

# The quest for interoperability

# Setting expectations:

- Some background
- HIT Goal for Interoperability In Healthcare
  - Tools for Interoperability: Standards
    - Examples, Strengths & Weaknesses
      - selected subset of existing standards
- Reaching the Goal

# Health Information Technology

(HIT) has been seen as a vehicle for:

- improving the quality and safety of health care,
- gaining more fiscal accountability and value
- advancing consumer role and engagement of in prevention and health decisions,
- accelerating discovery and dissemination of new treatments, and
- sharpening public-health monitoring and surveillance.

# The Federal HIT launch (WH, 2004)

## Four national priorities:

- 1. providing information tools to clinicians (e.g. EHRs), for use in patient care);**
- 2. connecting health information so that it**
  - a. follows patients throughout care**
  - b. can be aggregated to advance health care delivery;**
- 3. supporting consumers with information to help them manage care;**
- 4. advancing public health, clinical trials, and other data-intensive activities other data-intensive activities.**

The 2004 HIT plan has been updated('09, '11,'15); the core priorities remain similar.

## Goal 4: Develop and deploy approaches to identify, learn from, and reduce diagnostic errors and near misses in clinical practice

### RECOMMENDATION 4A

Accreditation organizations and the Medicare conditions of participation should require that health care organizations have programs in place to monitor the diagnostic process and identify, learn from, and reduce diagnostic errors and near misses in a timely fashion. Proven approaches should be incorporated into updates of these requirements.

### RECOMMENDATION 4B

Health care organizations should:

- Monitor the diagnostic process and identify, learn from, and reduce diagnostic errors and near misses as a component of their research, quality improvement, and patient safety programs.
- Implement procedures and practices to provide systematic feedback on diagnostic performance to individual health care professionals, care teams, and clinical and organizational leaders.

### RECOMMENDATION 4C

HHS should provide funding for a designated subset of health care systems to conduct routine postmortem examinations on a representative sample of patient deaths.

### RECOMMENDATION 4D

Health care professional societies should identify opportunities to improve accurate and timely diagnoses and reduce diagnostic errors in their specialties.

# ONC for Health IT:

- Interoperability
  - the ability of systems to exchange and use electronic health information from other systems without special effort on the part of the user
- Advancing HIT interoperability is a key element in helping transform the health care delivery system into one that provides better care, smarter spending and healthier people.

### Goal 3: Ensure that health information technologies support patients and health care professionals in the diagnostic process

#### RECOMMENDATION 3A

Health IT vendors and the Office of the National Coordinator for Health Information Technology (ONC) should work together with users to ensure that health IT used in the diagnostic process demonstrates usability, incorporates human factors knowledge, integrates measurement capability, fits well within clinical workflow, provides clinical decision support, and facilitates the timely flow of information among patients and health care professionals involved in the diagnostic process.

#### RECOMMENDATION 3B

ONC should require health IT vendors to meet standards for interoperability among different health IT systems to support effective, efficient, and structured flow of patient information across care settings to facilitate the diagnostic process by 2018.

#### RECOMMENDATION 3C

The Secretary of the U.S. Department of Health and Human Services (HHS) should require health IT vendors to:

- Routinely submit their products for independent evaluation and notify users about potential adverse effects on the diagnostic process related to the use of their products.
- Permit and support the free exchange of information about real-time user experiences with health IT design and implementation that adversely affect the diagnostic process.

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# IOM Report 2015

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**How do we make things work together ?**

## Health Level-7: Messaging



- Set of international standards for transfer of clinical and administrative data between software applications
- Prevalent throughout healthcare environment
- Supports administrative, logistical, financial and clinical processes

HL7

LOINC

ICD

SNOMED CT



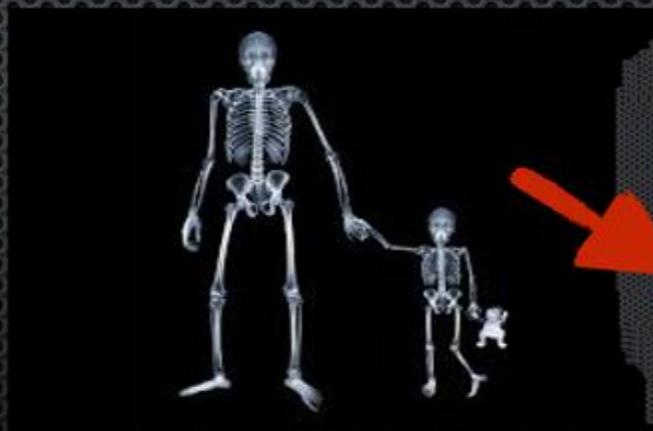
OBX|6|CWE|433177401000004108^Breast-Architectural pattern of  
DCIS^SCT||128880009^Solid^SCT|||||F OBX|7|CWE|517577331000004103^Breast-Grade of  
DCIS^SCT||399611001^High^SCT|||||F OBX|8|CWE|404211521000004100^Breast-Necrosis within  
DCIS^SCT||47492008^Not identified^SCT|||||F OBX|9|CWE|359792211000004109^Breast-Surgical  
margins (Carcinoma)^SCT||55182004^Not involved by carcinoma^SCT|||||F  
OBX|10|CWE|726087401000004103^Breast-Surgical margins (DCIS)^SCT||55182004^Not involved  
by DCIS^SCT|||||

