Hochschule Niederrhein
University of Applied Sciences

LOINC

Logical Observation Identifiers, Names and Codes

Grundlagen, Anwendungsszenarien und Statusupdate

Prof. Dr.med. Sylvia Thun

Was ist LOINC?

- LOINC = Logical Observation Identifiers Names and Codes
- Nomenklatur (Code-System mit Klassen) zur universellen Kennzeichnung von
  - Laborbestimmungen,
  - Vitalwerten, klinischen Messungen/Beobachtungen
  - Dokumententypen
- Erstellt/gepflegt seit 1994 vom LOINC-Komitee am Regenstrief Institute/ Indianapolis (USA)

13318-1	Escherichia coli enteroinvasive identified in Stool by Organism specific culture

LOINC Fakten

- LOINC 2.42 und RELMA 6.0
- **71,464** Einträge
- Access, CSV→ Import in MySQL, Oracle

- gemeinfrei (Copyright-geschützt)

- ISO, CEN – Normierungsarbeiten, DIN, ANSI

- Bestandteil des HL7- und IHE-Standards

- in den USA im Einsatz, in Europa auf dem Vormarsch

  → 19,700 registrierte Benutzer in 149 Ländern

Warum LOINC?

Anforderung: „Natrium im Serum“

Krankenhaus

NaS

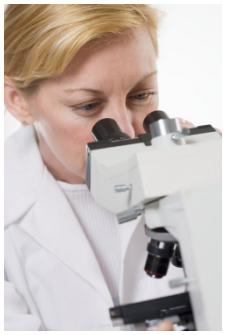
2947-0

Labor 1

abc

NaS

Na_S



Labor 2

abc

Facharzt

Fallbeispiel LOINC im VHITG Arztbrief

Beschreibung	Wert	Einheit	Normbereich
Erythrozyten	4.37	10*12/l	4.2 - 6.2
Hämoglobin	12.6	g/dl	14 - 18
Hämatokrit	37.6	%	37 - 40
MCV	86.0	fl	83 - 98
MCH	28.8	pg	28 - 34
MCHC	33.5	g/dl	32 - 36
Leukozyten	8.49	10*9/l	4.4 - 11.2
Thrombozyten	278	10*9/l	140 - 440
Neutrophile	62.0	%	50 - 70
Lymphozyten	24.6	%	20 - 40
Monozyten	7.2	%	4.7 - 12.5
Eosinophile	5.7	%	2 - 4
Basophile	0.5	%	0 - 1

Wissenschaftliche Veröffentlichungen

Case Report ■

LOINC® Codes for Hospital Information Systems Documents: A Case Study

MARTIN DUGAS, MD, MS, SYLVIA THUN, MD, MS, THOMAS FRANKEWITSCH, MD, KAI U. HEITMANN, MD

Abstract Hospital Information Systems (HIS) handle a large number of different types of documents. Exchange and analysis of data from different HIS is facilitated by the use of standardized codes to identify document types. HL7's Clinical Document Architecture (CDA) uses LOINC (logical observation identifiers names and Codes) codes for clinical documents. The authors assessed the coverage of LOINC codes for document types in a German HIS. The authors analyzed document types that occurred more than 10 times in approximately 1.3 million documents in a commercial HIS at a major German University Hospital. Document types were mapped manually to LOINC using the Regenstrief LOINC Mapping Assistant (RELMA). Each document type was coded by two physicians. In case of discrepancies a third expert was consulted to reach consensus. For 76 of 86 document categories a LOINC code was identified, but for 38 of these categories, the LOINC code was not specific as deemed necessary. More than 93% of our local HIS documents had local document types that could be assigned a LOINC code.

■ **J Am Med Inform Assoc.** 2009;16:400–403. DOI 10.1197/jamia.M2882.

Wissenschaftliche Veröffentlichungen

- Edeler, Birte; Majeed, Raphael; Ahlbrandt, Janko; Stöhr, Mark; Stommeln, Florian; Brenck, Florian; Thun, Sylvia; Röhrig, Rainer **LOINC in prehospital emergency medicine in Germany - Experience of the 'DIRK'-Project**

- Hübner U, Flemming D, Heitmann KU, Oemig F, Thun S, Dickerson A, Veenstra M (2010) **The Need for Standardised Documents in Continuity of Care: Results of Standardising the eNursing Summary.** Stud Health Technol Inform. 160:1169-73.

- Zunner C, Bürkle T, Prokosch HU, Ganslandt T**. Mapping local laboratory interface terms to LOINC at a German university hospital using RELMA V.5: a semi-automated approach.** J Am Med Inform Assoc. 2013 Mar-Apr;20(2):293-7.

