Standards and Semantics for Biomedicine

Olivier Bodenreider
Lister Hill National Center
for Biomedical Communications
Bethesda, Maryland - USA

NIH
U.S. National Library of Medicine
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Standards and Semantics for Biomedicine

Semantic Web, RxNorm, UMLS, BioPortal, Meaningful Use, Clinical Data Elements, Ontologies, LOINC, BD2K, FIHR, CTS2, SNOMED CT, HL7, Clinical Information Models, Interoperability, Standards, Journal of Biomedical Semantics, Structured Data Capture, Health Information Exchange, Big Data
Standards and Semantics for Biomedicine

- Standard vocabularies
- Data elements
- Information models
- Document markup standards

- Protocols
- Interfaces

Biomedical standards and semantics in action

- Clinical quality measures (Meaningful Use)
Standard vocabularies

- Data elements
- Information models
- Document markup standards

Standard vocabularies
Standards to support epidemiology

◆ John Graunt (1620-1674)
  ▪ Analyzes the vital statistics of the citizens of London

◆ William Farr (1807-1883)
  ▪ Medical statistician
  ▪ Improves Cullen’s classification
  ▪ Contributes to creating ICD

◆ Jacques Berthillon (1851-1922)
  ▪ Chief of the statistical services (Paris)
  ▪ Classification of causes of death (161 rubrics)
London Bills of Mortality

A general Bill for this present year, ending the 19 of December 1665, according to the Report made to the King's Most Excellent Majesty, by the Company of Parish Clerks of London, etc.

The Diseases and Casualties this year.

- Bovine and Stillborn: 617
- Executed: 34
- Aged: 1545
- Found dead in streets, fields, etc.: 635
- Plague: 635
- Pox: 635
- Apparrel and Suddenly: 116
- French Pox: 86
- Cholera: 55
- Grief: 45
- Gripe: 18
- Sperital: 12
- Vomiting: 10

London Bills of Mortality

For this present Year:

Beginning the 27th of December 1664, and ending the 19th of December following:

As also, the General or Whole Bills:

According to the Report made to the King's Most Excellent Majesty.

By the Company of Parish Clerks of London, etc.

Printed and are to be sold by S. Coghill living in Aldersgate-street, Printer to the said Company 1665.
Standard vocabularies in the era of Meaningful Use

◆ Diagnoses / Diseases / Conditions
  ● International classification of diseases (ICD)
  ● SNOMED CT

◆ Procedures
  ● Current Procedural terminology (CPT)
  ● ICD10-PCS
  ● SNOMED CT

◆ Drugs
  ● RxNorm

◆ Laboratory tests
  ● LOINC
SNOMED Clinical Terms
SNOMED CT Characteristics (1)

- Current version: January 31, 2014 (2 annual releases)
- Type: Reference terminology / ontology
- Domain: Clinical medicine
- Developer: IHTSDO
- Funding: IHTSDO
- Availability
  - Publicly available: Yes* (in member countries)
  - Repositories: UMLS
- URL: http://www.ihtsdo.org/
SNOMED CT Characteristics (2)

◆ Number of
  ● Concepts: ~300,000 active concepts (Jan. 31, 2014)
  ● Terms: ~1.1M active “descriptions”

◆ Major organizing principles:
  ● Utility for clinical medicine (e.g., assertional + definitional knowledge)
  ● Model of meaning (incomplete)
  ● Rich set of associative relationships
  ● Small proportion of defined concepts (many primitives)

◆ Formalism: Description logics (EL++)
SNOMED CT Example

Hierarchy

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>27010001</td>
<td>partial excision of large intestine</td>
</tr>
<tr>
<td>8613002</td>
<td>operation on appendix</td>
</tr>
<tr>
<td>80146002</td>
<td>appendectomy</td>
</tr>
<tr>
<td>82730006</td>
<td>incidental appendectomy</td>
</tr>
<tr>
<td>49438003</td>
<td>appendectomy with drainage</td>
</tr>
<tr>
<td>174036004</td>
<td>emergency appendectomy</td>
</tr>
<tr>
<td>174045003</td>
<td>interval appendectomy</td>
</tr>
<tr>
<td>6025007</td>
<td>laparoscopic appendectomy</td>
</tr>
<tr>
<td>235313004</td>
<td>non-emergency appendectomy</td>
</tr>
<tr>
<td>235314005</td>
<td>inversion appendectomy</td>
</tr>
<tr>
<td>1299000</td>
<td>excision of appendiceal stump</td>
</tr>
</tbody>
</table>