HL7

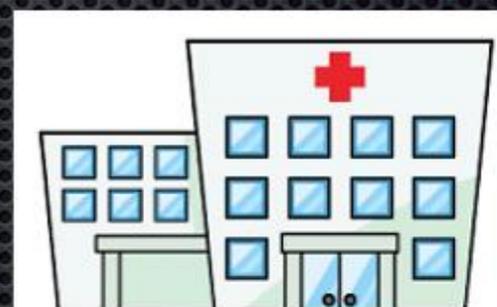
LOINC

ICD

SNOMED CT



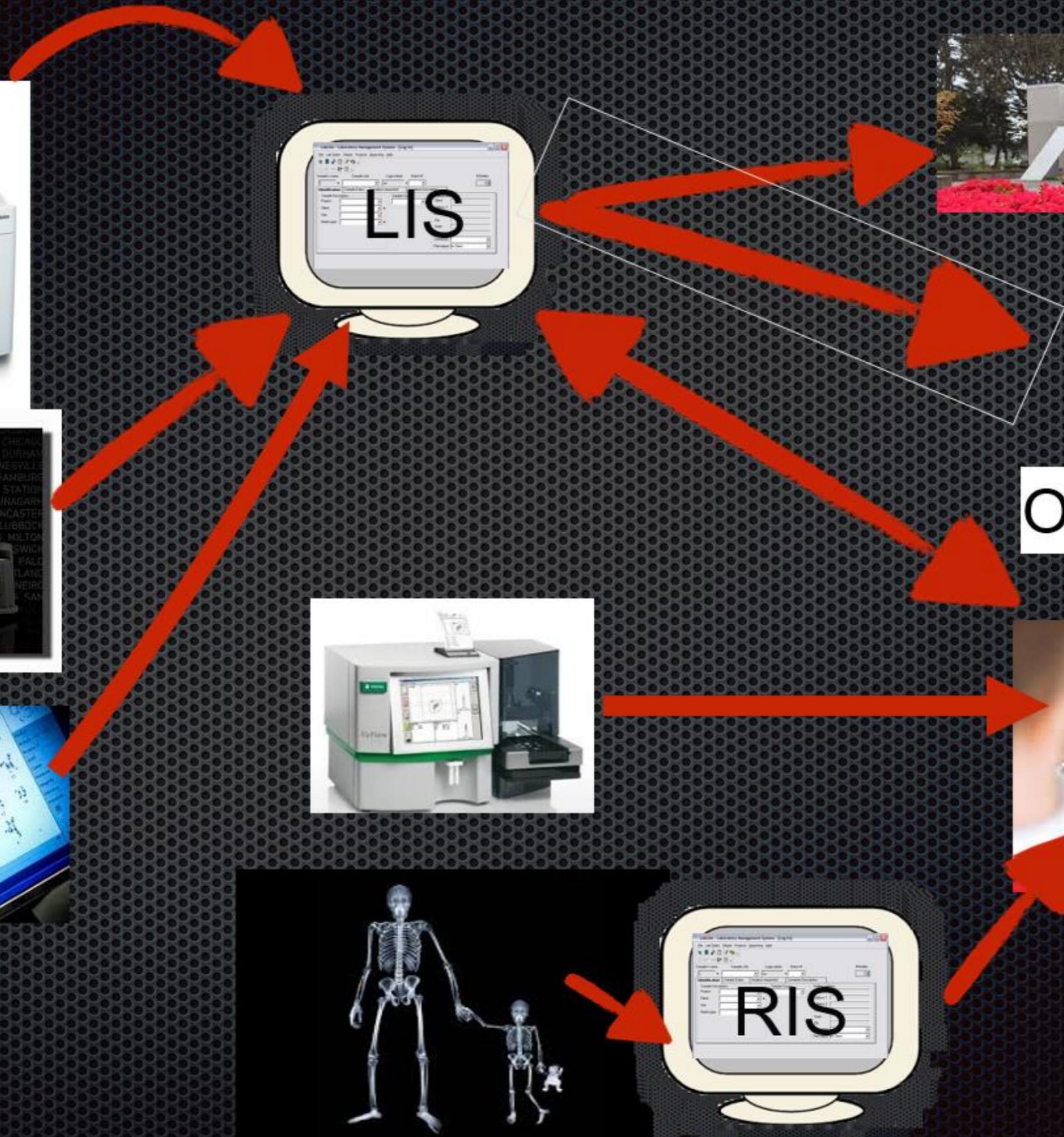
DOH



Other Hospital



EHR



HL7

LOINC

ICD

SNOMED CT



Encodes data for  
transmission and mapping

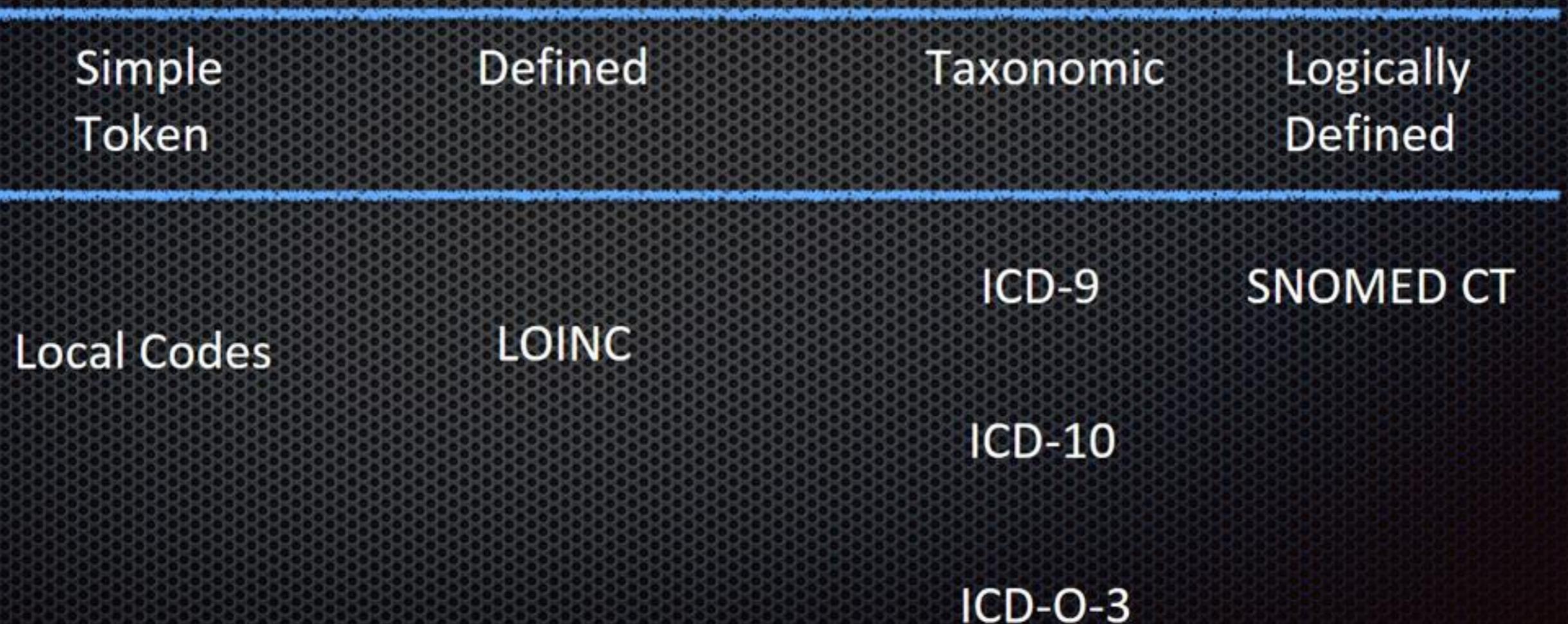


Does not encode strict  
definitions or semantic  
relationships

# Technical Standards

## Semantic Spectrum

- Codes are not created equal
- Codes and coding systems fall into a spectrum of meaning and knowledge representation



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- A common language (set of identifiers, names, and codes) for clinical and laboratory observations.
- A rich catalog of measurements, including laboratory tests, clinical measures like vital signs and anthropomorphic measures, standardized survey instruments, and more.
- A standard which enables the exchange and aggregation of clinical results for care delivery, outcomes management, and research by providing a set of universal codes and structured names to unambiguously identify things you can measure or observe.

# Logical Observation Identifiers Names and Codes

- Standard for identifying names, & codes for clinical & laboratory observations
- Free for use (free licensing)
- Prevalent in commercial health information systems
- Has an international presence

uses six axes:

790-6 = Erythrocytes [#volume] in Blood by Manual Count  
defined by:

Component = Erythrocytes	Property = Number count
System = Blood	Timing = Point in time
Scale = Quantitative	Method = Manual Count

## Defined Code

- Code bound to string of words (definition)
- communicates meaning of word or value
- does not communicate how it relates to other codes

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- Axes do not convey relationships
  - within parts or between concepts
- Aggregation of subtypes not defined:
  - System = Blood vs. Cord Blood vs. RBC
- Logical relationships between concepts not supported
  - 790-6 = Erythrocytes [#volume] in Blood by Manual Count
  - 789-9 = Erythrocytes [#volume] in Blood by Automated Count
  - 26453-1 = Erythrocytes [#volume] in Blood

