

Laboratory Terminology for eHR

John Mok
Health Informatician
eHR Information Standards Office

Outline

- Some background of laboratory terminology standards
- Standardization of laboratory data in HA
- Planning of laboratory terminology for eHR

Laboratory Terminology Standards

- The Laboratory – Pioneering informatics Standards



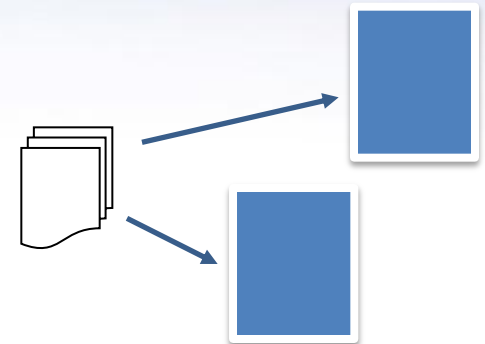
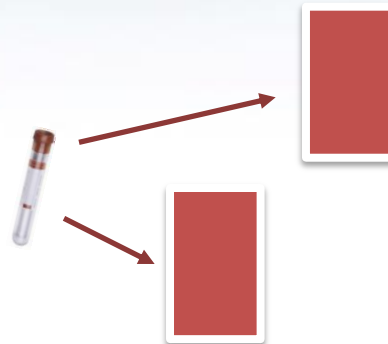
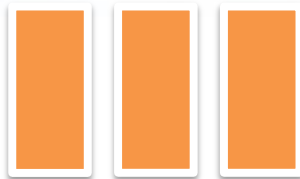
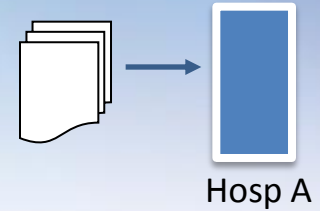
Evolving Laboratory Business

Lab test setup

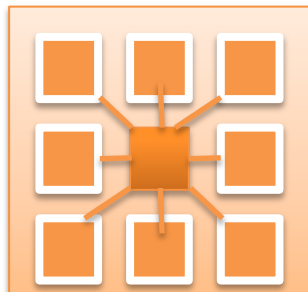
Specimen flow

Lab report

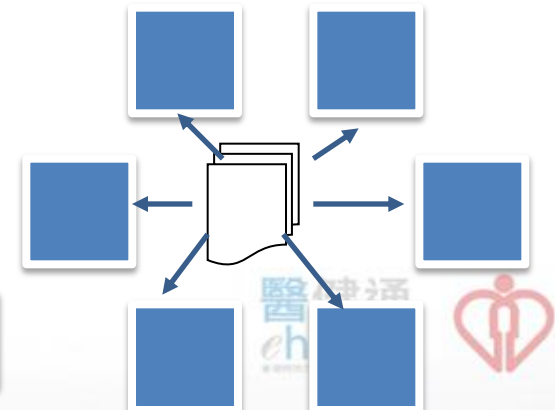
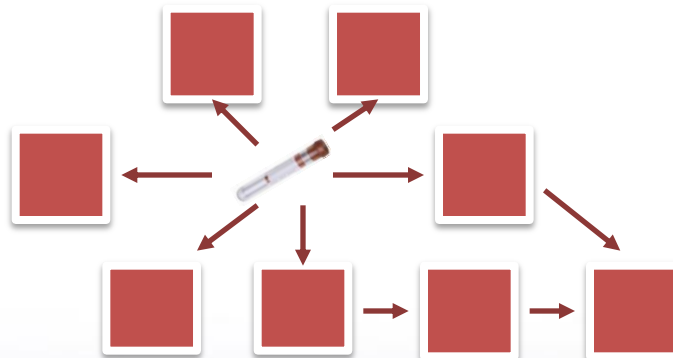
Past