Projekte: LOINC in epSOS

48765-2	The adverse and other adverse reactions section shall contain a description of the substance intolerances and the associated adverse reactions suffered by the patient. It shall include entries for intolerances and adverse reactions as described in the Entry Content Modules	ALLERGIES, ADVERSE REACTIONS, ALERTS
11348-0	The History of Past Illness section shall contain a description of the conditions the patient suffered in the past. It shall include entries for problems as described in the Entry Content Modules.	HISTORY OF PAST ILLNESS
11369-6	The immunizations section shall contain a description of the immunizations administered to the patient in the past. It shall include entries for medication administration as described in the Entry Content Modules.	HISTORY OF IMMUNIZATIONS

LOINC in Deutschland

- **DIMDI**
  - Erlass BMG
  - zentralen Datenhaltung, Koordination
  - Übersetzung
- **LOINC User Group**
  - Zusammenschluss von Anwendern und interessierten Förderern
- **Interoperabilitätsforum** (DIN, IHE, HL7, BVitG)
  - Anwendung in Spezifikationen
- **Erste Implementierungen**

International

- USA: Meaningful Use → LOINC als Standard in Laboratory Information Systems
- Canada: Pan-Canadian LOINC Observation Code Database (pCLOCD) Nomenclature Standard
- Österreich: ELGA Value Sets für Dokumente, Sektionen und Laborparameter

ISO Standards zu LOINC

- EN 1614 - Health Informatics - Representation of dedicates kind of property in laboratory medicine.
- ISO/IEEE 11073 RTM Terminologie
- Health informatics – Structures and Controlled Vocabularies for Laboratory Test Units for the Reporting of Laboratory Results (prEN ISO 11595)
- Health informatics – Identification of Medicinal Products – Structures and Controlled Vocabularies for Units of Measurement (ISO 11240)

IHE Frameworks beinhalten LOINC

IHE

- Patient Care Coordination (PCC)
- Pharmacy
- Laboratory
- Quality, Research and Public Health
- Patient Care Devices

LOINC und Snomed CT

INTERNATIONAL HEALTH TERMINOLOGY STANDARDS DEVELOPMENT ORGANISATION

LOINC®
Logical Observation Identifiers Names and Codes

Regenstrief and IHTSDO start collaborative efforts

Indianapolis, USA and Copenhagen, Denmark: July 12, 2012

The Regenstrief Institute, whose Logical Observation Identifiers Names and Codes, or LOINC, is the most accepted international terminology for medical tests and measurements, and the International Health Terminology Standards Development Organisation, provider of the leading comprehensive clinical terminology for health care, called SNOMED CT, are exploring a long-term collaborative relationship to develop coded content to support order entry and result reporting critical to the computerized transmission of medical information.

The two groups recently drafted a general framework for collaboration that will serve as a basis for a formal agreement. This framework builds on and complements the strengths of both organizations and terminologies. The initial focus of the cooperative work will be laboratory testing, with the intention of extending to other areas of mutual interest. The IHTSDO and the Regenstrief Institute will work together to develop this initial framework into a formal business agreement, assess the initial efforts required to put the proposed agreement into effect, as well as plan, support and undertake continuing cooperative work.

Was beinhaltet LOINC?

Codes für

- Laborwerte
- klinische Untersuchungen
  - Radiologie
- Dokumenttypen und –abschnitte

Anwendungsgebiete

- Blutdruck, Herz-und Atmungsfrequenz
- Notfalluntersuchungen, Herzleistung, Körpermaße, Körpertemperatur, Stoffwechsel
- Laboruntersuchungen (Mikrobiologie, Toxikologie,..)
- EKG, Sonographie (Geburtshilfe, Urologie), gastrointestinale Endoskopie
- Beatmungsverfahren, Zähne, Notaufnahme, radiologische Untersuchungen
- Klinischer und physischer Zustand
- Entlassungs-und Operationsberichte
- Angaben zur Tumorregistrierung
- Dokumentenarten

Produkte zu LOINC

Datenbank (über 70.000 Codes):