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**LOINC** HIV1 PCR

LOINC	LongName	Component	Property	Timing	System	Scale	Method	exUCUMunits	exUnits	Lforms	Rank	SIrank	Class	ShortName	Type	OrderObs
74856-6	HIV 1 group O RNA+HIV 1 group M RNA+HIV 2 RNA+Hepatitis C virus RNA+Hepatitis B virus DNA (Presence) in Serum or Plasma from donor by Probe and target amplification method	HIV 1 group O RNA+HIV 1 group M RNA+HIV 2 RNA+Hepatitis C virus RNA+Hepatitis B virus DNA	PrThr	Pt	Ser/Plas*donor	Ord	Probe.amp.tar						MICRO	HIV1+HIV2+HCV+HBV DNA SerPI Donr Qi PCR	Lab	Both
76007-2	HIV 1 proviral DNA (Logarithmic entic number) (viral load) in Blood mononuclear cells by Probe and target amplification method	HIV 1 proviral DNA	EntLogNum	Pt	Bld MC	Qn	Probe.amp.tar	Log copies/10 <sup>6</sup> (cx	Log copies/10 cells				MICRO	HIV 1 proviral DNA Bld MC PCR-EntLogNum	Lab	Both
76010-6	HIV 1 proviral DNA (Logarithmic entic number) (viral load) in Mononuclear cells from unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	EntLogNum	Pt	XXX MC	Qn	Probe.amp.tar	Log copies/10 <sup>6</sup> (cx	Log copies/10 cells				MICRO	HIV 1 proviral DNA XXX MC PCR-EntLogNum	Lab	Observation
76009-8	HIV 1 proviral DNA (Entic number) (viral load) in Blood mononuclear cells by Probe and target amplification method	HIV 1 proviral DNA	EntNum	Pt	Bld MC	Qn	Probe.amp.tar	Copies/10 <sup>6</sup> (c	copies/10 cells				MICRO	HIV 1 proviral DNA Bld MC PCR-EntNum	Lab	Both
76008-0	HIV 1 proviral DNA (Entic number) (viral load) in Mononuclear cells from unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	EntNum	Pt	XXX MC	Qn	Probe.amp.tar	Copies/10 <sup>6</sup> (c	copies/10 cells				MICRO	HIV 1 proviral DNA XXX MC PCR-EntNum	Lab	Both
74855-8	HIV 1 proviral DNA (Log #Volume) (viral load) in Unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	LnCnc	Pt	XXX	Qn	Probe.amp.tar	(Log_cells)/ml	Log cells/mL				MICRO	HIV 1 proviral DNA XXX PCR-Log#	Lab	Both
74854-1	HIV 1 proviral DNA (Volume) (viral load) in Blood by Probe and target amplification method	HIV 1 proviral DNA	NCnc	Pt	Bld	Qn	Probe.amp.tar	(copies)/mL	copies/mL				MICRO	HIV 1 proviral DNA # Bld PCR	Lab	Both
44871-2	HIV 1 proviral DNA (Presence) in Blood by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Bld	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA Bld Qi PCR	Lab	Both
77368-9	HIV 1 proviral DNA (Presence) in Semen by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Semen	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA Srmn Qi PCR	Lab	Both
48023-6	HIV 1 proviral DNA (Presence) in Serum or Plasma by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Ser/Plas	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA SerPI Qi PCR	Lab	Both
74853-3	HIV 1 proviral DNA (Presence) in Unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	XXX	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA XXX Qi PCR	Lab	Both
62469-2	HIV 1 RNA (Units/volume) (viral load) in Serum or Plasma by Probe and target amplification method	HIV 1 RNA	ACnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(U)/mL	IU/mL				MICRO	HIV1 RNA SerPI PCR-aCnc	Lab	Both
41497-9	HIV 1 RNA (Log #Volume) (viral load) in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA	LnCnc	Pt	CSF	Qn	Probe.amp.tar	(Log_copies)/r	log copies/mL				MICRO	HIV1 RNA CSF PCR-Log#	Lab	Both
29541-0	HIV 1 RNA (Log #Volume) (viral load) in Plasma by Probe and target amplification method	HIV 1 RNA	LnCnc	Pt	Plas	Qn	Probe.amp.tar	(log_copies)/r	log copies/mL		654	654	MICRO	HIV1 RNA Plas PCR-Log#	Lab	Both
61786-5	HIV 1 RNA (Log #Volume) (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 0.5 log copies/mL	HIV 1 RNA	LnCnc	Pt	Ser/Plas	Qn	Probe.amp.tar detection limit = 0.5 log copies/mL	(Log_copies)/r	log copies/mL				MICRO	HIV1 RNA SerPI PCR DL=0.5-Log#	Lab	Both
48510-2	HIV 1 RNA (Log #Volume) (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 1.7 log copies/mL	HIV 1 RNA	LnCnc	Pt	Ser/Plas	Qn	Probe.amp.tar detection limit = 1.7 log copies/mL	(Log_copies)/r	log copies/mL				MICRO	HIV1 RNA SerPI PCR DL=1.7-Log#	Lab	Both
48552-4	HIV 1 RNA (Log #Volume) (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 2.6 log copies/mL	HIV 1 RNA	LnCnc	Pt	Ser/Plas	Qn	Probe.amp.tar detection limit = 2.6 log copies/mL	(Log_copies)/r	log copies/mL				MICRO	HIV1 RNA SerPI PCR DL=2.6-Log#	Lab	Both
48890-7	HIV 1 RNA (Log #Volume) (viral load) in Unspecified specimen by Probe and target amplification method	HIV 1 RNA	LnCnc	Pt	XXX	Qn	Probe.amp.tar	(Log_copies)/r	log copies/mL				MICRO	HIV1 RNA XXX PCR-Log#	Lab	Both
41498-7	HIV 1 RNA (Volume) (viral load) in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA	NCnc	Pt	CSF	Qn	Probe.amp.tar	(copies)/mL	copies/mL				MICRO	HIV1 RNA # CSF PCR	Lab	Both
70241-5	HIV 1 RNA (Volume) (viral load) in Plasma by Probe and target amplification method detection limit = 20 copies/mL	HIV 1 RNA	NCnc	Pt	Plas	Qn	Probe.amp.tar detection limit = 20 copies/mL	(copies)/mL	copies/mL				MICRO	HIV1 RNA # Plas PCR DL=20	Lab	Both
60447-9	HIV 1 RNA (Volume) (viral load) in Serum or Plasma by Probe and target amplification method	HIV 1 RNA	NCnc													
48551-6	HIV 1 RNA (Volume) (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 400 copies/mL	HIV 1 RNA	NCnc													
48511-0	HIV 1 RNA (Volume) (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 50 copies/mL	HIV 1 RNA	NCnc													
25836-8	HIV 1 RNA (Volume) (viral load) in Unspecified specimen by Probe and target amplification method	HIV 1 RNA	NCnc													
5017-9	HIV 1 RNA (Presence) in Blood by Probe and target amplification method	HIV 1 RNA	PrThr													
42917-5	HIV 1 RNA (Presence) in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA	PrThr													
77369-7	HIV 1 RNA (Presence) in Semen by Probe and target amplification method	HIV 1 RNA	PrThr													
25835-0	HIV 1 RNA (Presence) in Serum or Plasma by Probe and target amplification method	HIV 1 RNA	PrThr													
5018-7	HIV 1 RNA (Presence) in Unspecified specimen by Probe and target amplification method	HIV 1 RNA	PrThr													
50624-6	HIV 1 RNA panel (viral load) in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA panel	-													
70380-2	HIV 1 RNA+proviral DNA (Presence) in Blood by Probe and target amplification method	HIV 1 RNA+proviral DNA	PrThr													
70379-4	HIV 1 RNA+proviral DNA (Presence) in Plasma by Probe and target amplification method	HIV 1 RNA+proviral DNA	PrThr													
73658-7	HIV 1 subtype in Unspecified specimen by Probe and target amplification method	HIV 1 subtype	Type													
53825-9	HIV 1+Hepatitis C virus RNA (Presence) in Serum or Plasma by Probe and target amplification method	HIV 1+Hepatitis C virus RNA	PrThr													
38998-1	HIV 1+Hepatitis C virus RNA (Presence) in Serum or Plasma from Blood product unit by Probe and target amplification method	HIV 1+Hepatitis C virus RNA	PrThr													
50652-1	HIV 1+Hepatitis C virus RNA+Hepatitis B virus DNA (Presence) in Serum or Plasma by Probe and target amplification method	HIV 1+Hepatitis C virus RNA+Hepatitis B virus DNA	PrThr													