Future

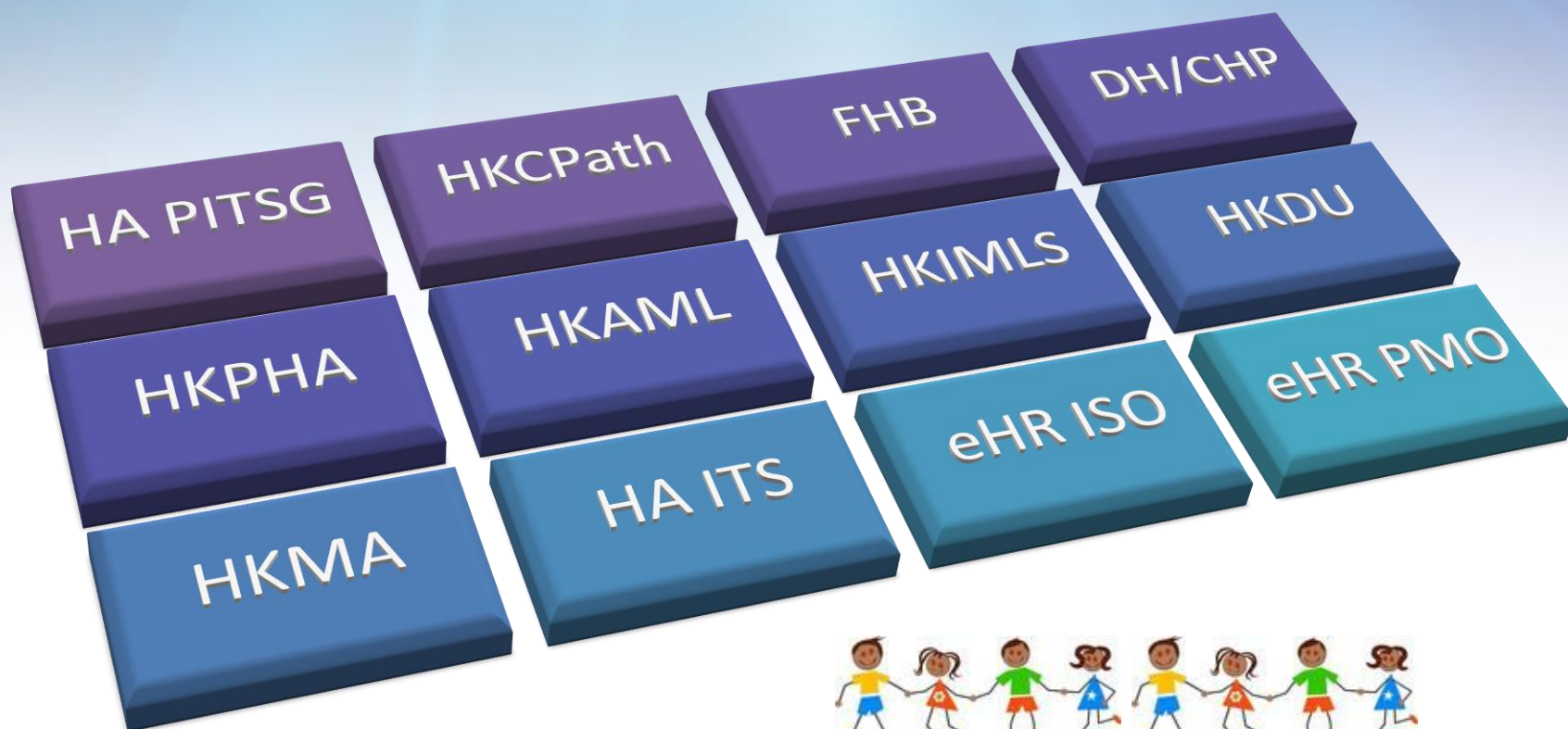


Knowledge base

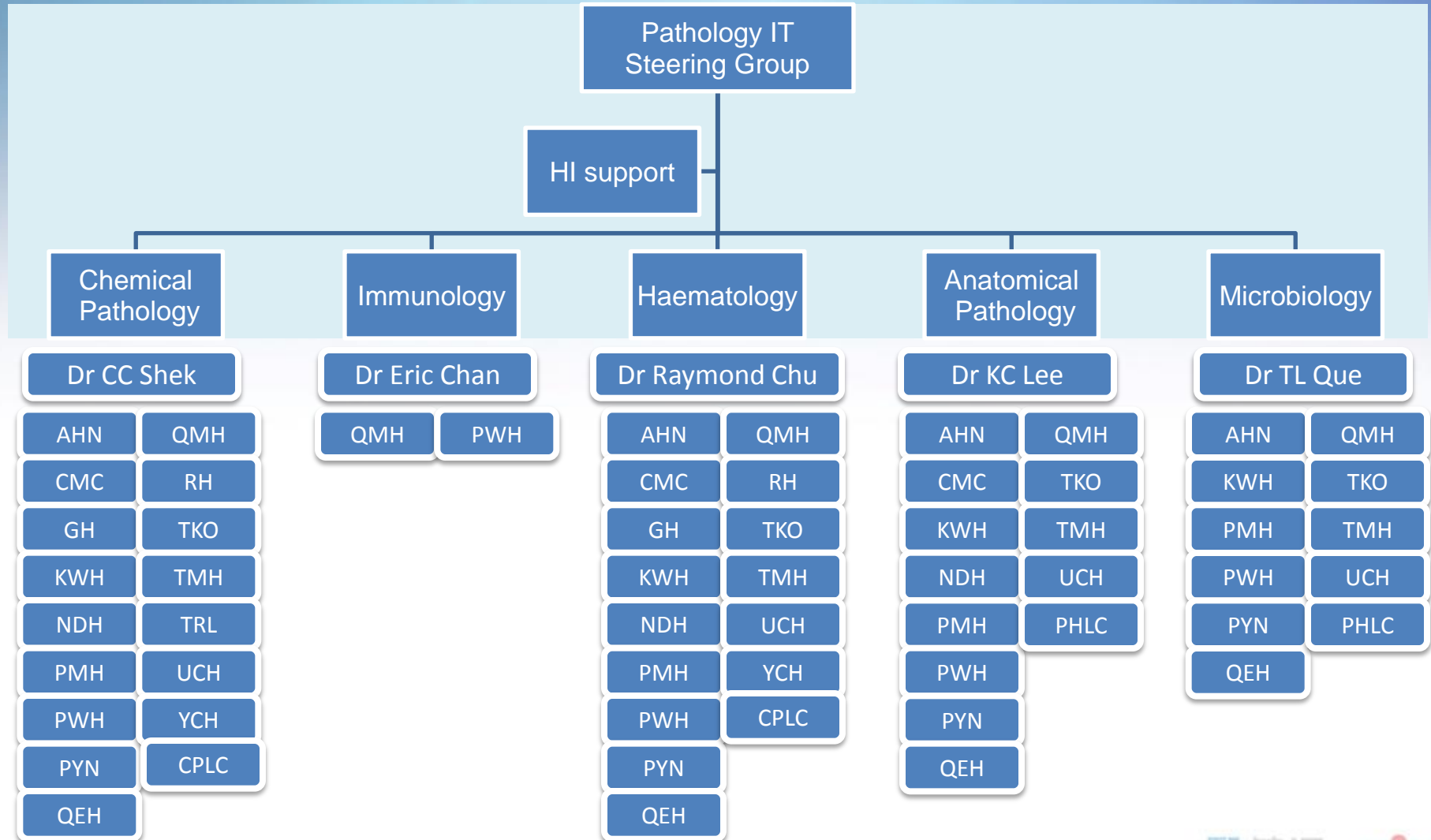


Where are we today?

eHR Information Standard Domain Group on Laboratory Records - Membership



Laboratory Informatics Standards Working Group in HA



Progress

- Laboratory data standardization/mapping progress

Type	Area	Terminology	Status
Micro-organisms	HA and DH	SNOMED CT	Completed initial mapping
Specimen type	HA and DH	SNOMED CT	Completed initial mapping
Antibiotics	HA and DH	LOINC	Completed initial mapping
Microbiology tests	HA and DH	LOINC	In progress
Biochemistry tests (common)	HA and DH	LOINC	Completed initial mapping
Haematology tests (common)	HA and DH	LOINC	Completed initial mapping
Immunology tests	HA and DH	LOINC	In progress
Anatomical Pathology (Diagnosis code)	HA and DH	SNOMED CT	In progress
Molecular/Esoteric tests	HA and DH	LOINC	Pending
Test request name	eHR	SNOMED CT	Pending

Challenges – Maintenance and Quality Assurance

Lab data Terminology Adoption



Like a Question –
Urine Culture?



SNOMED CT

Like an Answer –
Escherichia coli

Both LOINC and SNOMED CT being used