Definition: Fully defined by...

is a

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>partial excision of large intestine</td>
<td>P1-57450</td>
</tr>
<tr>
<td>operation on appendix</td>
<td>X20Wz</td>
</tr>
</tbody>
</table>

Group

- excision - action
- procedure site - Direct
- appendix structure

Qualifiers

- access
- surgical access values
- priority
- priorities

Codes

- Original SnomedId : P1-57450
- Read Code (Ctv3Id) : X20Wz
RxNorm
**RxNorm Characteristics (1)**

- **Current version:** March, 2014 (monthly releases)
- **Type:** Controlled terminology
- **Domain:** Drug names
- **Developer:** NLM
- **Funding:** NLM

**Availability**
- Publicly available: Yes*
- Repositories: UMLS

RxNorm Characteristics (2)

◆ Number of
  ● Concepts: 120,000 drug entities (March 2014)
  ● Terms: ~1.3 term per concept

◆ Major organizing principles:
  ● Generic vs. brand
  ● Combinations of Ingredient / Form / Dose
  ● No hierarchical structure
  ● Links to all major US drug information sources
  ● No clinical information

◆ Formalism: UMLS RRF format
<table>
<thead>
<tr>
<th>Strength</th>
<th>Ingredient</th>
<th>Dose form</th>
</tr>
</thead>
<tbody>
<tr>
<td>4mg/ml</td>
<td>Fluoxetine</td>
<td>Oral Solution</td>
</tr>
</tbody>
</table>

Semantic clinical drug component

Semantic clinical drug form

Semantic clinical drug
Rx Norm  Generic vs. Brand

- **Generic**
  - Ingredient (IN)
  - Clinical drug form (SCDF)
  - Clinical drug component (SCDC)
  - Clinical drug (SCD)

- **Brand**
  - Brand name (BN)
  - Branded drug form (SBDF)
  - Branded drug component (SBDC)
  - Branded drug (SBD)

*tradename_of*
RxNorm  Relations among drug entities
Logical Observation Identifiers, Names and Codes (LOINC)
LOINC Characteristics (1)

- **Current version:** 2.46 (Dec. 2013)
- **Type:** Controlled terminology*
- **Domain:** Laboratory and clinical observations
- **Developer:** Regenstrief Institute
- **Funding:** NLM

**Availability**
- Publicly available: Yes
- Repositories: UMLS

**URL:** [www.regenstrief.org/loinc/loinc.htm](http://www.regenstrief.org/loinc/loinc.htm)
LOINC Characteristics (2)

◆ Number of
  ● Concepts: ~70k active codes (2.46)
    (2 annual releases)
  ● Terms: n/a*

◆ Major organizing principles:
  ● No hierarchical structure among the main codes
  ● 6 axes
    ■ Component (analyte [+ challenge] [+ adjustments])
    ■ Property
    ■ Timing
    ■ System
    ■ Scale
    ■ [Method]

◆ Formalism: “DL-like”
**LOINC**  Example

- **Sodium:** *SCnc:* *Pt:* *Ser/Plas:* *Qn*
  
  [the molar concentration of sodium is measured in the plasma (or serum), with quantitative result]

<table>
<thead>
<tr>
<th>Axis</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td>Sodium</td>
</tr>
<tr>
<td>Property</td>
<td>SCnc – Substance Concentration (per volume)</td>
</tr>
<tr>
<td>Timing</td>
<td>Pt – Point in time (Random)</td>
</tr>
<tr>
<td>System</td>
<td>Ser/Plas – Serum or Plasma</td>
</tr>
<tr>
<td>Scale</td>
<td>Qn – Quantitative</td>
</tr>
<tr>
<td>Method</td>
<td>--</td>
</tr>
</tbody>
</table>
Semantics across standards

Terminology integration systems
Addison’s disease – Different names

Addison Disease
Primary hypoadrenalism
Primary adrenocortical insufficiency
Addison's disease (disorder)

MeSH D000224
MedDRA 10036696
ICD-10 E27.1
SNOMED CT 363732003
Integrating subdomains