**LOINC** HIV1 PCR

LOINC	LongName	Component	Property	Timing	System	Scale	Method	exUCUMunits	exUnits	Lforms	Rank	SIrank	Class	ShortName	Type	OrderObs
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76007-2	HIV 1 proviral DNA (Logarithmic entic number) (viral load) in Blood mononuclear cells by Probe and target amplification method	HIV 1 proviral DNA	EntLogNum	Pt	Bld MC	Qn	Probe.amp.tar	Log copies/10 <sup>6</sup> (cx	Log copies/10 cells				MICRO	HIV 1 proviral DNA Bld MC PCR-EntLogNum	Lab	Both
76010-6	HIV 1 proviral DNA (Logarithmic entic number) (viral load) in Mononuclear cells from unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	EntLogNum	Pt	XXX MC	Qn	Probe.amp.tar	Log copies/10 <sup>6</sup> (cx	Log copies/10 cells				MICRO	HIV 1 proviral DNA XXX MC PCR-EntLogNum	Lab	Observation
76009-8	HIV 1 proviral DNA (Entic number) (viral load) in Blood mononuclear cells by Probe and target amplification method	HIV 1 proviral DNA	EntNum	Pt	Bld MC	Qn	Probe.amp.tar	Copies/10 <sup>6</sup> (c	copies/10 cells				MICRO	HIV 1 proviral DNA Bld MC PCR-EntNum	Lab	Both
76008-0	HIV 1 proviral DNA (Entic number) (viral load) in Mononuclear cells from unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	EntNum	Pt	XXX MC	Qn	Probe.amp.tar	Copies/10 <sup>6</sup> (c	copies/10 cells				MICRO	HIV 1 proviral DNA XXX MC PCR-EntNum	Lab	Both
74855-8	HIV 1 proviral DNA (Log #Volume) (viral load) in Unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	LnCnc	Pt	XXX	Qn	Probe.amp.tar	(Log_cells)/ml	Log cells/mL				MICRO	HIV 1 proviral DNA XXX PCR-Log#	Lab	Both
74854-1	HIV 1 proviral DNA (Volume) (viral load) in Blood by Probe and target amplification method	HIV 1 proviral DNA	NCnc	Pt	Bld	Qn	Probe.amp.tar	(copies)/mL	copies/mL				MICRO	HIV 1 proviral DNA # Bld PCR	Lab	Both
44871-2	HIV 1 proviral DNA (Presence) in Blood by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Bld	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA Bld Qi PCR	Lab	Both
77368-9	HIV 1 proviral DNA (Presence) in Semen by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Semen	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA Srmn Qi PCR	Lab	Both
48023-6	HIV 1 proviral DNA (Presence) in Serum or Plasma by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Ser/Plas	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA SerPI Qi PCR	Lab	Both
74853-3	HIV 1 proviral DNA (Presence) in Unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	XXX	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA XXX Qi PCR	Lab	Both
62469-2	HIV 1 RNA (Units/volume) (viral load) in Serum or Plasma by Probe and target amplification method	HIV 1 RNA	ACnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(U)/mL	IU/mL				MICRO	HIV1 RNA SerPI PCR-aCnc	Lab	Both
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29541-0	HIV 1 RNA (Log #Volume) (viral load) in Plasma by Probe and target amplification method	HIV 1 RNA	LnCnc	Pt	Plas	Qn	Probe.amp.tar	(log_copies)/r	log copies/mL		654	654	MICRO	HIV1 RNA Plas PCR-Log#	Lab	Both

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ID of specifically defined items or concepts

Not designed to ID semantic relationships or hierarchies

# International Statistical Classification of Diseases and Related Health Problems (ICD)

## WHO medical classification list

- **Taxonomic code**
  - Communicates meaning of the associated value or word string in the context of the hierarchical structure
  - Does NOT communicate how it relates to other taxonomic codes NOT in the same hierarchy OR at the same level of the same hierarchy

401.0 Malignant hypertension

vs.

401.1 Benign hypertension

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401.0 Malignant hypertension

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401.1 Benign hypertension

## ICD-10-CM Code Structure

ICD-10 diagnosis codes have between 3 and 7 characters:



K Diseases of Digestive system

K55 Vascular disorders of intestine

K55.01 Acute (reversible) ischemia of small intestine

K55.012 Diffuse acute (reversible) ischemia of small intestine

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LOINC

ICD

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allows querying by  
increasing/decreasing  
specificity & taxonomies



Not designed to support  
semantic interoperability

HL7

LOINC

ICD

SNOMED CT

# Systematized Nomenclature Of MEDicine -- Clinical Terms

Logically defined code does communicate

- meaning of the associated value or word string
- how it relates to other codes

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SNOMED CT

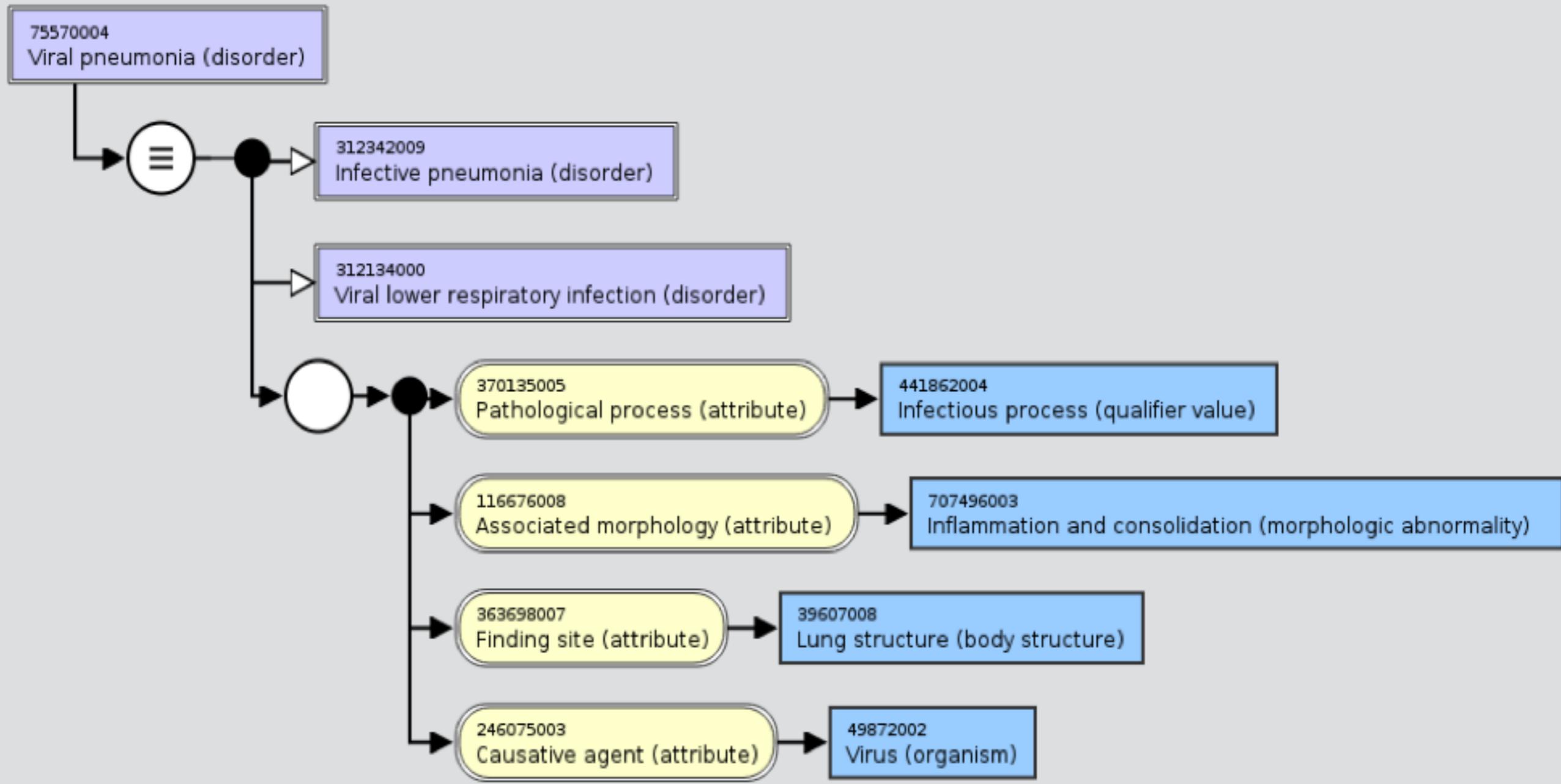
- All concepts belong to a specific semantic hierarchy
  - Body structure
  - Observable entity
  - Clinical Finding
- Attributes represent types of relationships between concepts
  - Finding site
  - Associated morphology
  - Causative agent
- SNOMED CT concept representation and how meaning conveyed
  - Parents (|ISA| relationship)
  - Defining attribute-value pairs
  - Allowable attribute-value pairs defined by concept model

SNOMED CT applies logical rules to defining attribute/value pairs:

75570004 = Viral pneumonia:

IS An infectious disease,  
a disease of the lung,  
a viral infection

HAS SUBTYPES of Measles pneumonia,  
pneumonia due to RSV, ....