Implementation of National Standards (LOINC, SNOMED) for Electronic Reporting of Laboratory Results: BioSense Experience

Nikolay Lipskiy¹, DrPH, MS, MBA; Jerome I. Tokars¹, MD, MPH; Stephen Benoit¹, MD, MPH, Roseanne English¹ and Sundak Ganesan², MD

CDC, 1-National Center for Public Health Informatics, Division of Emergency Preparedness and Response; 2- National Center for Public Health Informatics, Division of Informatics Shared Services

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official positions of the Centers for Disease Control and Prevention

SAFER • HEALTHIER • PEOPLE™

Terminology - A brief introduction of LOINC

LOINC - Background

- Logical Observation Identifiers Names and Codes
- LOINC system was initiated in 1994 by the Regenstrief Institute, a non-profit medical research organization associated with Indiana University.
- Developed for data exchange of lab results among different institutions
- Free to use

Why LOINC

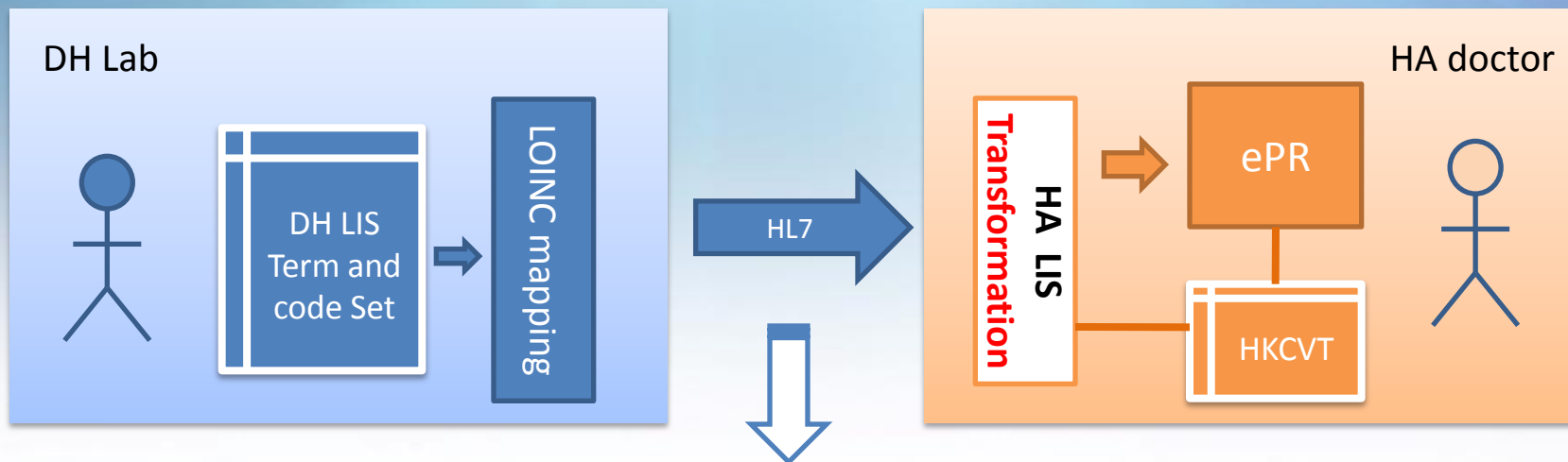
- To facilitate the **exchange** and pooling of results, for **clinical care, outcomes management, and research**.
- Most widely adopted reference terminology for Laboratory
- Over **44,000** laboratory terms