- Clinical repositories
- Genetic knowledge bases
- UMLS
  - SNOMED CT
  - OMIM
  - MeSH
  - Biomedical literature
  - GO
  - Genome annotations
  - FMA
  - Anatomy
  - NCBI Taxonomy
  - Model organisms
  - Other subdomains
Integrating subdomains

- Clinical repositories
- Genetic knowledge bases
- Biomedical literature
- Genome annotations
- Anatomy
- Model organisms
- Other subdomains
Terminology integration

Addison's disease (363732003)

Other subdomains

Clinical repositories

SNOMED CT

Genetic knowledge bases

OMIM

Biomedical literature

Addison Disease (D000224)

Model organisms

NCBI Taxonomy

FMA

GO

Anatomy

Genome annotations

UMLS C0001403

MeSH
Unified Medical Language System

Welcome to the UTS

The UMLS Terminology Services (UTS) allows you to:

- Request a UMLS Metathesaurus License and create a UTS account
- Search and display content from UTS Applications including:
  - Metathesaurus Browser
  - Semantic Network Browser
  - SNOMED CT Browser
- Download data files including:
  - UMLS Knowledge Sources
  - RxNorm weekly and monthly updates
  - SNOMED CT
  - CORE Problem List and Route of Administration Subsets of SNOMED CT
- Query data remotely via Web Services (see API Documentation)
- Complete UMLS Annual Report and SNOMED CT® Affiliate Reports

https://uts.nlm.nih.gov/
Welcome to BioPortal! For help using BioPortal, click on this icon: 📕

Search all ontologies
Enter concept, e.g. Melanoma
Search
Advanced Search

Find an ontology
Enter ontology name, e.g. NCI Thesaurus
Explore
Browse Ontologies >

Search resources
Enter a concept, e.g. Melanoma
Search
Advanced Resource Search

Most Viewed Ontologies
<table>
<thead>
<tr>
<th>Ontology</th>
<th>Views</th>
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</thead>
<tbody>
<tr>
<td>SNOMED Clinical Terms</td>
<td>13,601</td>
</tr>
<tr>
<td>National Drug File</td>
<td>9,320</td>
</tr>
<tr>
<td>MedDRA</td>
<td>4,254</td>
</tr>
<tr>
<td>International Classification of Diseases</td>
<td>3,415</td>
</tr>
<tr>
<td>NCI Thesaurus</td>
<td>1,528</td>
</tr>
</tbody>
</table>

Latest Notes
- test (Chemical Entities of Biological Interest Ontology) about 17 hours ago by steschu
can test by stefan to see whether bioportal notes arrive
- New Term Proposal–t2XVgSUMoQCc (Radiology Lexicon) 5 months ago by rboden
- New Term Proposal–QgPnBnZbfGppdoi (Radiology Lexicon) 5 months ago by rboden
- New Term Proposal–HtxKivGottfruQ (Radiology Lexicon) 5 months ago by rboden
- New Term Proposal–WMPPrfBiOEDEqFyz (Radiology Lexicon) 5 months ago by rboden

Latest Mappings
- Mixed ductal and lobular carcinoma of breast (SNOMEDCT) <=> Abnormal Cell (NCIT)
  REST Mapping 03/05/2014 by captes
- Synaptic dysfunctioning (ADO) <=> Amyloid beta protein (ADO)
  REST Mapping 12/26/2013 by djones1988
- Malignant neoplasm of bronchus and lung, unspecified (ICD10CM) <=> Non-small cell lung cancer (SNOMEDCT)
  BioPortal UI 04/02/2013 by twicker
- Malignant neoplasm of unspecified bronchus or lung (ICD10CM) <=> Non-small cell lung cancer (SNOMEDCT)
  BioPortal UI 04/02/2013 by twicker
Collaborations between SDOs

◆ **SNOMED CT-LOINC**
  - Description of lab tests and clinical measurements in reference to SNOMED CT concepts

◆ **SNOMED CT-ICD11**
  - SNOMED CT is being used as the ontological framework for ICD11
CTS2 – Common Terminology Services

http://informatics.mayo.edu/cts2/
Data elements

Individual variables
Common data elements at NIH


NIH encourages the use of common data elements (CDEs) in clinical research, patient registries, and other human subject research in order to improve data quality and opportunities for comparison and combination of data from multiple studies and with electronic health records. This portal provides access to NIH-supported CDE initiatives and other tools and resources that can assist investigators developing protocols for data collection. What is a CDE?