HL7

LOINC

ICD

SNOMED CT



Supports semantic /relational query

Not designed as messaging framework or for simple definitions



Abraham Maslow said in 1966, "I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail."

- Each of these standards has individual strengths and weaknesses
- Currently there is no single standard that meets all coding needs to achieve the IOM objective

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**LOINC** HIV1 PCR

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78027-2	HIV 1 proviral DNA [Logarithmic entic number] (viral load) in Blood mononuclear cells by Probe and target amplification method	HIV 1 proviral DNA	EntLogNum	Pt	Bld MC	Qn	Probe.amp.tar	Log copies/10 <sup>5</sup> cells	Log copies/10 <sup>5</sup> cells				MICRO	HIV 1 proviral DNA Bld MC PCR-EntLogNum	Lab	Both
78010-6	HIV 1 proviral DNA [Logarithmic entic number] (viral load) in Mononuclear cells from unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	EntLogNum	Pt	XXX MC	Qn	Probe.amp.tar	Log copies/10 <sup>5</sup> cells	Log copies/10 <sup>5</sup> cells				MICRO	HIV 1 proviral DNA XXX MC PCR-EntLogNum	Lab	Observation
78025-9	HIV 1 proviral DNA [Entic number] (viral load) in Blood mononuclear cells by Probe and target amplification method	HIV 1 proviral DNA	EntNum	Pt	Bld MC	Qn	Probe.amp.tar	Copies/10 <sup>5</sup> cells	Copies/10 <sup>5</sup> cells				MICRO	HIV 1 proviral DNA Bld MC PCR-EntNum	Lab	Both
78028-5	HIV 1 proviral DNA [Entic number] (viral load) in Mononuclear cells from unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	EntNum	Pt	XXX MC	Qn	Probe.amp.tar	Copies/10 <sup>5</sup> cells	Copies/10 <sup>5</sup> cells				MICRO	HIV 1 proviral DNA XXX MC PCR-EntNum	Lab	Both
74855-8	HIV 1 proviral DNA [Log #volume] (viral load) in Unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	LnCnc	Pt	XXX	Qn	Probe.amp.tar	(Log copies) log cells/mL	Log cells/mL				MICRO	HIV 1 proviral DNA XXX PCR-Log#	Lab	Both
74854-1	HIV 1 proviral DNA [Volume] (viral load) in Blood by Probe and target amplification method	HIV 1 proviral DNA	NCnc	Pt	Bld	Qn	Probe.amp.tar	(copies) mL	(copies) mL				MICRO	HIV 1 proviral DNA # Bld PCR	Lab	Both
44871-2	HIV 1 proviral DNA [Presence] in Blood by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Bld	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA Bld QI PCR	Lab	Both
77268-9	HIV 1 proviral DNA [Presence] in Semen by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Semen	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA Sem QI PCR	Lab	Both
48023-6	HIV 1 proviral DNA [Presence] in Serum or Plasma by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	Ser/Plas	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA SerPl QI PCR	Lab	Both
48023-3	HIV 1 proviral DNA [Presence] in Unspecified specimen by Probe and target amplification method	HIV 1 proviral DNA	PrThr	Pt	XXX	Ord	Probe.amp.tar						MICRO	HIV 1 proviral DNA XXX QI PCR	Lab	Both
62469-2	HIV 1 RNA [Units/volume] (viral load) in Serum or Plasma by Probe and target amplification method	HIV 1 RNA	ACnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(U) mL	(U) mL				MICRO	HIV1 RNA SerPl PCR-eCnc	Lab	Both
41487-9	HIV 1 RNA [Log #volume] (viral load) in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA	LnCnc	Pt	CSF	Qn	Probe.amp.tar	(Log copies) log copies/mL	log copies/mL				MICRO	HIV1 RNA CSF PCR-Log#	Lab	Both
29541-6	HIV 1 RNA [Log #volume] (viral load) in Plasma by Probe and target amplification method	HIV 1 RNA	LnCnc	Pt	Plas	Qn	Probe.amp.tar	(log copies) log copies/mL	log copies/mL	654	654		MICRO	HIV1 RNA Plas PCR-Log#	Lab	Both
51780-5	HIV 1 RNA [Log #volume] (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 0.5 log copies/mL	HIV 1 RNA	LnCnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(Log copies) log copies/mL	log copies/mL				MICRO	HIV1 RNA SerPl PCR DL=0.5-Log#	Lab	Both
48010-2	HIV 1 RNA [Log #volume] (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 1.7 log copies/mL	HIV 1 RNA	LnCnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(Log copies) log copies/mL	log copies/mL				MICRO	HIV1 RNA SerPl PCR DL=1.7-Log#	Lab	Both
48052-4	HIV 1 RNA [Log #volume] (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 2.6 log copies/mL	HIV 1 RNA	LnCnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(Log copies) log copies/mL	log copies/mL				MICRO	HIV1 RNA SerPl PCR DL=2.6-Log#	Lab	Both
48890-7	HIV 1 RNA [Log #volume] (viral load) in Unspecified specimen by Probe and target amplification method	HIV 1 RNA	LnCnc	Pt	XXX	Qn	Probe.amp.tar	(Log copies) log copies/mL	log copies/mL				MICRO	HIV1 RNA XXX PCR-Log#	Lab	Both
41486-7	HIV 1 RNA [Volume] (viral load) in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA	NCnc	Pt	CSF	Qn	Probe.amp.tar	(copies) mL	(copies) mL				MICRO	HIV1 RNA # CSF PCR	Lab	Both
20441-6	HIV 1 RNA [Volume] (viral load) in Plasma by Probe and target amplification method detection limit = 20 copies/mL	HIV 1 RNA	NCnc	Pt	Plas	Qn	Probe.amp.tar	(copies) mL	(copies) mL				MICRO	HIV1 RNA # Plas PCR DL=20	Lab	Both
20447-6	HIV 1 RNA [Volume] (viral load) in Serum or Plasma by Probe and target amplification method	HIV 1 RNA	NCnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(copies) mL	(copies) mL	626	626		MICRO	HIV1 RNA # SerPl PCR	Lab	Both
48016-1	HIV 1 RNA [Volume] (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 400 copies/mL	HIV 1 RNA	NCnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(copies) mL	(copies) mL				MICRO	HIV1 RNA # SerPl PCR DL=400	Lab	Both
48011-6	HIV 1 RNA [Volume] (viral load) in Serum or Plasma by Probe and target amplification method detection limit = 50 copies/mL	HIV 1 RNA	NCnc	Pt	Ser/Plas	Qn	Probe.amp.tar	(copies) mL	(copies) mL				MICRO	HIV1 RNA # SerPl PCR DL=50	Lab	Both
25636-9	HIV 1 RNA [Volume] (viral load) in Unspecified specimen by Probe and target amplification method	HIV 1 RNA	NCnc	Pt	XXX	Qn	Probe.amp.tar	(copies) mL	(copies) mL	685	685		MICRO	HIV1 RNA # XXX PCR	Lab	Both
5017-9	HIV 1 RNA [Presence] in Blood by Probe and target amplification method	HIV 1 RNA	PrThr	Pt	Bld	Ord	Probe.amp.tar						MICRO	HIV1 RNA Bld QI PCR	Lab	Both
42917-5	HIV 1 RNA [Presence] in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA	PrThr	Pt	CSF	Ord	Probe.amp.tar						MICRO	HIV1 RNA CSF QI PCR	Lab	Both
77269-2	HIV 1 RNA [Presence] in Semen by Probe and target amplification method	HIV 1 RNA	PrThr	Pt	Semen	Ord	Probe.amp.tar						MICRO	HIV1 RNA Sem QI PCR	Lab	Both
25635-6	HIV 1 RNA [Presence] in Serum or Plasma by Probe and target amplification method	HIV 1 RNA	PrThr	Pt	Ser/Plas	Ord	Probe.amp.tar						MICRO	HIV1 RNA SerPl QI PCR	Lab	Both
5018-7	HIV 1 RNA [Presence] in Unspecified specimen by Probe and target amplification method	HIV 1 RNA	PrThr	Pt	XXX	Ord	Probe.amp.tar						MICRO	HIV1 RNA XXX QI PCR	Lab	Both
50624-6	HIV 1 RNA panel (viral load) in Cerebral spinal fluid by Probe and target amplification method	HIV 1 RNA panel	-	Pt	CSF	Qn	Probe.amp.tar						PANEL MICRO	HIV 1 RNA Pnl CSF PCR	Lab	Order
78030-2	HIV 1 RNA+proviral DNA [Presence] in Blood by Probe and target amplification method	HIV 1 RNA+proviral DNA	PrThr	Pt	Bld	Ord	Probe.amp.tar						MICRO	HIV 1 RNA+proviral DNA Bld QI PCR	Lab	Both
78073-4	HIV 1 RNA+proviral DNA [Presence] in Plasma by Probe and target amplification method	HIV 1 RNA+proviral DNA	PrThr	Pt	Plas	Ord	Probe.amp.tar						MICRO	HIV 1 RNA+proviral DNA Plas QI PCR	Lab	Both
78026-7	HIV 1 subtype in Unspecified specimen by Probe and target amplification method	HIV 1 subtype	Type	Pt	XXX	Nom	Probe.amp.tar						MICRO	HIV 1 subtype XXX PCR	Lab	Both
38826-6	HIV 1+Hepatitis C virus RNA [Presence] in Serum or Plasma by Probe and target amplification method	HIV 1+Hepatitis C virus RNA	PrThr	Pt	Ser/Plas	Ord	Probe.amp.tar						MICRO	HIV 1+HCV RNA SerPl QI PCR	Lab	Both
38926-1	HIV 1+Hepatitis C virus RNA [Presence] in Serum or Plasma from Blood product unit by Probe and target amplification method	HIV 1+Hepatitis C virus RNA	PrThr	Pt	Ser/Plas^BPU	Ord	Probe.amp.tar						MICRO	HIV 1+HCV RNA SerPl BPU QI PCR	Lab	Both
95092-1	HIV 1+Hepatitis C virus RNA+Hepatitis B virus DNA [Presence] in Serum or Plasma by Probe and target amplification method	HIV 1+Hepatitis C virus RNA+Hepatitis B virus DNA	PrThr	Pt	Ser/Plas	Ord	Probe.amp.tar						MICRO	HIV 1+HCV RNA+HBV DNA SerPl QI PCR	Lab	Both