- Einträge für "anything" mit Attributen
- Register mit Regeln für Namen

Hierarchie

- Panels
- Klassifikationen

Werkzeuge

- RELMA für Mapping lokaler Codesysteme
- UCUM

Weitere Produkte

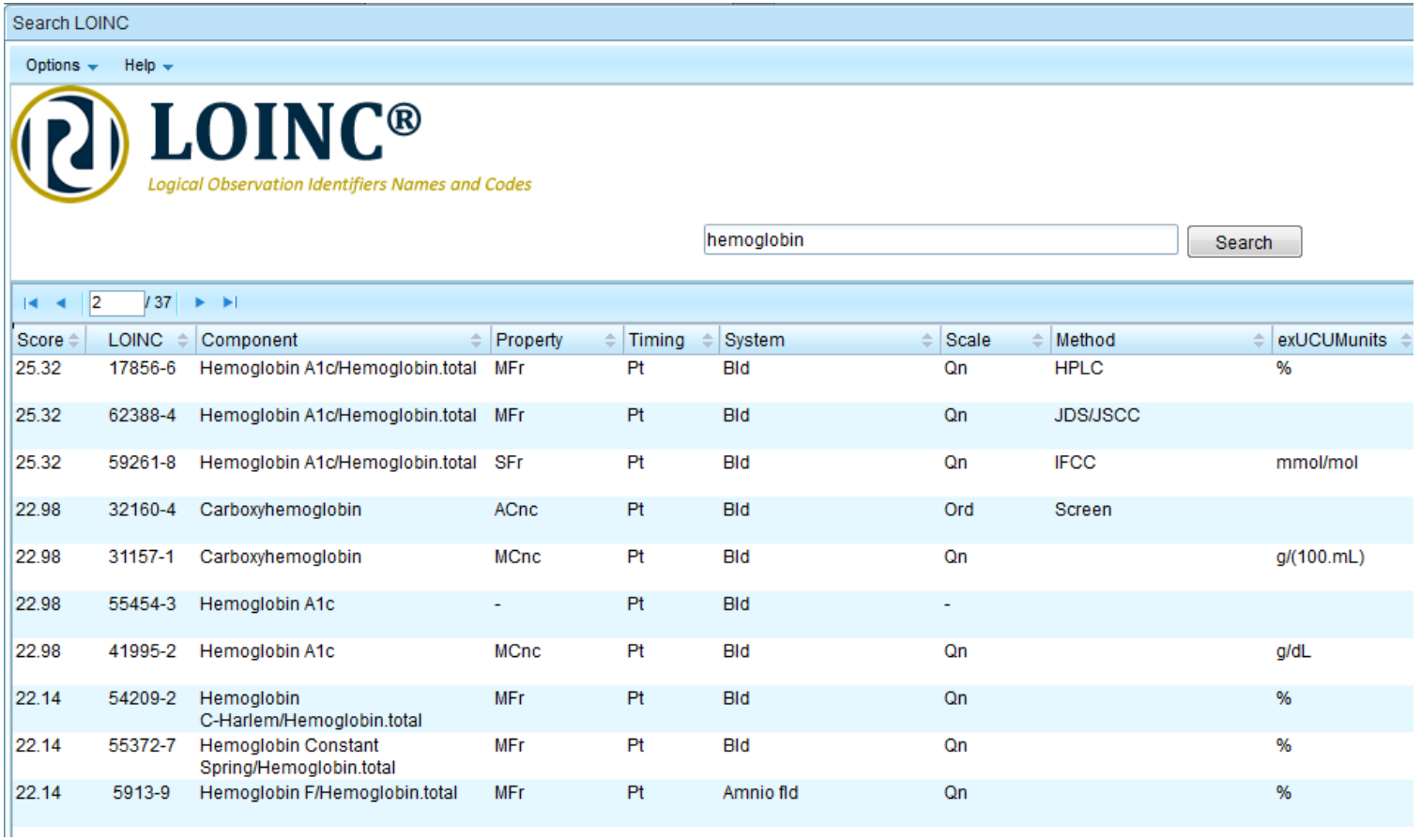
- LOINC Panels and Forms File
- LOINC Multiaxial Hierarchy File
- LOINC Context-specific Hierarchy Template File

- LOINC Top 2000 Results
- LOINC Top 300 Orders
  - (80 Codes → 80%, 784 Codes → 99%))

- Common UCUM units

Online-Kodierung

http://search.loinc.org/



Score	LOINC	Component	Property	Timing	System	Scale	Method	exUCUMunits
25.32	17856-6	Hemoglobin A1c/Hemoglobin.total	MFr	Pt	Bld	Qn	HPLC	%
25.32	62388-4	Hemoglobin A1c/Hemoglobin.total	MFr	Pt	Bld	Qn	JDS/JSCC	
25.32	59261-8	Hemoglobin A1c/Hemoglobin.total	SFr	Pt	Bld	Qn	IFCC	mmol/mol
22.98	32160-4	Carboxyhemoglobin	ACnc	Pt	Bld	Ord	Screen	
22.98	31157-1	Carboxyhemoglobin	MCnc	Pt	Bld	Qn		g/(100.mL)
22.98	55454-3	Hemoglobin A1c	-	Pt	Bld	-		
22.98	41995-2	Hemoglobin A1c	MCnc	Pt	Bld	Qn		g/dL
22.14	54209-2	Hemoglobin C-Harlem/Hemoglobin.total	MFr	Pt	Bld	Qn		%
22.14	55372-7	Hemoglobin Constant Spring/Hemoglobin.total	MFr	Pt	Bld	Qn		%
22.14	5913-9	Hemoglobin F/Hemoglobin.total	MFr	Pt	Amnio fld	Qn		%

Definitionen

59576-9 Body mass index (BMI) [Percentile] Per age and gender

NAME

Fully-Specified Name:

Component	Property	Time Aspect	System	Scale	Method
Body mass index	Prctl	Pt	^Patient	Qn	Per age and gender

TERM DEFINITION/DESCRIPTION(S)

The percentile of a patient's body mass index indicates the relative position of the patient's BMI number among a given population. For children and teens the interpretation of BMI is both age- and sex-specific.

