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LOINC Data Standards and Resources and Their Application in EHDS

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Outline

Background	Background and A bit of history . . .
Content	Content areas, scope,
Brief	Brief Tour

IHE CATALYST

A healthcare standard provides the fundamental definitions for and structures of the data that can be communicated in wide variety of healthcare use cases:

- Data exchange (transport, privacy, security)
  - HL7
- Semantics (meaning)
  - LOINC
  - SNOMED CT
  - RxNorm

Standards make health data more portable and understandable

Portable

Syntax Standards

Messages, Documents, APIs

e.g., HL7, C-CDA, FHIR, IHE profiles

Physically move data from one place to another in a standardized way

Understandable

Semantic Standards

Clinical Terminologies

e.g., LOINC, SNOMED CT, RxNORM,

Convey meaning of the data in the message

Background and History

LOINC & Health Data Standards

- Program of Regenstrief since mid 90s
- Focal point for data standards initiatives and policies across Regenstrief
- **Mission:** Promote adoption of clinical data standards that enable efficient semantic interoperability.
- **Vision:** A world where systems get clinicians all the information they need at the right time and place.

(Logical Observation Identifiers Names and Codes)

- Originated in 1994 by Clement McDonald, MD, Indianapolis, IN
- Vision for information technology to help clinicians make better decisions
  - Universal language to describe clinical observations,
    - those observations that occurred during the course of caring for a patient
    - observations that are a result of laboratory testing.

LOINC adoption around the world

LOINC began in the US and is now used in over 180 countries

LOINC is the official national standard in 30+ countries

International adoption is enabled through LOINC translations (15+ variants in 12 languages)

- Chinese (China) 汉语/漢語;中文
- Dutch (Netherlands) Nederlands
- Estonian (Estonia) eesti keel
- English (United States) *Official Distribution*
- French (Belgium) français
- French (Canada) français
- French (France) français
- German (Austria) Deutsch
- German (Germany) Deutsch
- Greek (Greece) ελληνικά
- Italian (Italy) italiano
- Korean (Korea, Republic of) 한국어
- Polish (Poland) Polski
- Portuguese (Brazil) português
- Russian (Russian Federation) ру́сский язы́к
- Spanish (Argentina) español
- Spanish (Mexico) español
- Spanish (Spain) español
- Turkish (Turkey) Türkçe

LOINC Development

- Maintained by the LOINC team at Regenstrief Institute, Inc. in Indianapolis, IN
- LOINC Committees provide oversight and guidance
  - Laboratory Committee
  - Clinical Committee
    - Nursing subcommittee
    - Document ontology subcommittee
  - LOINC/RadLex Committee
- Vibrant international user community with active participation in LOINC development activities

It takes a village!

Scope

- Standard terminology to identify lab tests, clinical measurements, documents, surveys, and more
- Nearly 105K terms and growing
- 4 major categories of terms
  - Laboratory LOINC
  - Clinical LOINC
  - Documents
  - Standardized Survey instruments

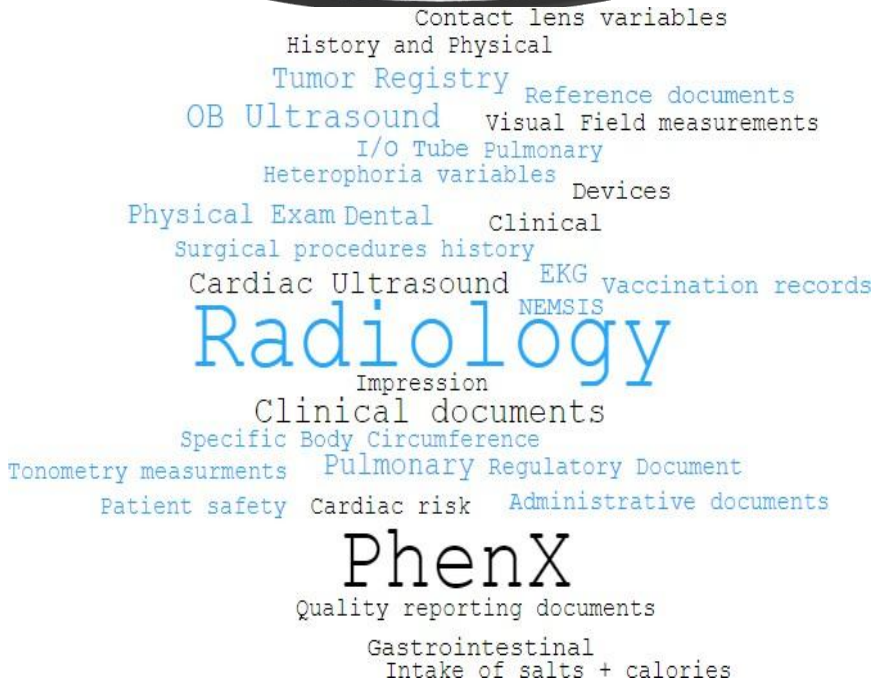
- **One Common Identifier** for results that are clinically the same