HIV serum

Search

LOINC	LongName	Component	Property	Timing	System	Scale	Method
74856-6	HIV 1 group O RNA+HIV 1 group M RNA+HIV 2 RNA+Hepatitis C virus RNA+Hepatitis B virus DNA [Presence] in Serum or Plasma from donor by Probe and target amplification method	HIV 1 group O RNA+HIV 1 group M RNA+HIV 2 RNA+Hepatitis C virus RNA+Hepatitis B virus DNA	PrThr	Pt	Ser/Plas^donor	Ord	Probe.amp.tar
85037-0	HIV 1 and 2 Ab and HIV 1 p24 Ag panel - Serum or Plasma by Immunoassay	HIV 1 & 2 Ab & HIV 1 p24 Ag panel	-	Pt	Ser/Plas	-	IA
83101-6	HIV 1+2 Ab and HIV1 p24 Ag panel - Serum or Plasma by Immunoassay	HIV 1+2 Ab & HIV1 p24 Ag panel	-	Pt	Ser/Plas	-	IA
75666-8	HIV 1+2 Ab and HIV1 p24 Ag [Identifier] in Serum, Plasma or Blood by Rapid immunoassay	HIV 1+2 Ab & HIV1 p24 Ag	Prid	Pt	Ser/Plas/Bld	Nom	IA.ra
58900-2	HIV 1+2 Ab+HIV1 p24 Ag [Units/volume] in Serum or Plasma by Immunoassay	HIV 1+2 Ab+HIV1 p24 Ag	ACnc	Pt	Ser/Plas	Qn	IA
56888-1	HIV 1+2 Ab+HIV1 p24 Ag [Presence] in Serum or Plasma by Immunoassay	HIV 1+2 Ab+HIV1 p24 Ag	PrThr	Pt	Ser/Plas	Ord	IA
59052-1	HIV 1+Hepatitis C virus RNA+Hepatitis B virus DNA [Presence] in Serum or Plasma by Probe and target amplification method	HIV 1+Hepatitis C virus RNA+Hepatitis B virus DNA	PrThr	Pt	Ser/Plas	Ord	Prot
68961-2	HIV 1 Ab [Presence] in Serum, Plasma or Blood by Rapid immunoassay	HIV 1 Ab	PrThr	Pt	Ser/Plas/Bld	Ord	IA.ra
80387-4	HIV 1+2 Ab [Presence] in Serum, Plasma or Blood by Rapid immunoassay	HIV 1+2 Ab	PrThr	Pt	Ser/Plas/Bld	Ord	IA.ra
81641-3	HIV 2 Ab [Presence] in Serum, Plasma or Blood by Rapid immunoassay	HIV 2 Ab	PrThr	Pt	Ser/Plas/Bld	Ord	IA.ra
49483-1	HIV 1 [Interpretation] in Serum or Plasma by Immunoassay Narrative	HIV 1	Imp	Pt	Ser/Plas	Nar	IA

Search generated 148 hits in 0.012 secs.

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HIV serum elisa

Search

LOINC	LongName	Component	Property	Timing	System
85037-0	HIV 1 and 2 Ab and HIV 1 p24 Ag panel - Serum or Plasma by Immunoassay	HIV 1 & 2 Ab & HIV 1 p24 Ag panel	-	Pt	Ser/Plas
83101-6	HIV 1+2 Ab and HIV1 p24 Ag panel - Serum or Plasma by Immunoassay	HIV 1+2 Ab & HIV1 p24 Ag panel	-	Pt	Ser/Plas
75666-8	HIV 1+2 Ab and HIV1 p24 Ag [Identifier] in Serum, Plasma or Blood by Rapid immunoassay	HIV 1+2 Ab & HIV1 p24 Ag	Prid	Pt	Ser/Plas/Bld
58900-2	HIV 1+2 Ab+HIV1 p24 Ag [Units/volume] in Serum or Plasma by Immunoassay	HIV 1+2 Ab+HIV1 p24 Ag	ACnc	Pt	Ser/Plas
56888-1	HIV 1+2 Ab+HIV1 p24 Ag [Presence] in Serum or Plasma by Immunoassay	HIV 1+2 Ab+HIV1 p24 Ag	PrThr	Pt	Ser/Plas
49483-1	HIV 1 [Interpretation] in Serum or Plasma by Immunoassay Narrative	HIV 1	Imp	Pt	Ser/Plas
44607-0	HIV 1 [Interpretation] in Serum or Plasma by Immunoassay	HIV 1	Imp	Pt	Ser/Plas
5220-9	HIV 1 Ab [Units/volume] in Serum or Plasma by Immunoassay	HIV 1 Ab	ACnc	Pt	Ser/Plas
29893-5	HIV 1 Ab [Presence] in Serum or Plasma by Immunoassay	HIV 1 Ab	PrThr	Pt	Ser/Plas
5222-5	HIV 1 Ag [Presence] in Serum or Plasma by Immunoassay	HIV 1 Ag	PrThr	Pt	Ser/Plas
5223-3	HIV 1+2 Ab [Units/volume] in Serum or Plasma by Immunoassay	HIV 1+2 Ab	ACnc	Pt	Ser/Plas
31201-7	HIV 1+2 Ab [Presence] in Serum or Plasma by Immunoassay	HIV 1+2 Ab	PrThr	Pt	Ser/Plas
40733-8	HIV 1+2 IgG Ab [Presence] in Serum or Plasma by Immunoassay	HIV 1+2 Ab.IgG	PrThr	Pt	Ser/Plas