NIH CDE Initiatives
Collections of CDEs that have been identified for use in particular NIH-supported research projects or registries after a formal evaluation and selection processes.

NIH CDE Tools and Resources
Databases and repositories of data elements and case report forms that may assist investigators in identifying and selecting data elements for use in their projects.

Summary Table
Subject Areas

The CDE Resource Portal also includes Other CDE Resources and Relevant Standards. Descriptions of all four groups can be found in the
Information models

Questionnaires, forms
Mission & Principles

Mission Statement

CDISC is a global, open, multidisciplinary, non-profit organization that has established standards to support the acquisition, exchange, submission and archive of clinical research data and metadata. The CDISC mission is to develop and support global, platform-independent data standards that enable information system interoperability to improve medical research and related areas of healthcare. CDISC standards are vendor-neutral, platform-independent and freely available via the CDISC website.

*The CDISC Vision is to Inform Patient Care & Safety Through Higher Quality Medical Research.*

Core Principles

- Lead the development of standards that improve efficiency while supporting the scientific nature of clinical research.
- Recognize the ultimate goal of creating regulatory submissions that allow for flexibility in scientific content and are easily interpreted, understood, and navigated by regulatory reviewers.
Clinical information modeling initiative (CIMI)

- Information models for healthcare
  - Clinical decision support

- International consortium
  - SDOs
  - Clinical institutions
  - Governmental agencies

- Isosematic models
  - Harmonization across models
  - Interface with terminology

http://informatics.mayo.edu/CIMI/
Document markup standards

Information exchange
Clinical Document Architecture

Health Level Seven International

Home > Standards > Product Brief

Section 1: Primary Standards
Section 3: Clinical and Administrative Domains

CDA® Release 2

DESCRIPTION

The HL7 Version 3 Clinical Document Architecture (CDA®) is a document markup standard that specifies the structure and semantics of "clinical documents" for the purpose of exchange between healthcare providers and patients. It defines a clinical document as having the following six characteristics: 1) Persistence, 2) Stewardship, 3) Potential for authentication, 4) Context, 5) Wholeness and 6) Human readability.

A CDA can contain any type of clinical content -- typical CDA documents would be a Discharge Summary, Imaging Report, Admission & Physical, Pathology Report and more. The most popular use is for inter-enterprise information exchange, such as is envisioned for a US Health Information Exchange (HIE).

ALTERNATIVE NAMES

CDA® Release 2 may also go by the following names or acronyms:

"Clinical Document Architecture, R2", "Clinical Document Architecture, R2 (Reaffirmation)", CDAR2

TARGETS

- Healthcare Providers
- Healthcare IT Vendors
Exchanging information with patients
Blue Button

Your Health Records

About Blue Button

Do you want to feel more in control of your health and your personal health information? Do you have a health issue? Are you caring for an elderly parent? Are you changing doctors? Do you need to find the results of a medical test or a complete and current list of your medications? Blue Button may be able to help.

Your Health Records

Millions of Americans can get easy, secure online access to their health records thanks to "Blue Button". Health information about you may be stored in many places, such as doctors' offices, hospitals, drug stores and health insurance companies. Blue Button is a way you can access your health records electronically so you can:

- Share them with your doctor or trusted family members or caregivers
- Check to make sure the information, such as your medication list, is accurate and up to date
- Share it with a new doctor if you change doctors or hospitals
- Have it included on a new insurance application
Getting relevant information – InfoButton

Health Level Seven International

Home > Standards > Product Brief

Section 3: Clinical and Administrative Domains
Section 7: Education & Awareness

HL7 Version 3 Standard: Context Aware Knowledge Retrieval Application ("Infobutton"), Knowledge Request

DESCRIPTION

Context-aware knowledge retrieval into clinical information systems (CIS), such as electronic health record (EHR) and personal health record (PHR) systems, is an increasingly promising approach for delivering relevant clinical knowledge to the point of care as well as patient-tailored educational material to support patient-centered care. These kinds of knowledge retrieval tools have been known as "Infobuttons." For example, an infobutton displayed in the context of a patient’s problem list may allow a user to view directly educational material regarding the evaluation and treatment of a specific disease without having to leave the CIS and look up the knowledge elsewhere.