An example of a LOINC code

Six-axis	
<u>LOINC code</u>	<u>2951-2</u>
<ul style="list-style-type: none">• Component• Property• Timing• System• Scale• Method	<ul style="list-style-type: none">• Sodium• SCnc• Pt• Ser/Plas• Qn

Sodium [Moles/volume] in Serum or Plasma

Laboratory results interface between DH and HA



```

<OBX>
  <OBX.1>1</OBX.1>
  <OBX.2>CE</OBX.2>
  <OBX.3>
    <CE.1>Sodium</CE.1>
    <CE.4>2951-2</CE.4>
    <CE.6>LN</CE.6>
  </OBX.3>
  <OBX.5>
    <CE.1>140</CE.1>
  </OBX.5>
  <OBX.6>
    <CE.1>mmol/L</CE.6>
  </OBX.6>
  <OBX.7>(136 - 145)</OBX.7>
  <OBX.11>F</OBX.11>
</OBX>

```

Chemical Pathology Report

Test Name	Result	Reference Range
Sodium	140	136 - 145

Physiology Report

Test Name	Result	Reference Range
Sodium	140	136 - 145
Potassium	4.0	3.5 - 5.0
Creatinine	0.8	0.6 - 1.2

Laboratory data standards for eHR



References

Logical Observation Identifiers Names and Codes (LOINC®) Users' Guide

Edited by:
Clem McDonald, MD, Stan Huff, MD, Kathy Mercer, Jo Ama Hernandez,
Daniel J. Vreeman, PT, DPT

Please send questions and comments to:

LOINC
c/o Regenstrief Institute, Inc.
410 West 10th St. Suite 2000
Indianapolis, IN 46202

or via email:
loinc@regenstrief.org

This and other relevant documents and files are available at
<http://loinc.org>

List of Files:

Description	Format	File Name
LOINC table (database)	MDB	LOINCDB.MDB
LOINC table (database)	ASCII	LOINCDB.TXT
LOINC Users' Guide	PDF	LOINCManual.pdf
RELMA Program		Setup.exe
RELMA Users' Manual	PDF	RELMAManual.pdf

nehta

Pathology Terminology Approach Document

31/10/2008
Public

nehta

Clinical Terminology - Pathology

Detailed Release Information

Version 1.0 - 30/05/2007

INTERNATIONAL HEALTH TERMINOLOGY
STANDARDS DEVELOPMENT ORGANISATION



SNOMED Clinical Terms® User Guide July 2010 International Release (US English)

©2002-2010 International Health Terminology Standards Development Organisation
CVR #: 30363434

IHE International

Integrating the Healthcare Enterprise



Laboratory Technical Framework

Volume 4 (LAB TF-4) LOINC Test Codes Subset

Revision 2.1 - Final Test
August 8, 2008

Issues in Mapping LOINC Laboratory Tests to SNOMED CT

Olivier Bodnarider, MD, PhD
U.S. National Library of Medicine, NIH, Bethesda, MD
olivier@nlm.nih.gov

Abstract

Comprehensive clinical terminologies such as SNOMED CT and LOINC (e.g., for the domain of laboratory procedures). Terminological systems such as the IHEs are often used to bridge between terminologies. However, the integration of LOINC in the IHEs and with other terminologies remains incomplete. We mapped concepts for laboratory tests from LOINC to pre-coordinated SNOMED CT concepts, based on shared relations to other concepts. At LOINC is finer-grained than SNOMED CT, several LOINC codes tend to map to the same SNOMED CT concept. However, a large proportion of LOINC codes could not be mapped to SNOMED CT through this approach, because of underspecified definitions in SNOMED CT and a lack of fine-grained, pre-coordinated concepts in SNOMED CT.

Introduction

Biomedical terminologies and ontologies have proliferated in the past decade, not only for biology, but also for clinical medicine [1]. Terminologies such as SNOMED CT provide a large coverage of the domain of clinical medicine and often overlap with other large general terminologies (e.g., MeSH) and with specialized terminologies (e.g., LOINC).

In clinical information systems, terminologies such as SNOMED CT, used in patient records, need to be interoperable with terminologies used in subsystems, such as laboratory systems (e.g., LOINC). Terminology integration systems, such as the Unified Medical Language System (UMLS) play an important role in creating *a priori* link mappings between these terminologies and contribute to the interoperability of systems relying on these terminologies. A key element in identifying equivalent concepts across terminologies is the UMLS's *lexical* relationships among concepts names. As a consequence, concepts whose names are not amenable to natural language processing, such as the names of laboratory tests in LOINC, generally cannot be mapped to equivalent concepts in other terminologies. However, both SNOMED CT and LOINC provide formal definitions

for their concepts in the form of a rich set of relations to other concepts. Comparing such sets of relations also provides the basis for comparing these concepts, provided there are enough shared relations between the two terminologies.