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# Inter-institutional Comparability

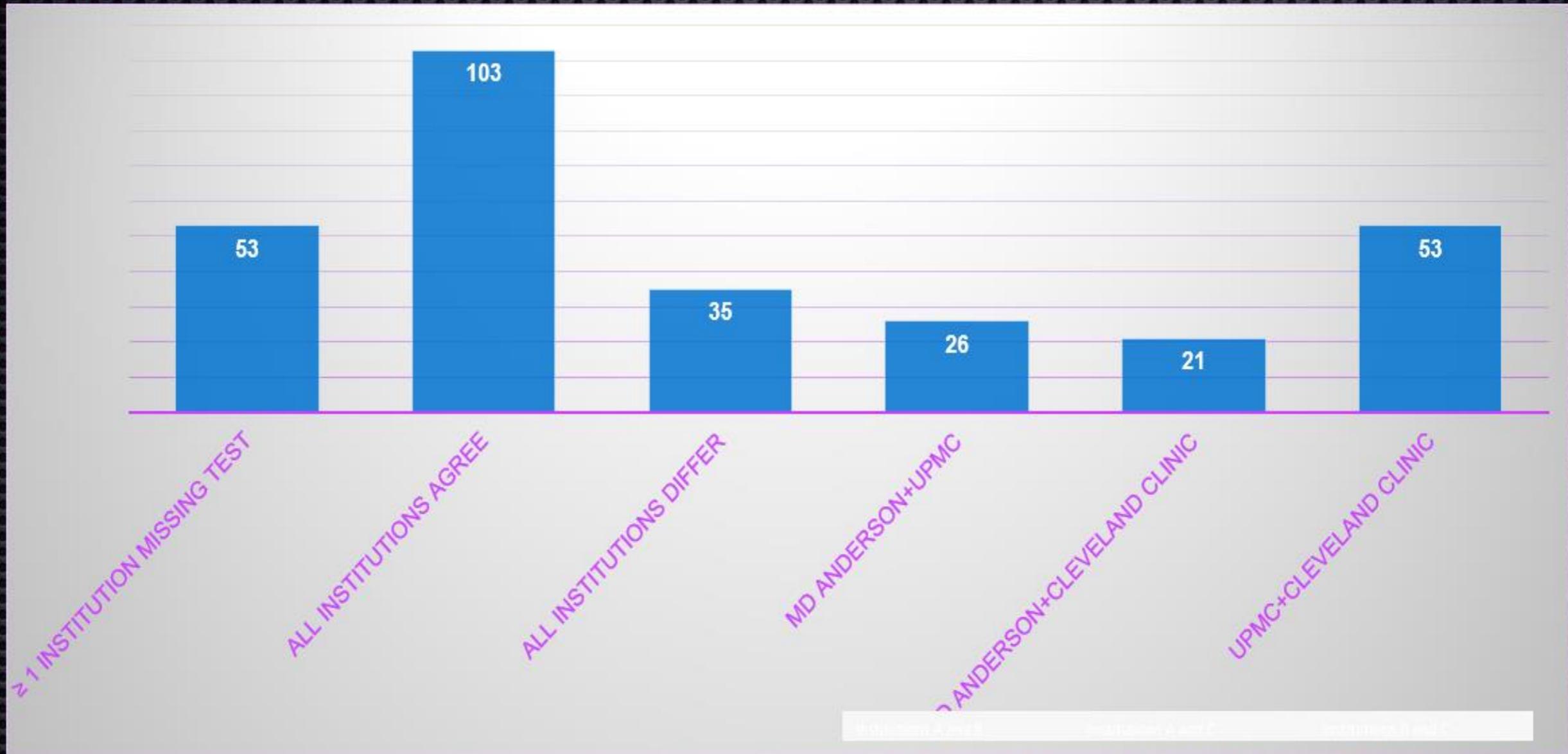
LOINC codes from top 300 clinical lab tests from chemistry, hematology and immunology at UPMC were shared with Cleveland Clinic and MDACC. 249 identical tests were compared. Matching was defined as universal (3/3), partial(2/3) and none (0/0) concurrence.

**Results:** Among the 3 healthcare systems, concordance for the list of common laboratory tests using LOINC codes was low (44%)

**44% universal      30% partial matching      26% zero matching**

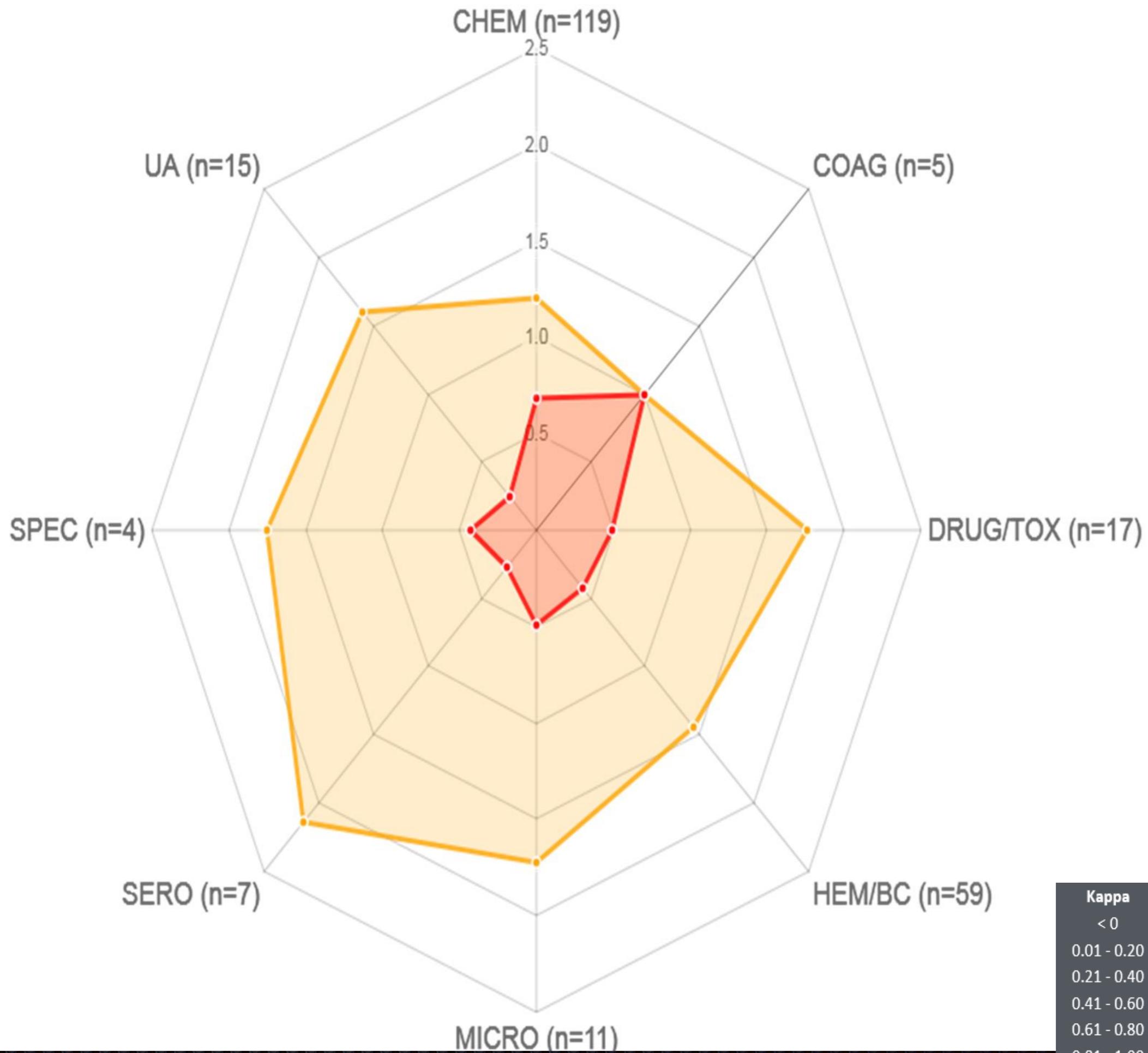
# Summary of Test Availability and Agreement