ALTERNATIVE NAMES

HL7 Version 3 Standard: Context Aware Knowledge Retrieval Application ("Infobutton"), Knowledge Request may also go by the following names or acronyms:

https://www.hl7.org/
Biomedical standards and semantics in action

VALUE SETS IN

CLINICAL QUALITY MEASURES
“Meaningful Use”

◆ Health Information Technology for Economic and Clinical Health (HITECH) Act
  ● Eligible health care professionals and hospitals can qualify for Medicare and Medicaid incentive payments when they adopt certified EHR technology and use it to achieve specified objectives

◆ Two sets of regulations
  ● Incentive Program for Electronic Health Records
    Medicare and Medicaid Services (CMS)
  ● Standards and Certification Criteria for Electronic Health Records
    Office of the National Coordinator (ONC)
# Meaningful Use stages

<table>
<thead>
<tr>
<th><strong>Stage 1</strong></th>
<th><strong>Stage 2</strong></th>
<th><strong>Stage 3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2011-2012</strong></td>
<td><strong>2014</strong></td>
<td><strong>2016</strong></td>
</tr>
<tr>
<td>Data capture and sharing</td>
<td>Advance clinical processes</td>
<td>Improved outcomes</td>
</tr>
</tbody>
</table>

### Stage 1: Meaningful use criteria focus on:
- Electronically capturing health information in a standardized format
- Using that information to track key clinical conditions
- Communicating that information for care coordination processes
- Initiating the reporting of clinical quality measures and public health information
- Using information to engage patients and their families in their care

### Stage 2: Meaningful use criteria focus on:
- More rigorous health information exchange (HIE)
- Increased requirements for e-prescribing and incorporating lab results
- Electronic transmission of patient care summaries across multiple settings
- More patient-controlled data

### Stage 3: Meaningful use criteria focus on:
- Improving quality, safety, and efficiency, leading to improved health outcomes
- Decision support for national high-priority conditions
- Patient access to self-management tools
- Access to comprehensive patient data through patient-centered HIE
- Improving population health
CMS MEDICARE AND MEDICAID EHR INCENTIVE PROGRAMS: STAGE 2 FINAL RULE

On August 23, 2012, the Centers for Medicare & Medicaid Services (CMS) announced a final rule to govern Stage 2 of the Medicare and Medicaid Electronic Health Record (EHR) Incentive Programs. The rule specifies the Stage 2 criteria that eligible professionals (EPs), eligible hospitals, and critical access hospitals (CAHs) must meet in order to continue to participate in the EHR Incentive Programs.

Rule Provisions

Through the Stage 2 requirements of the Medicare and Medicaid EHR Incentive Programs, CMS seeks to expand the meaningful use of certified EHR technology. Certified EHR technology used in a meaningful way is one piece of a broader health information technology infrastructure needed to reform the health care system and improve health care quality, efficiency, and patient safety. Highlights of the rule’s provisions follow.

Stage 2 Timing

In the Stage 1 meaningful use regulations, CMS established an original timeline that would have required Medicare providers who first demonstrated meaningful use in 2011 to meet the Stage 2 criteria in 2013. The Stage 2 rule gives providers more time to meet Stage 2 criteria. A provider that attested to Stage 1 of meaningful use in 2011 would attest to Stage 2 in 2014, instead of in 2013. Therefore, providers are not required to meet Stage 2 meaningful use before 2014. The table below illustrates the progression of meaningful use stages from the first year a Medicare provider begins participation in the program.
Clinical Quality Measures (CQMs)

Measure Sets and Reporting

The rule finalized that:

- EPs must report on 9 out of 64 total clinical quality measures (CQMs)
- Eligible hospitals and CAHs must report on 16 out of 29 total CQMs

In addition, all providers must select CQMs from at least 3 of the 6 key health care policy domains from the Department of Health and Human Services’ National Quality Strategy:

- Patient and Family Engagement
- Patient Safety
- Care Coordination
- Population and Public Health
- Efficient Use of Healthcare Resources
- Clinical Processes/Effectiveness
Summary
The 2014 Edition S&CC final rule completes the Office of the National Coordinator for Health IT’s (ONC) second full rulemaking cycle to adopt standards, implementation specifications, and certification criteria for EHR technology. This final rule complements the newly released Centers for Medicare & Medicaid Services (CMS) final rule which establishes Stage 2 of the Medicare and Medicaid Electronic Health Record (EHR) Incentive Programs, updates Stage 1, and includes other program modifications.