Source: Regenstrief LOINC

PART DEFINITION/DESCRIPTION(S)

The body mass index (BMI), or Quetelet index, is a statistical measurement which compares a person's weight and height. Though it does not actually measure the percentage of body fat, it is a useful tool to estimate a healthy body weight based on how tall a person is. Due to its ease of measurement and calculation, it is the most widely used diagnostic tool to identify weight problem within a population including: underweight, overweight and obesity. It was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing "social physics". Body mass index is defined as the individual's body weight divided by the square of his height. The formulas universally used in medicine produce a unit of measure of kg/m^2. BMI can also be determined using a BMI chart, which displays BMI as a function of weight (horizontal axis) and height (vertical axis) using contour lines for different values of BMI or colours for different BMI categories.

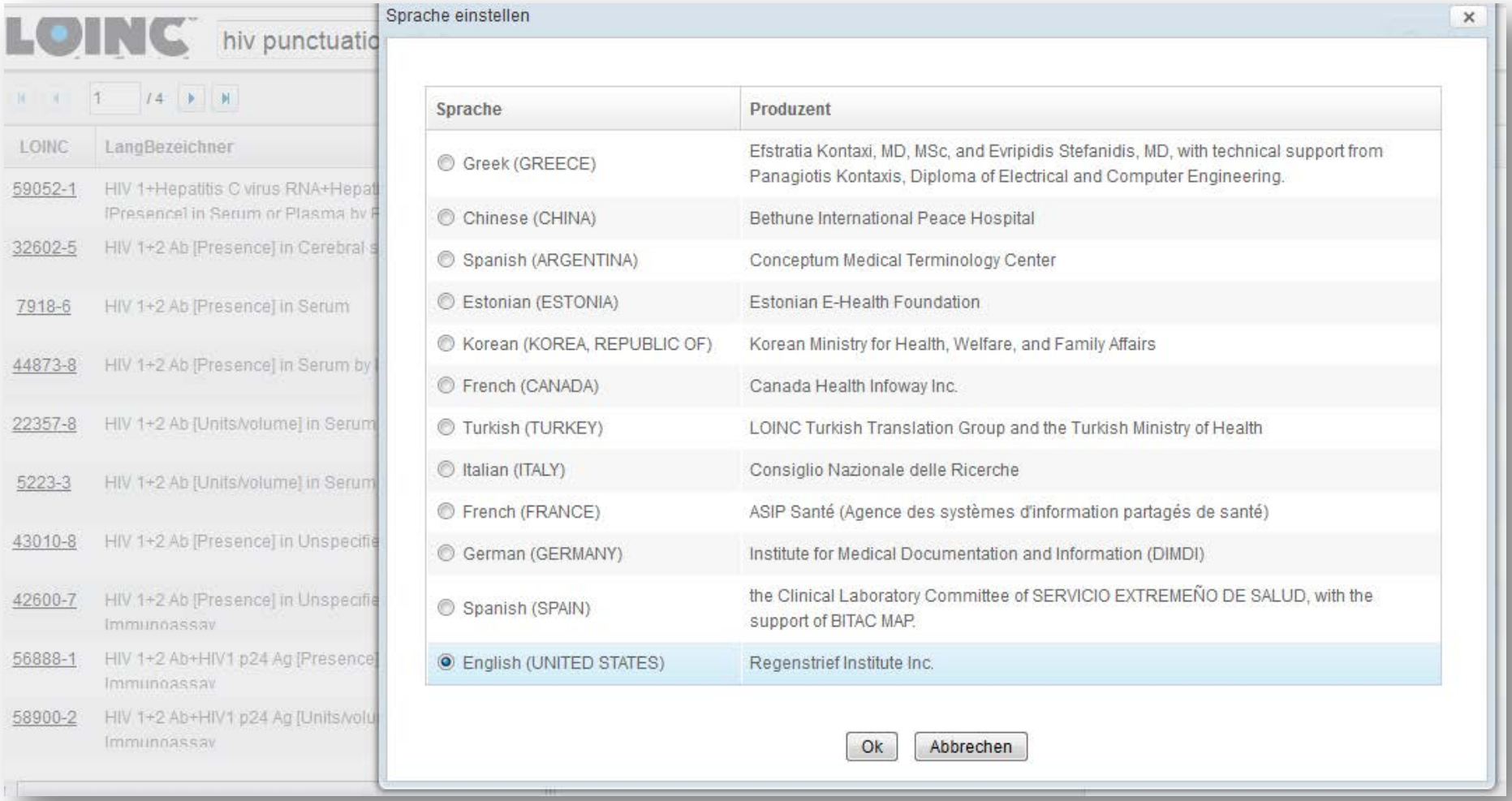
Source: Wikipedia, URL: Body mass index

BASIC ATTRIBUTES

Class/Type:	BDYWGT.MOLEC/Clinical
Last Updated:	2010/07/28
Status:	Active

Generated from LOINC version 2.42.