The objective of this paper is to analyze the issues in mapping concepts for laboratory tests from LOINC to existing pre-coordinated SNOMED CT concepts, based on their definitions (i.e., their relations to other concepts) and to evaluate the properties of such mappings that can be derived automatically. Although SNOMED CT supports post-coordinates, this study is purposely limited to the mapping between pre-coordinated concepts in LOINC and SNOMED CT.

The development of these terminologies is often supported by public funding and harmonization between these terminologies has recently become a requirement from some funding agencies. Therefore, this study can also be considered a contribution to harmonizing SNOMED CT, the most comprehensive clinical terminology, with LOINC, the leading terminology for laboratory tests. While a few studies have explored the mappings of LOINC and SNOMED [2, 3], the two terminologies have not been harmonized yet.

Background

The general problem area of this study is ontology matching, i.e., the identification of equivalent (or related) concepts across ontologies. Among the approaches developed for aligning ontologies, the two major families of techniques exploit the lexical resemblance among concept names (lexical alignment) and the structural resemblance among sets of relations in which the concepts are involved (structural resemblance). A review of these methods is beyond the scope of this paper and the interested reader is referred to [4] for further information.

In the case of LOINC, as mentioned earlier, the names of laboratory tests are not amenable to natural language processing techniques, including edit distance, stemming and normalization, because LOINC strings are created by concatenating with colons the names of the concepts to which a laboratory test is

Structured report model - Microbiology

醫院管理局
Hospital Authority
東區醫院
Tung Chung Hospital
病理化驗部
Department of Pathology
微生物化驗報告 Microbiology Report

Case No.: SUR 07012345 (MSK: 223345)
Name: CHAN, TAI MAN
HKID: A123456 (3)
Sex: M Age: 10Y DOB: 01/07/1987
Hosp/Spec/Ward/Bed: TCM/SUR/AS/02
Doctor Request: Dr. Chan Wing
Dr. Ref.:
Final Report URGENT

Lab No.: 07020377791
Date Collected: 13/03/07
Date Arrived: 13/03/07
Clinical Details: ? Fever
Specimen: Sputum

Appearance: Purulent

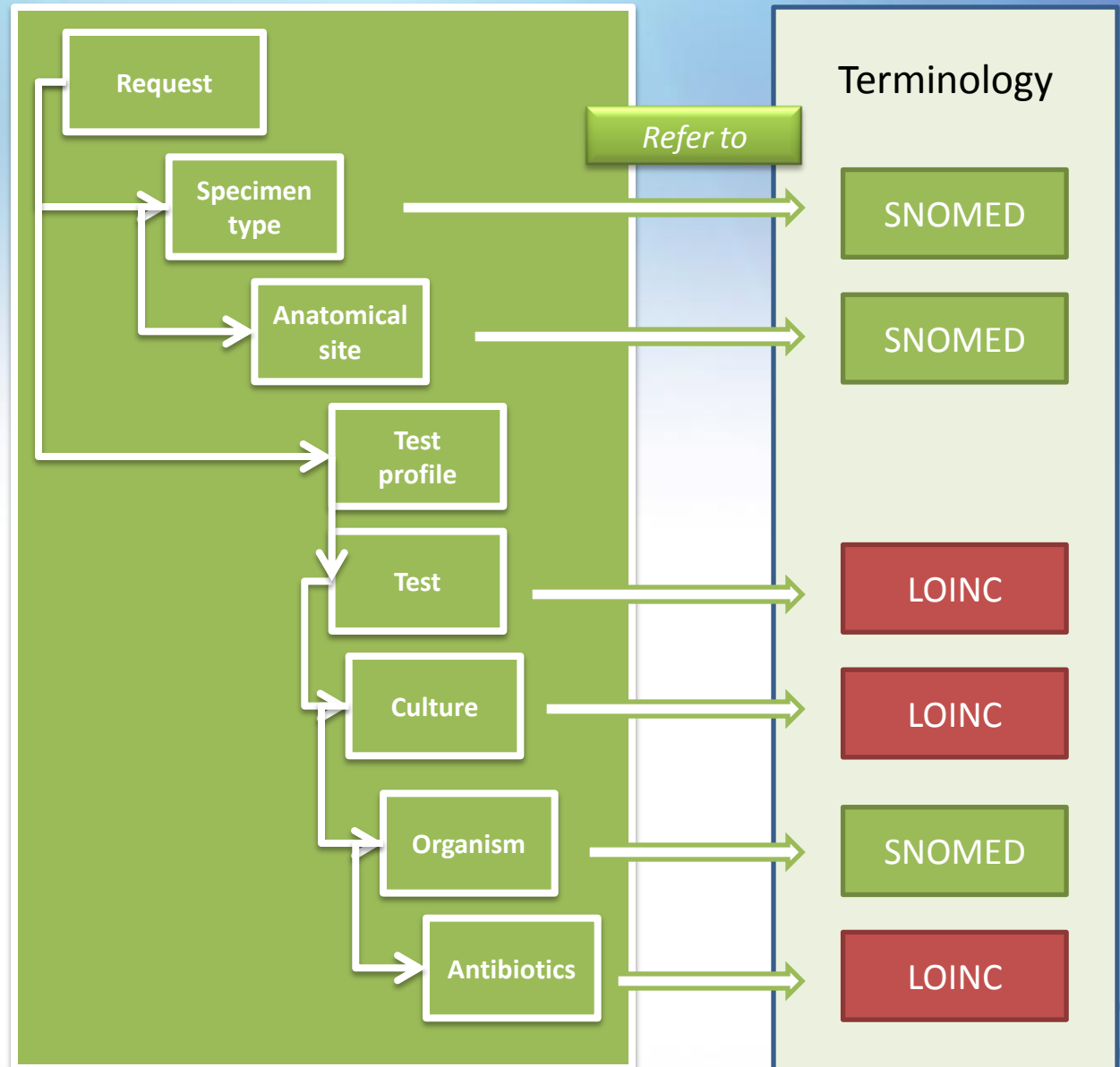
Gram stain :-
WBC: ++ (Moderate)
Epithelial cell: ++ (Moderate)