Number of Tests

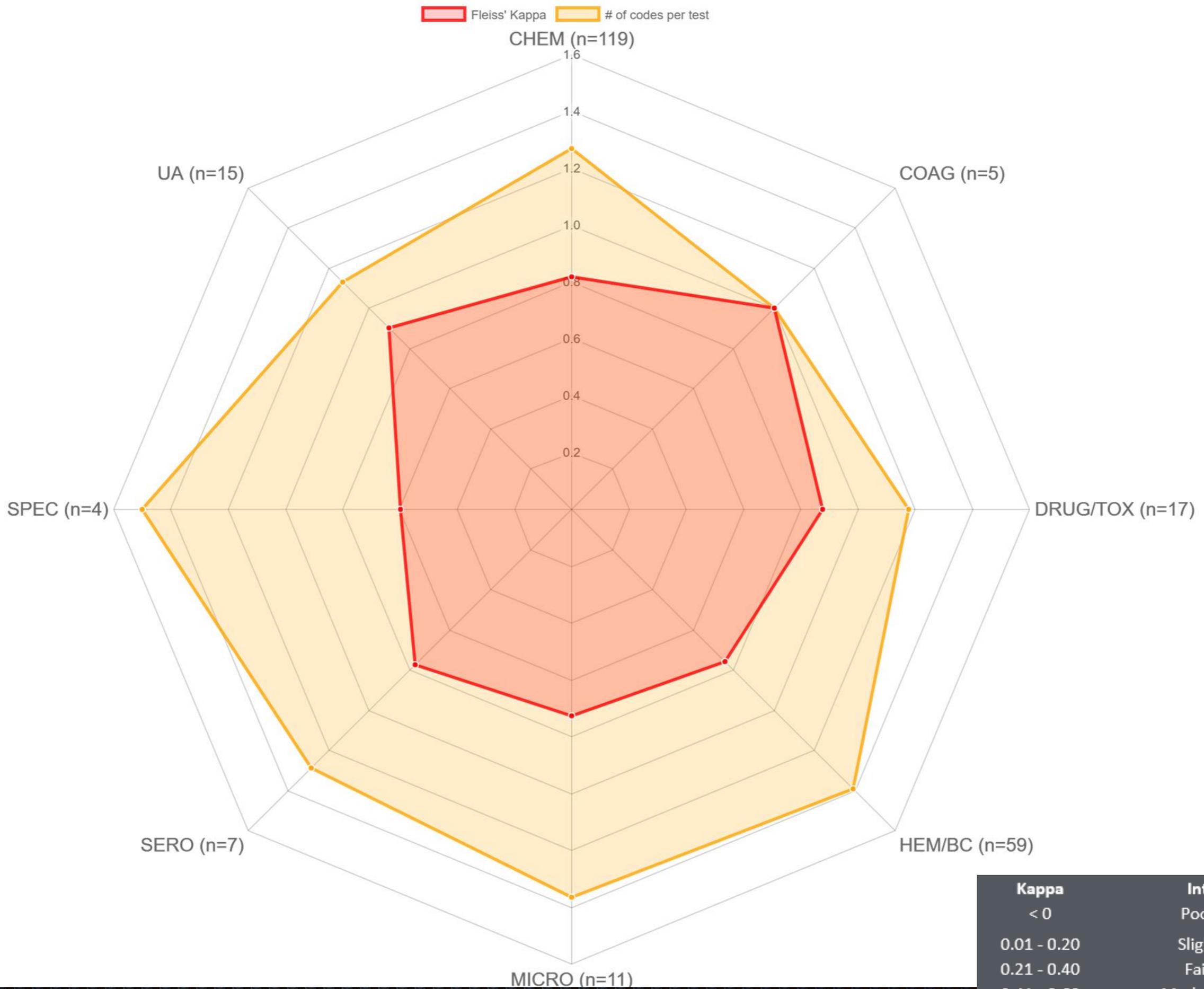


This is a summary chart for the data analyzed. There was a missing code from one or more of the institutions for 53 tests. There was exact agreement among all three sites for 103 tests; this computes to 35.4% of all 291 tests or 43.3% of 238 tests with complete data. All institutions differed for 35 tests, which is approximately 12% of all 291 tests or 14.7% of the 238 tests with complete data.

Fleiss' Kappa # of codes per test



Kappa	Interpretation
< 0	Poor agreement
0.01 - 0.20	Slight agreement
0.21 - 0.40	Fair agreement
0.41 - 0.60	Moderate agreement
0.61 - 0.80	Substantial agreement
0.81 - 1.00	Almost perfect agreement



Kappa	Interpretation
< 0	Poor agreement
0.01 - 0.20	Slight agreement
0.21 - 0.40	Fair agreement
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# References

Stram Michelle<sup>1</sup>, Jansen Seheult<sup>1</sup>, Tony Gigliotti<sup>2</sup>, Navid Farahani<sup>1</sup>, Walter H Henricks<sup>3</sup>, Michael Riben<sup>4</sup>, Mark Routbort<sup>4</sup>, Douglas Hartman<sup>1</sup>, Liron Pantanowitz<sup>1</sup>

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<sup>2</sup> Information Services Division, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA

<sup>3</sup> Pathology and Laboratory Medicine Institute, Cleveland Clinic, Cleveland, Ohio, USA

<sup>4</sup> Department of Pathology and Laboratory Medicine, The University of Texas MD Anderson Cancer Center, Houston, Texas, USA

 42569-4 Potassium [Mass or Moles/volume] in Serum or Plasma



 22760-3 Potassium [Mass/volume] in Serum or Plasma



2823-3 Potassium [Moles/volume] in Serum or Plasma



77142-8 Potassium [Moles/volume] in Serum, Plasma or Blood



# Meaningful Use

- With the roll-out of MU, LOINC utilization was mandated and broadly adopted
- There was no formal process to align codes
- The internal logic of LOINC precludes evaluating for semantic relationships

# The IOM

***Digital Infrastructure for the Learning Health System:  
The Foundation for Continuous Improvement in  
Health and Health Care*** report on HIT & interoperability  
determined that

**“without seamless interoperability,”**

the implementation of HIT will not achieve the goal of  
improving the quality of healthcare.

# Interoperability: Where?

- Patient Care
  - One Patient
    - within an institution
    - among institutions
  - Many patients within /among institutions
- Epidemiology / Public Health
- Population Care Management / Health Care Economies

- Standard Development Organizations (SDO) are trying to align, where appropriate

- LOINC/SNOMED

- SNOMED/ICD-O

- ICD-10/SNOMED



**KEEP  
CALM  
AND  
MIND  
THE GAP**

Don't jump to a solution  
Before the problem  
Is adequately defined

# Proposed Recommendation

CLIAC recommends that HHS create a process for standards utilization field studies across a wide range of clinical laboratories (varying size and complexity) to:

1. better understand the nuances, specificity and compatibility of sharing LOINC or other standard codes
  - a. on both order-and result-side implementation
  - b. in special cases (radiology, clinical findings, anatomic pathology, etc)
2. Identify areas in which a combination(s) of standards is needed to realize the level of granularity and semantic interoperability necessary to achieve the IOM goals