Übersetzungen



Übersetzungen

Deutsche Übersetzungen in RELMA

Clotting time.intrinsic coagulation system activated.heparin insensitive	Gerinnungszeit.intrinsisches Koagulationssystem aktivitiert.Heparin insensitiv
Clover Ab.IgE	Klee Ak.IgE
Clover Ab.IgE.RAST class	Klee Ak.IgE.RAST Klasse
Clozapine	Clozapin

Beschreibung einer Messung

- Angaben zum Kontext
- System, zeitliche Umstände
- Gegenstand der Untersuchung
- Beschreibung der untersuchten Eigenschaft
- Attribut, Messgröße
- Maß, Messmethode

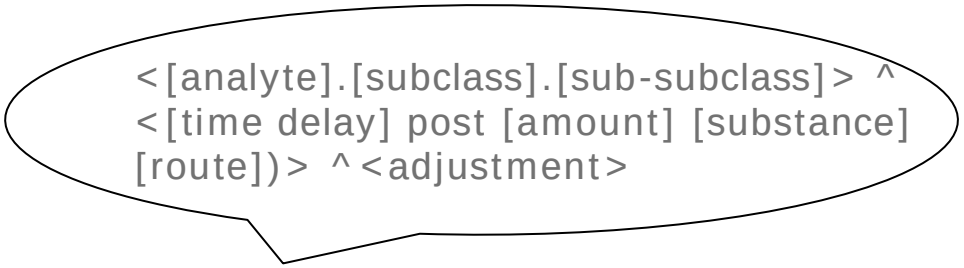
6-achsige Systematik der Nomenklatur

- Eindeutige Bezeichnung (z.B. Glukose)
- Gemessene Eigenschaft (z.B. Massenkonzentration)
- Zeitbezug (z.B. einmalig, in 24 Stunden o.ä.)
- Untersuchungsmaterial (Urin, Serum etc.)
- Typ der Mess-Skala (quantitativ, qualitativ, narrativ, nominal)
- Methode (z.B. PCR, Angiografie)

Beispiel Hämatokrit

Feld	Erklärung	
4544-3	LOINC Code	
Hematocrit	Komponente (Analyt)	
VFr	Gemessene Eigenschaft	
Pt	Zeitangabe: Zeitpunkt, Zeitspanne	
Bld	Art der Probe (z.B. Blut, Urin)	
Qn	Skalierung: quantitativ, ordinal, ...	
Automated count	Methode (optional)	
HEM/BC	Klasse (hier Hämatologie, Differenzialblutbild)	

Schreibweise



<Analyte/component>:<kind of property >:
<time aspect>:<system>:<scale>:<method>

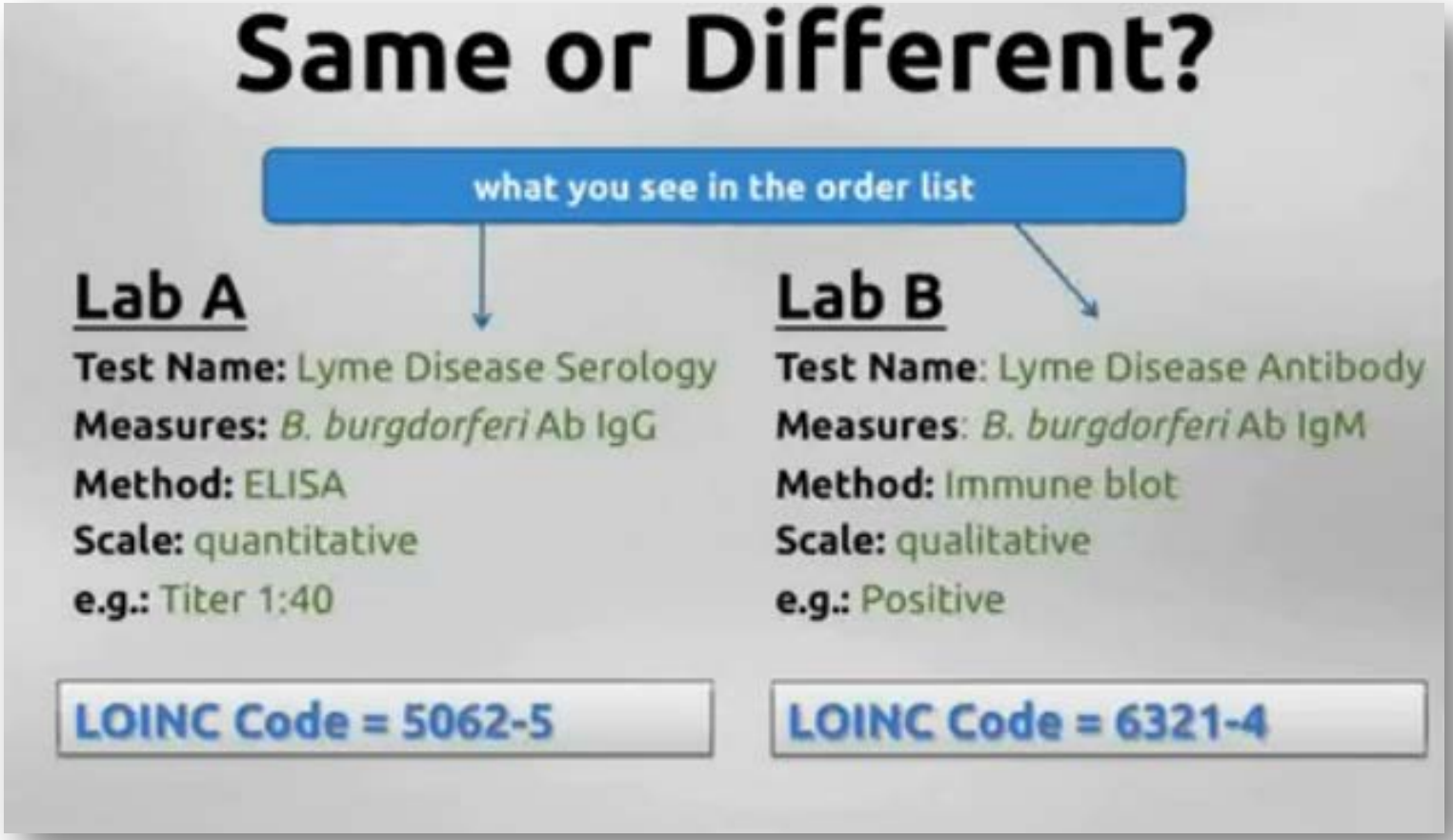
Beispiele:

- Sodium:SCnc:PT:Urine:Qn
- Creatinine renal clearance:VRat:24H:Ur+Ser/Plas:Qn
- Glucose^2H post 100 g glucose PO:MCnc:PT:Ser/Plas:Qn
- Gentamicin^peak:MCnc:PT:Ser/Plas:Qn
- Body temperature:Temp:8H^max:XXX:Qn
- Chief complaint:Find:PT:^Patient:Nar:Reported
- Physical findings:Find:PT:Abdomen:Nar:Observed
- Creatinine renal clearance.predicted:Vrat:Pt:Ser/Plas:Qn:Cockcroft-Gault formula

Ermittlung eines LOINC-Kodes nach RKI Vorgaben am Bsp. Hepatitis C

Suche nach einem bestimmten Erreger	Hepatitis C Virus
Unterscheidung nach Nachweisverfahren	Nukleinsäure-Nachweis Antikörper-Nachweis
Unterscheidung nach Methode	ELISA Immunoblot PCR
Unterscheidung nach Mess-Skala	Quantitative Messung Ordinale Skalierung
Unterscheidung nach Probenmaterial	Blut Plasma / Serum

Unterscheidung der LOINC-Codes



Unterscheidung von zwei LOINC-Kodes

20955-1

- **Salmonella sp.**

Nachweis einer Salmonellen-Spezies im Stuhl durch kulturelle Anzucht.