Culture :-
Organism 1 : Methicillin Resistant Staphylococcus aureus (Heavy)

ANTIBIOTICS	
AMPCICILLIN + CLAVULANIC ACID	S
CERAPALOTRIN	R
CLINDAMYCIN	S
CO-TRIMOXAZOLE	S
RHYTHOMYCIN	R
FUSIDIC ACID	S
GENTAMICIN	S
MINOCYCLINE	R
OSACILLIN	R
PENICILLIN G	R
RIFAMPICIN	S
VANCOMYCIN	S

S: Susceptible M: Intermediate R: Resistant ++: Positive --: Negative

Authorized By: LIS
Medical Microbiologist: Dr. LUK WUI KWANG
***** End of report *****
This is a final report. Please retain in patient record permanently.
This Laboratory is accredited by the College of American Pathologists
CAP Accreditation Number 17765-25
Report on: 13/03/2007 17:37 Printed on 13/03/2007 17:37
Report Destination: KWS/SUR/PL Page No.: 1/1



Structured report model - Clinical Pathology

C

醫院管理局
Hospital Authority
東涌醫院
Tung Chung Hospital
病理化驗部
Department of Pathology
生化病理報告 Chemical Pathology Report

Case No.: SUB 07012345 (MSH: 223345)
Name: CHAN, TAI MAN
陳太文
HKID: A123456 (3)
Sex: M Age: 197 DOB: 01/07/1987
Ward/Spec/Ward/Bed: TCH/SUR/As/02
Doctor Request: Dr. Chan Wing
Dr. Ref.:

Lab No.: 070377791 Final Report URGENT
Clinical Details: CIB

Collect Date: 12/03/07
Collect Time: 18:40
Arrive Date: 12/03/07
Arrive Time: 18:40
Request No.: C0377791
Urgency: --

	Reference	Units
Sodium	139	mmol/L
Potassium	3.0	L
Chloride	100	mmol/L
Urea	5.1	mmol/L
OCreatinine	68	umol/L
Total Protein	68	g/L
Albumin	37	g/L
Globulin	31	g/L
Bilirubin, total	11	umol/L
ALP	60	U/L
ALT	13	U/L
Calcium	2.27	mmol/L
Phosphate	1.39	mmol/L

H

醫院管理局
Hospital Authority
東涌醫院
Tung Chung Hospital
病理化驗部
Department of Pathology
血液化驗報告 Haematology Report