Laboratory LOINC

- Routine testing
  - Inpatient hospital lab
  - Outpatient lab
  - Testing done in providers' offices
- Tests performed by patients in their homes
- Specialized laboratory testing ("sendout")
- Newborn screening
- Veterinary
- Public health/Epidemiology

Clinical LOINC

- Measurements, procedures, documents, and other clinical information that are not in the laboratory domain
- Anthropomorphic measurements, vital signs, history and physical exam findings
- Radiology procedures and Interventional procedures such as EKG, OB ultrasound
- Ophthalmology, nursing, and other specialties
- Clinical notes



Survey Concepts

- Patient-reported outcomes and provider completed forms
- Functional assessments/symptom indexes
- Government required forms
- Behavioral health/Psychiatry/Substance abuse assessments
- Many of the LOINC term attributes, such as survey question text, and copyright information were created for surveys

LOINC Concept

Anatomy of LOINC concepts

Structure and design to convey meaning, standardize clinical and laboratory observations, concept model

Concept is a unique unit of thought

LOINC concept = LOINC code + LOINC name: FSN

Name that fully describes the concept is the Fully Specified Name (FSN)

94500-6 SARS coronavirus 2 RNA in Respiratory specimen by PCR

=

94500-6

+

SARS coronavirus 2 RNA in Respiratory specimen by PCR

The LOINC code

- Unique, permanent numeric code
  - Sequential
    - LOINC code value can help determine when code was created
  - No intrinsic structure except last character is a check digit
  - Once officially released, a code is never removed from the LOINC distribution

A LOINC concept - Defined by 6 Core *Parts*

Part	Description
Component	The analyte being measured
Property	The dimension of the analyte that is being measured
Time aspect	Whether the analyte is measured at a moment in time or over a specific period of time
System	The type of sample
Scale	A general classification of the result type, whether quantitative, qualitative, narrative, etc.
Method	How the analyte was measured **The Method is the only major axis that does not have to be populated for every LOINC term*

6 parts = clinically relevant information

LOINC pieces (Parts)

- LOINC Parts
  - Have *meaning - Conceptual*
  - Reusable pieces
  - Can be mapped to external ontologies.
  - Are hierarchical
- LOINC names (such as LCN) are built by rule-based assembly of LOINC Parts.

Putting the *Parts* together

Component	Property	Time aspect	System	Scale	Method
Sodium	SCnc	Pt	Urine	Qn	
2955-3 *Sodium [Moles/volume] in Urine*					
Sodium	SCnc	Pt	CSF	Qn	
2948-8 *Sodium [Moles/volume] in Cerebral spinal fluid*					
Body weight	Mass	Pt	^Patient	Qn	
29463-7 *Body weight*					
Body weight	Mass	Pt	^Fetus	Qn	US+Estimated from AC
11728-3 *Fetal Body weight estimated from Abdominal circumference on US*					