The 2014 Edition S&CC final rule reflects ONC’s commitment to reduce regulatory burden; promote patient safety and patient engagement; enhance EHR technology’s interoperability, electronic health information exchange capacity, public health reporting, and security; enable clinical quality measure data capture, calculation, and electronic submission to CMS or States; and introduce greater transparency and efficiency to the certification process.
Tools that help measure and track the quality of healthcare services provided by eligible professionals, eligible hospitals and critical access hospitals within our health care system

CQMs measure many aspects of patient care including: health outcomes, clinical processes, patient safety, efficient use of healthcare resources, care coordination, patient engagements, population and public health, and clinical guidelines
93 CLINICAL QUALITY MEASURES in 2014 Meaningful Use criteria

- **64** for ELIGIBLE PROVIDERS (NEED TO REPORT ON 9)
- **29** for ELIGIBLE HOSPITALS (NEED TO REPORT ON 16)
Hemoglobin A1c Test for Pediatric Patients

Hemoglobin | Sugar

Normal glucose levels in blood
Low HbA1c concentration

High glucose levels in blood
High HbA1c concentration
CLINICAL RECOMMENDATIONS

1. American Association of Clinical Endocrinologists (2002): Recommends that *a glycosylated hemoglobin be performed during an initial assessment and during follow-up assessments*, which should occur at no longer than three-month intervals.

2. American Diabetes Association (2006): Recommends *obtaining a glycosylated hemoglobin during an initial assessment and then routinely as part of continuing care*. In the absence of well-controlled studies that suggest a definite testing protocol, expert opinion recommends glycosylated hemoglobin be obtained at least twice a year in patients who are meeting treatment goals and who have stable glycemic control and more frequently (quarterly assessment) in patients whose therapy was changed or who are not meeting glycemic goals.
Hemoglobin A1c Test for Pediatric Patients

# diabetic patients [age 5-17] tested for HbA1c

= 

# diabetic patients [age 5-17]
Hemoglobin A1c Test for Pediatric Patients

Tests for HbA1c

# diabetic patients [age 5-17] tested for HbA1c =

# diabetic patients [age 5-17]

- Type 1 or Type 2 diabetes
- Excludes gestational diabetes

- Requires date of birth
Hemoglobin A1c Test for Pediatric Patients

- Type 1 or Type 2 diabetes
- Excludes gestational diabetes

# diabetic patients [age 5-17] tested for HbA1c

Tests for HbA1c

# diabetic patients [age 5-17]

Data element

List of LOINC codes

List of SNOMED CT or ICD 10 codes

Requires date of birth
ANATOMY OF A CLINICAL QUALITY MEASURE

Population criteria

- Initial Patient Population =
  - AND: "Patient Characteristic Birthdate: birth date" \(\geq\) 5 year(s) starts before start of "Measurement Period"
  - AND: "Patient Characteristic Birthdate: birth date" \(\leq\) 17 year(s) starts before start of "Measurement Period"
  - AND: "Diagnosis, Active: Diabetes" starts before or during (MOST RECENT : "Occurrence A of Encounter, Performed: Diabetes Visit" during "Measurement Period")
  - AND: "Encounter, Performed: Diabetes Visit" \(\geq\) 12 month(s) starts before start of "Occurrence A of Encounter, Performed: Diabetes Visit"

- Denominator =
  - AND: "Initial Patient Population"

- Denominator Exclusions =
  - AND NOT: "Occurrence A of Diagnosis, Active: Gestational Diabetes" ends before start of "Measurement Period"
  - AND: "Occurrence A of Diagnosis, Active: Gestational Diabetes" starts before or during "Measurement Period"

- Numerator =
  - AND: "Laboratory Test, Result: HbA1c Laboratory Test (result)" during "Measurement Period"

- Denominator Exceptions =
  - None

Data criteria (QDM Data Elements)