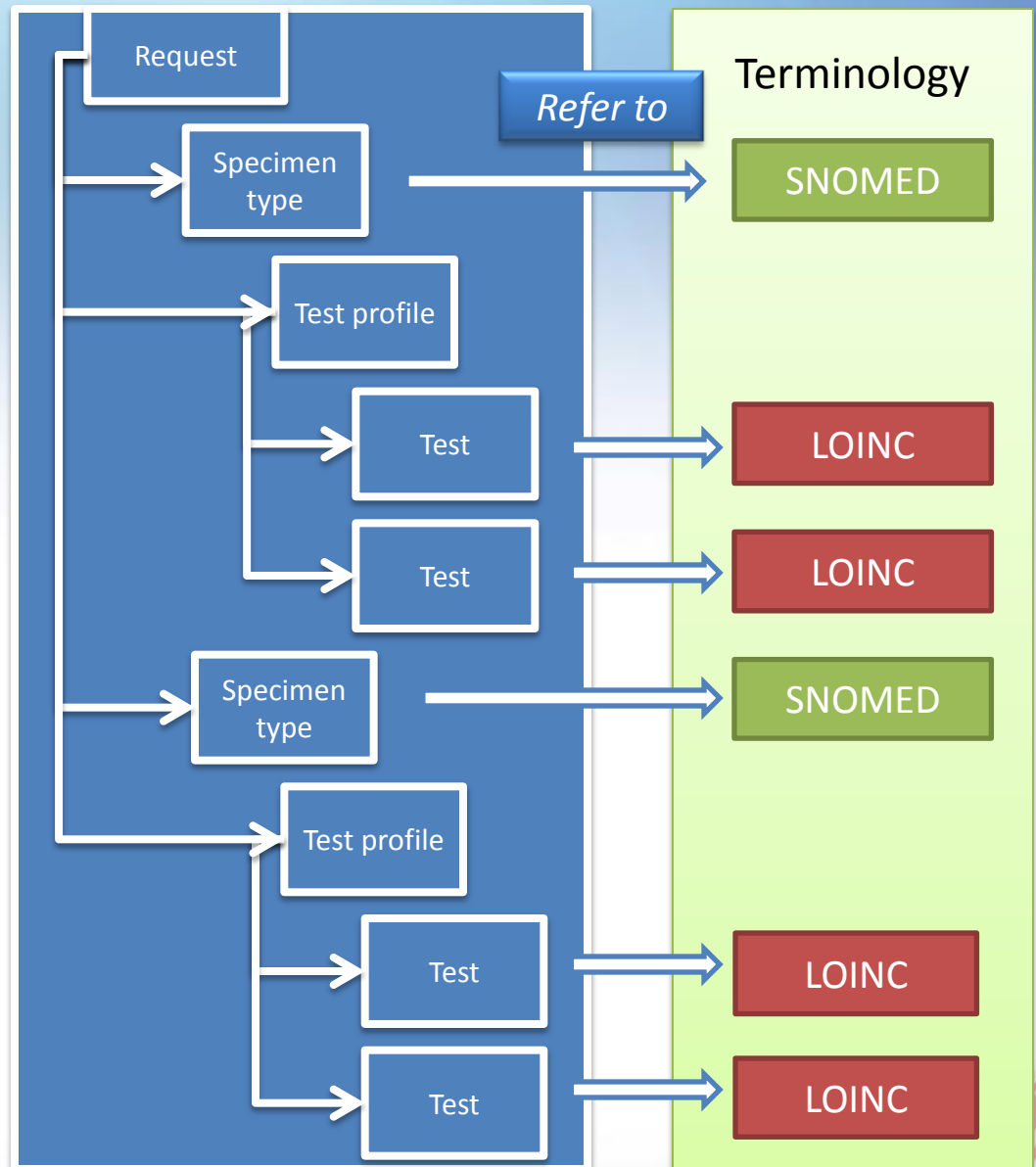
Case No.: SUB 07012345 (MSH: 223345)
Name: CHAN, TAI MAN
陳太文
HKID: A123456 (3)
Sex: M Age: 197 DOB: 01/07/1987
Ward/Spec/Ward/Bed: TCH/SUR/As/02
Doctor Request: Dr. Chan Wing
Dr. Ref.:

Lab No.: 07H0377791 Final Report URGENT
Clinical Details: CIB

Collect Date: 12/03/07
Collect Time: 17:07
Arrive Date: 12/03/07
Arrive Time: 17:07
Request No.: H0377791
Urgency: --

	Reference	Range	Units
Complete Blood Count			
WBC	7.5	4.0 - 11.0	10 ⁹ /L
RBC	2.96	4.50 - 5.90	10 ¹² /L
HGB	10.5	13.5 - 17.5	g/dL
HCT	0.283	0.41 - 0.53	L/L
MCV	95.5	80.0 - 100.0	fL
MCH	34.1	26.0 - 34.0	pg
MCHC	35.6	31.0 - 37.0	g/dL
RDW	17.9	11.5 - 14.5	%
PLT	280	150 - 450	10 ⁹ /L
MPV	10.0	7 - 10	fL
Plate Review	N		

Authorized by: LIS Team Member
***** End of report *****
*This is a final report. Please retain in patient record permanently.
This Laboratory is accredited by the College of American Pathologists
CAP Accreditation Number 71758-25
Report on: 12/03/2007 17:09
Report Destination: KMB/SUR/PL
Printed on 12/03/2007 17:10
Cum Page No.: 1 Page No.: 1/1



Structured report model - Anatomical Pathology

醫院管理局
Hospital Authority
東海醫院
Tung Chung Hospital
Department of Pathology
外科病理報告 Surgical Pathology Report

Case No.: SUR 07012345 (MSN: 223345)
Name: CHAN, TAI MAN
HKID: A123456(3)
Sex: M Age: 20Y DOB: 01/07/1987
Hosp/Spc/Ward/Bed: TCH/SUR/AS/02
Doctor Request: Dr. Chan Wing
Dr. Ref.:
S

Lab No.: 07S0377791 Final Report URGENT
Data Collected: 13/03/07
Date Arrived: 13/03/07
Specimen: Endometrium