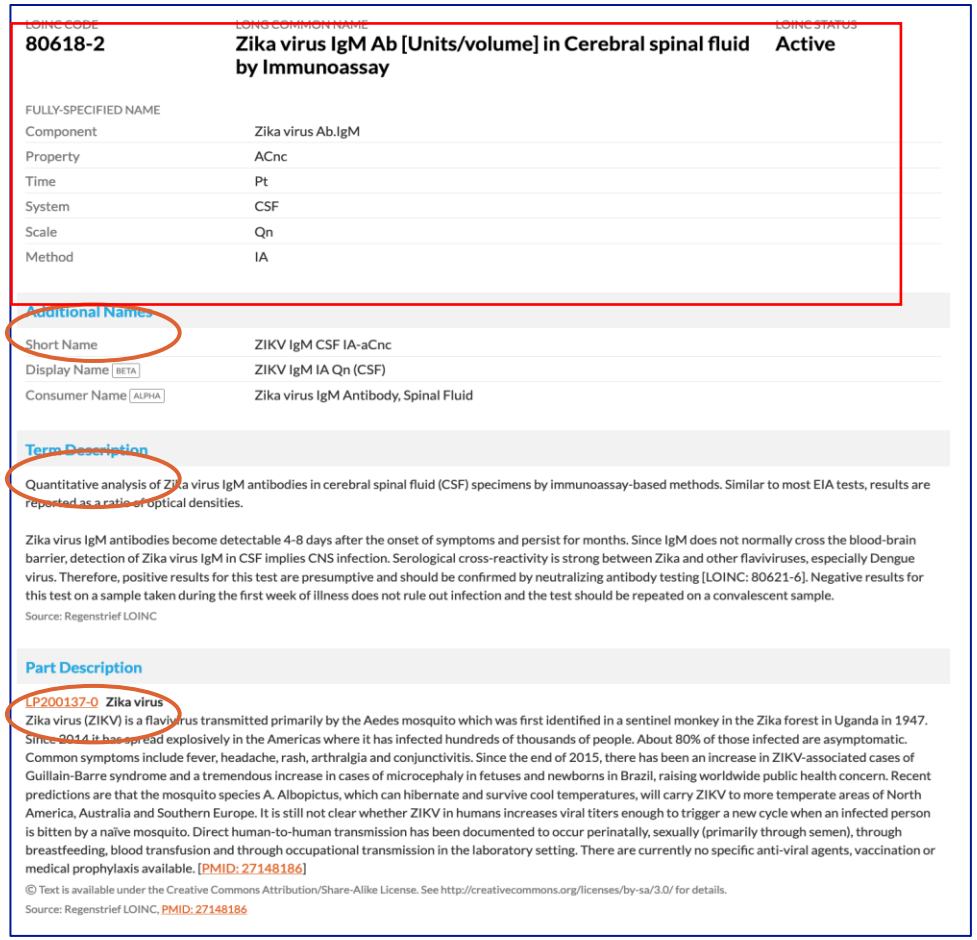
Other Concept Parts

- The 6 *Core Parts* define a given concept
- However, many other parts are associated with each term for different purposes:
  - To help users understand the meaning of the term
  - To organize terms and make them easier to find
  - To provide metadata, such as the version in which the concept was first published or most recently updated
  - To provide information surrounding the use of a term, such as copyright information

Parts examples (there are others)

Attribute	Description	Examples
Units	Example units of measure associated with the result, including submitted units and UCUM units	mg/dL, kg, cm/s, mm^2
Formula	The calculation used to determine the result	Ejection fraction=[(LV end-diastolic volume-LV end-systolic volume)/LV end-diastolic volume]*100
Type	General classification of the type of observation	1 (Laboratory), 2 (Clinical), 3 (HIPAA Attachments), 4 (Survey)
TypeName	Name of the classification	Laboratory, Clinical, Attachment, Survey
Class	More specific classification within a type	Microbiology, Chemistry, Cardiology, Radiology, PROMIS surveys
Status	The state of the term	Active, Discouraged, Deprecated, Trial
Order/Obs	Whether a term is an order, observation, or both	Order, Observation, Both