- "Diagnosis, Active: Diabetes" using "Diabetes Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1001)"
- "Diagnosis, Active: Gestational Diabetes" using "Gestational Diabetes Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1010)"
- "Encounter, Performed: Diabetes Visit" using "Diabetes Visit Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1012)"
- "Laboratory Test, Result: HbA1c Laboratory Test" using "HbA1c Laboratory Test Grouping Value Set (2.16.840.1.113883.3.464.1003.198.12.1013)"
- "Patient Characteristic Birthdate: birth date" using "birth date LOINC Value Set (2.16.840.1.113883.3.464.1003.198.12.1013)"

Value set = List of LOINC codes for HbA1c tests
ASSOCIATED VALUE SET

**Metadata**
- Name: HbA1c Laboratory Test
- OID: 2.16.840.1.113883.3.464.1003.198.12.1013
- Developer: National Committee for Quality Assurance

**Measure**
- Type: Grouping

**Grouping**

**Value Set Members** Expansion 20121025

<table>
<thead>
<tr>
<th>Code</th>
<th>Descriptor</th>
<th>Code System</th>
<th>Version</th>
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<tbody>
<tr>
<td>17855-8</td>
<td>Hemoglobin A1c/Hemoglobin.total in Blood by calculation</td>
<td>LOINC</td>
<td>2.40</td>
</tr>
<tr>
<td>17856-6</td>
<td>Hemoglobin A1c/Hemoglobin.total in Blood by HPLC</td>
<td>LOINC</td>
<td>2.40</td>
</tr>
<tr>
<td>4548-4</td>
<td>Hemoglobin A1c/Hemoglobin.total in Blood</td>
<td>LOINC</td>
<td>2.40</td>
</tr>
</tbody>
</table>
Meaningful Use Criteria - 2014

- **93 CQMs**
  - Developed by some 20 measure developers

- **3,000 value sets**
  - 1,500 unique

- **200,000 codes**
  - 80,000 unique
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Code System</th>
<th>Developer</th>
<th>OID</th>
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</thead>
<tbody>
<tr>
<td>birth date</td>
<td>Extension</td>
<td>LOINC</td>
<td>NQF</td>
<td>2.16.840.1.113883.3.560.100.4</td>
</tr>
<tr>
<td>Carotid Intervention</td>
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https://vsac.nlm.nih.gov/
Getting involved

A few pointers
The Health IT Standards Committee is charged with making recommendations to the National Coordinator for Health IT on standards, implementation specifications, and certification criteria for the electronic exchange and use of health information. Initially, the Health IT Standards Committee will focus on the policies developed by the Health IT Policy Committee's initial eight areas. Within 90 days of the signing of ARRA, the Health IT Standards Committee must develop a schedule for the assessment of policy recommendations developed by the Health IT Policy Committee, to be updated annually. In developing, harmonizing, or recognizing standards and implementation specifications, the Health IT Standards Committee will also provide for the testing of the same by the National Institute for Standards and Technology (NIST).
IHE

Integrating the Healthcare Enterprise (IHE)

IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care. Systems developed in accordance with IHE communicate with one another better, are easier to implement, and enable care providers to use information more effectively.

Become a Member

Become an IHE member organization and improve the interoperability of healthcare information systems.
Introduction

The **mission** of the Semantic Web Health Care and Life Sciences Interest Group (HCLS IG) is to develop, advocate for, and support the use of Semantic Web technologies across **health care**, **life sciences**, clinical research and **translational medicine**. These domains stand to gain tremendous benefit from intra- and inter-domain application of Semantic Web technologies as they depend on the interoperability of information from many disciplines. Please see the accompanying [Use Cases and Rationale](http://www.w3.org/blog/hcls/) document.

The group will:

- Continue to develop high level (e.g. **TMO** and architectural (e.g. **SWAN**) vocabularies.
- Implement proof-of-concept demonstrations and industry-ready code.
- Document guidelines to accelerate the adoption of the technology.
- Disseminate information about the group’s work at government, industry, academic events and by participating in community initiatives.
Linked Open Data Cloud – Biomedical resources
Medical Ontology Research

Contact: olivier@nlm.nih.gov

Olivier Bodenreider
Lister Hill National Center for Biomedical Communications
Bethesda, Maryland - USA