53956-9

- **Salmonella typhi**

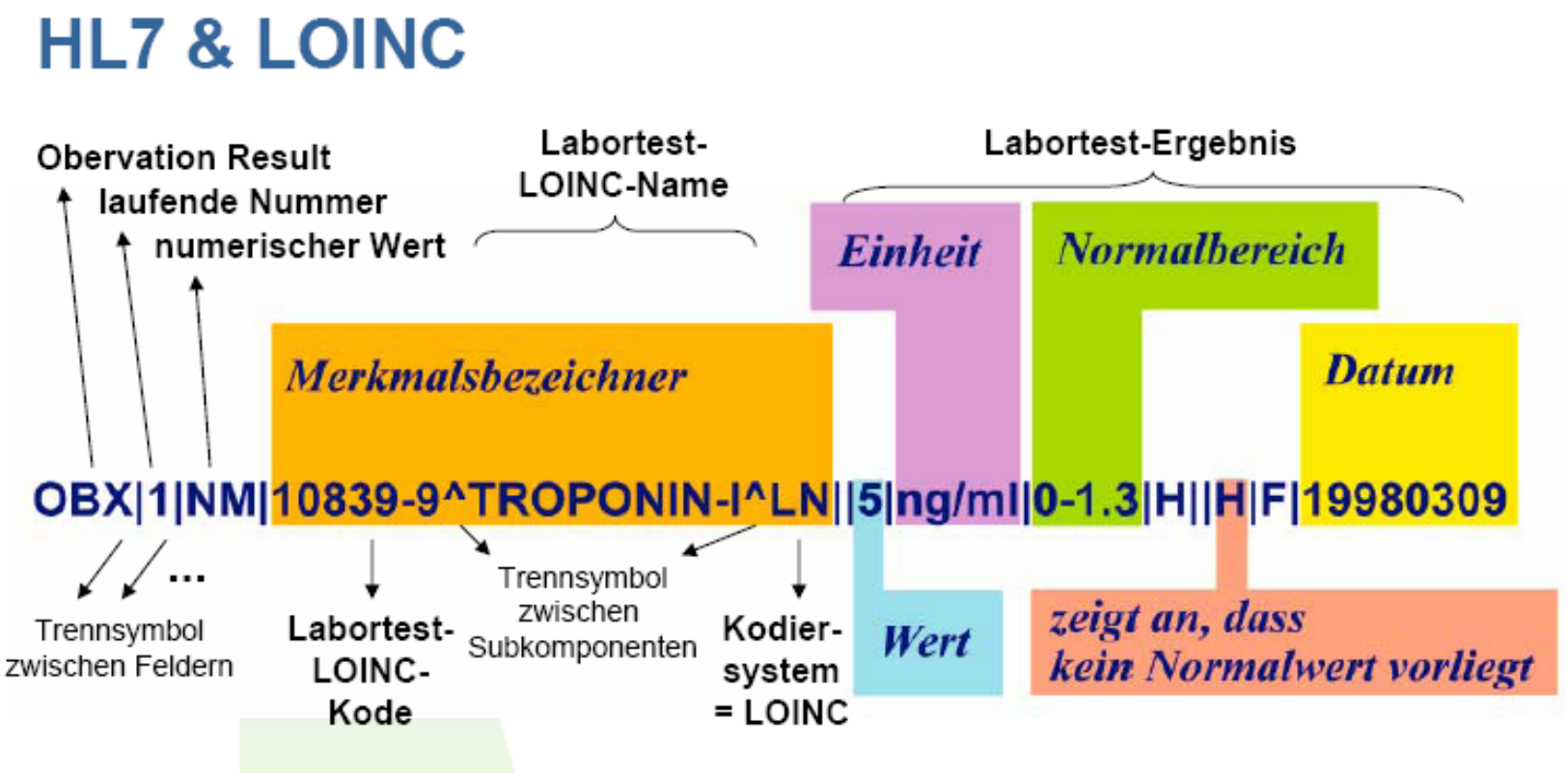
Nachweis des Bakteriums durch Agglutinationstest des aus der kulturellen Anzucht gewonnenen Isolats.

Was übermittelt LOINC nicht?

- Details zur Messung (Gerätetyp, Gerät)
- Details zur Probe
- Prozessbezogene Daten (Notfall, stationär, ambulant)
- Ortsangaben
- Zeiten und Datumsangaben
- Akteure
- Interpretation, Bewertung

…alles, was in HL7-Feldern übermittelt wird

LOINC in HL7 Version 2



LOINC in HL7 V2 Nachrichten

```
MSH|^~\&|HOSPITAL_A|SAMPLE_HOSPITAL_A|||$YearMonthDay|||||||||||||
PID|||$patientId$||$patientName$|||||||||||||||||||||
PV1|||||||$attendingDoctor$||$consultingDoctor$|||||||||
OBR|1|||012^CBC/Auto Diff^HSPA^57021-8^CBC W Auto Diff^LN||$reqDate|||||||||
OBX|2|NM|123^WBC^HSP_A^26464-8^Leukocytes [#/volume] in Blood^LN||10.8|K/MM3|||||F|
OBX|3|NM|234^RBC^HSP_A^26453-1^Erythrocytes [#/volume] in Blood^LN||4.82|MIL/MM3|||||F|
OBX|4|NM|345^HGB^HSP_A^718-7^Hemoglobin [Mass/volume] in Blood^LN||15.7|GM/DL|||||F|
OBX|5|NM|456^HCT^HSP_A^20570-8^Hematocrit [Volume Fraction] of Blood^LN||45|%|||||||F|
```

Stärke und Maßeinheit

http://www.netzausfall.de/wp-content/gewichte.jpg

- **100 mg / Tablette**
- **10 mg / ml**
- **100 IE / ml**
- **Mäuseeinheit**

- Units of measurement der ICH
- SI
- UCUM

UCUM - Unified Code for Units of Measure

- Ziel
  - Alle Einheiten, die derzeit genutzt werden, sollen abgebildet werden.
  - Zwischen Computersystemen eindeutig austauschbar und umrechenbar.

- Basiert auf ISO 2955-1983, ANSI X3.50-1986, HL7, ISO 11240.

