here just to provide examples for discussion.

Unstable Angina

The patient was hospitalized for unstable angina documented in the medical record with serial ECG's and biochemical profiles. One of the following criteria are necessary:

1) Angina at rest (usually prolonged >20 minutes).
2) New onset angina (<2 months) exertional angina of at least Canadian Cardiovascular Society Classification (CCSC) Class III.
3) *new per guidelines* Increasing angina - previously diagnosed angina that has become distinctly more frequent, longer in duration, or lower in threshold (i.e., increased by greater than or equal to 1 CCS class to at least CCS Class III severity).

ST Elevation Myocardial Infarction (STEMI)

Indicate whether the patient was hospitalized for an ST Elevation Myocardial Infarction (STEMI) documented in the medical record.

At least one of the following biochemical indicators for detecting myocardial necrosis must be present:

1) Troponin T or I:
    a. Maximal concentration of troponin T or I > the MI decision limit on at least one occasion during the first 24 hours after the index clinical event.
2) CK-MB:
    a. Maximal value of CK-MB > 2 x the upper limit of normal on one occasion during the first hours after the index clinical event; *or*
    b. Maximal value of CK-MB, preferable CK-MB mass, > upper limit of normal on two successive samples.
3) Total CK
    a. In the absence of availability of a troponin or CK-MB assay, total CK > 2 x the upper limit of normal, or the B fraction of CK may be employed, but these last two biomarkers are considerably less satisfactory than CK-MB.

…and one of the following ECG changes:

1) ST-segment elevation: New or presumed new ST segment elevation at the J point in two or more contiguous leads with the cut-off points >=0.2 mV in leads V1, V2, or V3, or >=0.1 mV in other leads; OR
2) Development of any Q wave in leads V1 through V3, or the development of a Q-wave > or = to 30 ms (0.03s) in leads I, II, aVL, aVF, V4, V5, or V6. (Q wave changes must be present in any two contiguous leads, and be > or = to 1mm in depth.)

References:

1. IT Infrastructure Technical Framework Supplement 2006-2007: Patient Identifier Cross-Reference (PIX) and Patient Demographic Query (PDQ), Trial Implementation Version, November 6, 2006. http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_Suppl_PIX_PDQ_HL7v3_TI_2006_11_06.pdf
2. IT Infrastructure Technical Framework Supplement 2006-2007: Retrieve Form for Data Capture (RFD), Trial Implementation Version , September 22, 2006 http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_Suppl_RFD_TI_2006_09_25.pdf
3. IHE Patient Care Coordination Technical Framework Volumes 1, 2 & 3 Revision 1.0 2005-2006, Final Text, August 11, 2006, http://www.ihe.net/Technical_Framework/upload/IHE_PCC_TF_Final_20060812.pdf
4. IHE Patient Care Coordination Technical Framework Supplement 2006-2007: Exchange of Personal Health Record Content (XPHR), Trial Implementation, August 12, 2006 http://www.ihe.net/Technical_Framework/upload/IHE_PCC_TF_XPHR_Exchanging_PHR_Content_20060812.pdf
5. IHE Patient Care Coordination Technical Framework Supplement 2006-2007, Pre-procedure History and Physical (PPHP), Draft for Trial Implementation, August 15, 2006 http://www.ihe.net/Technical_Framework/upload/IHE_PCC_TF_PPHP_Preprocedure_History_and_Physical_TI_2006_08_15.pdf
6. IHE Patient Care Coordination Technical Framework Volumes 1, 2 & 3 Revision 1.0 2005-2006, Final Text, August 11, 2006 http://www.ihe.net/Technical_Framework/upload/IHE_PCC_TF_Final_20060812.pdf
7. IHE Patient Care Coordination Technical Framework proposal for Query for Existing Data (QED): http://wiki.ihe.net/index.php?title=Query_for_Existing_Data