All Concept's features and Parts- Details page



LOINC CODE: 80618-2

LONG COMMON NAME: Zika virus IgM Ab [Units/volume] in Cerebral spinal fluid by Immunoassay

LOINC STATUS: Active

FULLY-SPECIFIED NAME

Component	Zika virus Ab.IgM
Property	ACnc
Time	Pt
System	CSF
Scale	Qn
Method	IA

Additional Names

Short Name	ZIKV IgM CSF IA-aCnc
Display Name BETA	ZIKV IgM IA Qn (CSF)
Consumer Name ALPHA	Zika virus IgM Antibody, Spinal Fluid

Term Description

Quantitative analysis of Zika virus IgM antibodies in cerebral spinal fluid (CSF) specimens by immunoassay-based methods. Similar to most EIA tests, results are reported as a ratio of optical densities.

Zika virus IgM antibodies become detectable 4-8 days after the onset of symptoms and persist for months. Since IgM does not normally cross the blood-brain barrier, detection of Zika virus IgM in CSF implies CNS infection. Serological cross-reactivity is strong between Zika and other flaviviruses, especially Dengue virus. Therefore, positive results for this test are presumptive and should be confirmed by neutralizing antibody testing [LOINC: 80621-6]. Negative results for this test on a sample taken during the first week of illness does not rule out infection and the test should be repeated on a convalescent sample.