- Probleme
    - “a” für “year” and “are”
    - “cd” für candela und centi-day
    - IE
    - Fehlende medizinische Einheiten z.B. mm[Hg]

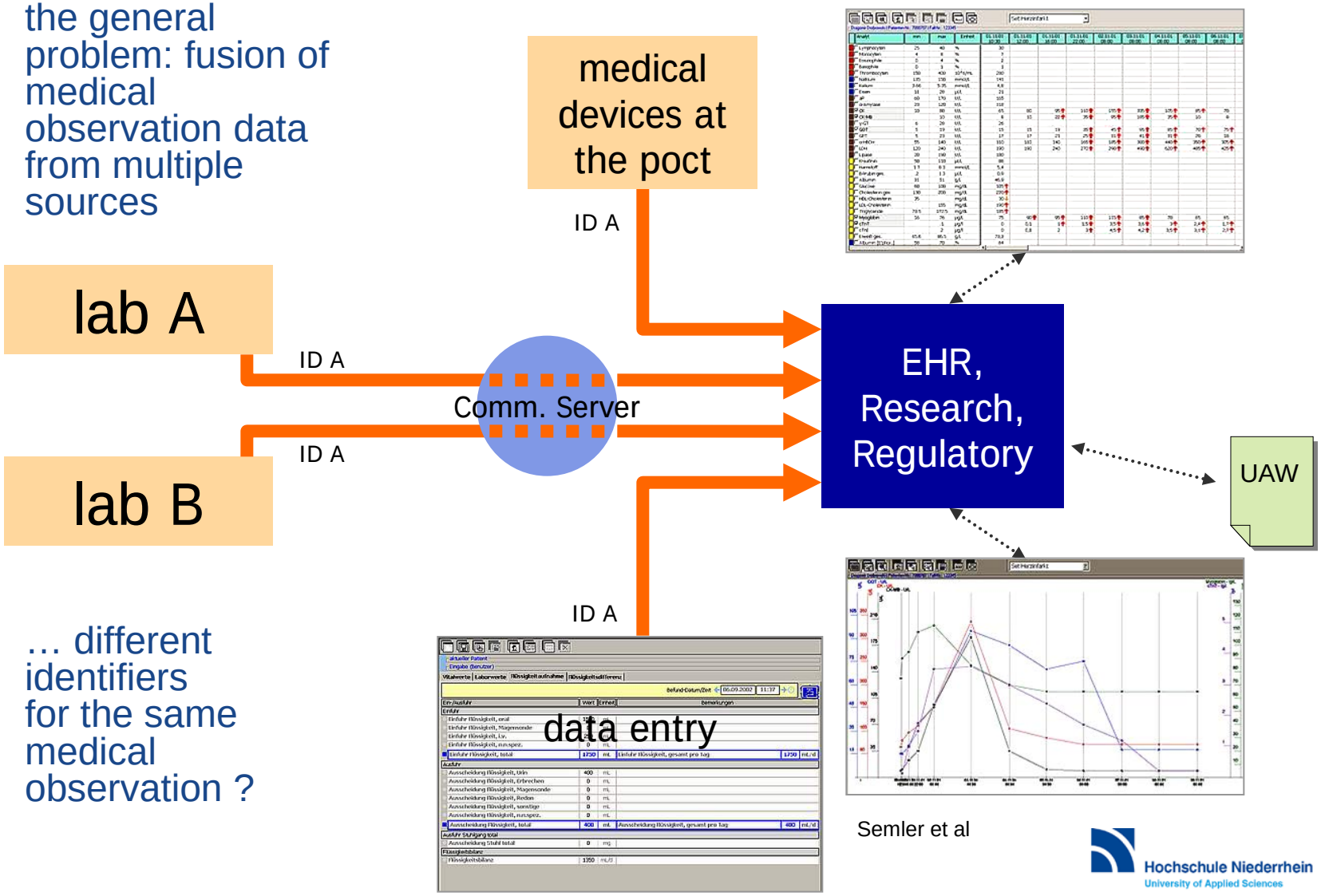
XML-Darstellung von LOINC

```
<component>
  <observation classCode="OBS" moodCode="EVN">
    <code code="4544-3" codeSystem="2.16.840.1.113883.6.1"
          codeSystemName="LOINC" displayName="HK Hämatokrit"/>
    <statusCode code="completed"/>
    <effectiveTime>
      <center value="200609241025"/>
    </effectiveTime>
    <value xsi:type="PQ" value="37.6" unit="%"/>
    <referenceRange>
      <observationRange>
        <value xsi:type="IVL_PQ">
          <low value="37" unit="%"/>
          <high value="40" unit="%"/>
        </value>
        <interpretationCode code="N"
           codeSystem="2.16.840.1.113883.5.83"/>
      </observationRange>
    </referenceRange>
  </observation>
</component>
```

Quelle: Addendum
zum VHitG-Arztbrief

Nutzen der Kodierung

- the general problem: fusion of medical observation data from multiple sources



- … different identifiers for the same medical observation ?

Semler et al

Vielen Dank für Ihre Aufmerksamkeit