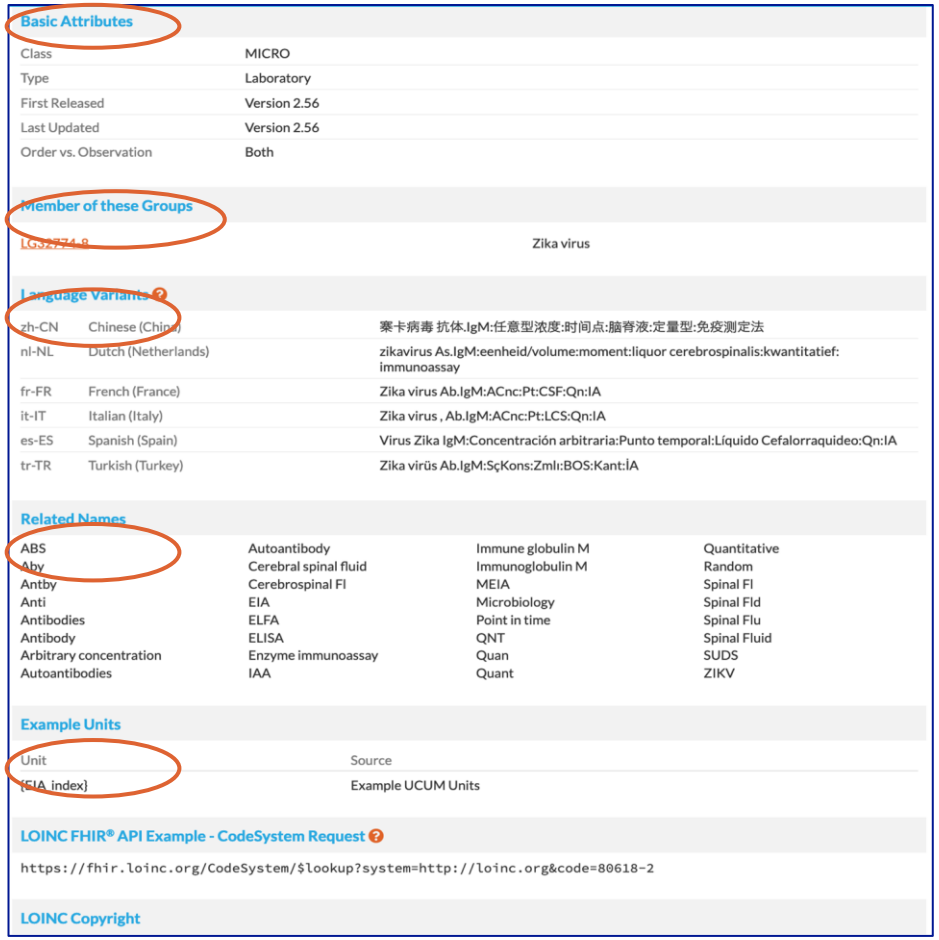
Source: Regenstrief LOINC

Part Description

LP200137-0 **Zika virus**

Zika virus (ZIKV) is a flavivirus transmitted primarily by the Aedes mosquito which was first identified in a sentinel monkey in the Zika forest in Uganda in 1947. Since 2014 it has spread explosively in the Americas where it has infected hundreds of thousands of people. About 80% of those infected are asymptomatic. Common symptoms include fever, headache, rash, arthralgia and conjunctivitis. Since the end of 2015, there has been an increase in ZIKV-associated cases of Guillain-Barre syndrome and a tremendous increase in cases of microcephaly in fetuses and newborns in Brazil, raising worldwide public health concern. Recent predictions are that the mosquito species A. Albopictus, which can hibernate and survive cool temperatures, will carry ZIKV to more temperate areas of North America, Australia and Southern Europe. It is still not clear whether ZIKV in humans increases viral titers enough to trigger a new cycle when an infected person is bitten by a naïve mosquito. Direct human-to-human transmission has been documented to occur perinatally, sexually (primarily through semen), through breastfeeding, blood transfusion and through occupational transmission in the laboratory setting. There are currently no specific anti-viral agents, vaccination or medical prophylaxis available. [PMID: 27148186]

Source: Regenstrief LOINC, PMID: 27148186



Basic Attributes

Class	MICRO
Type	Laboratory
First Released	Version 2.56
Last Updated	Version 2.56
Order vs. Observation	Both

Member of these Groups

LG32774-8	Zika virus

Language Variants

zh-CN	Chinese (China)	寨卡病毒 抗体.IgM:任意型浓度:时间点:脑脊液:定量型:免疫测定法
nl-NL	Dutch (Netherlands)	zikavirus As.IgM:eenheid/volume:moment:liquor cerebrospinalis:kwantitatief:immunoassay
fr-FR	French (France)	Zika virus Ab.IgM:ACnc:Pt:CSF:Qn:IA
it-IT	Italian (Italy)	Zika virus , Ab.IgM:ACnc:Pt:LCS:Qn:IA
es-ES	Spanish (Spain)	Virus Zika IgM:Concentración arbitraria:Punto temporal:Líquido Cefalorraquídeo:Qn:IA
tr-TR	Turkish (Turkey)	Zika virüs Ab.IgM:SçKons:Zmlı:BOS:Kant:İA

Related Names

ABS	Autoantibody	Immune globulin M	Quantitative
Aby	Cerebral spinal fluid	Immunoglobulin M	Random
Antby	Cerebrospinal Fl	MEIA	Spinal Fl
Anti	EIA	Microbiology	Spinal Fld
Antibodies	ELFA	Point in time	Spinal Flu
Antibody	ELISA	QNT	Spinal Fluid
Arbitrary concentration	Enzyme immunoassay	Quan	SUDS
Autoantibodies	IAA	Quant	ZIKV

Example Units

Unit	Source
{FIA_index}	Example UCUM Units

LOINC FHIR® API Example - CodeSystem Request

```
https://fhir.loinc.org/CodeSystem/$lookup?system=http://loinc.org&code=80618-2
```

LOINC Copyright

Relationships to other terminologies

- LOINC has links to external terminologies at multiple levels (Concepts, parts,), e.g.,
  - RXNorm
  - SNOMED CT
  - Others…
- LOINC is the **question**, other terminologies provide the **answer**
  - LOINC: What is the patient's body weight?
  - SNOMED: x LBs, or x Kg
  - LOINC: What is the patients blood type?
  - SNOMED: O+

Meaning for EHDS

- Several MOU in the work
  - IHE-Europe
  - XiA project
  - xSHARE project
  - HL7 Romania and more

- HDS for LOINC and UCUM at the Regenstrief Institute – in support

  - Submission and requests
  - Questions and clarification
  - Expediting critical codes and modeling to close content gaps


Q&A