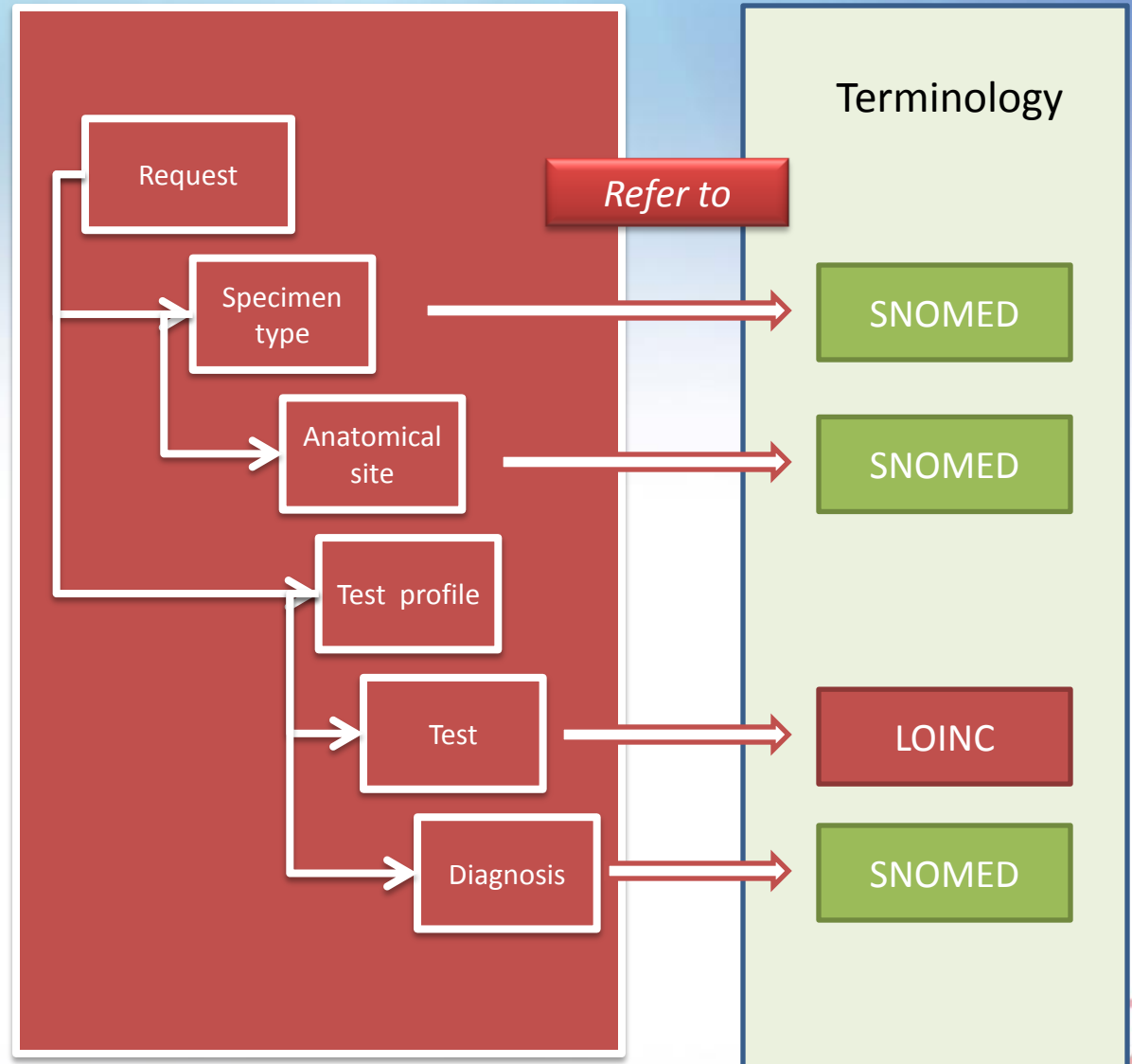
Clinical History
Irregular menses

Gross Examination
2 ml brownish soft tissue fragments. All embedded in 1 block.

Microscopic Examination
Section show secretory endometrial glands with supranuclear vacuoles and glandular dilatation in an edematous stroma. This is no endometritis, hyperplasia or malignancy.

Diagnosis
Endometrium, sampling - Secretory endometrium, PCD 7 - 8

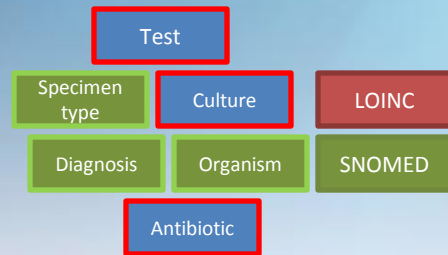
Reported by: LIS Testing
Authorized by: LIS Testing
***** End of report *****
*This is a final report. Please retain in patient record permanently.
This Laboratory is accredited by the College of American Pathologists
CAP Accreditation Number 71755-25
Report on: 13/03/2007 18:12
Report Destination: KHM/SUR/PL
Printed on 13/03/2007 18:12
Page No.: 1/1



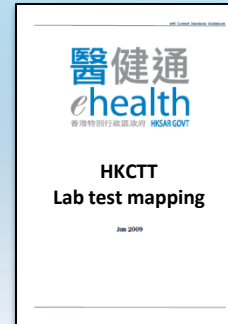
Recap - Terminology to be used

- Chemical Path / Haematology / Immunology
Tests -> LOINC
- Microbiology / Virology
Tests -> LOINC
Organisms -> SNOMED CT
Antibiotics -> LOINC
Specimen type -> SNOMED CT
- Anatomical Pathology
Tests -> LOINC
Diagnosis -> SNOMED CT

Laboratory Standards Roadmap



Lab Data



Test Mapping List



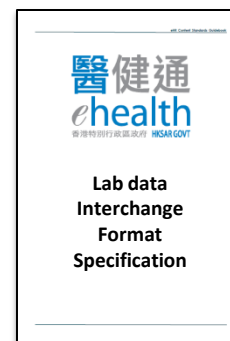
Editorial policy



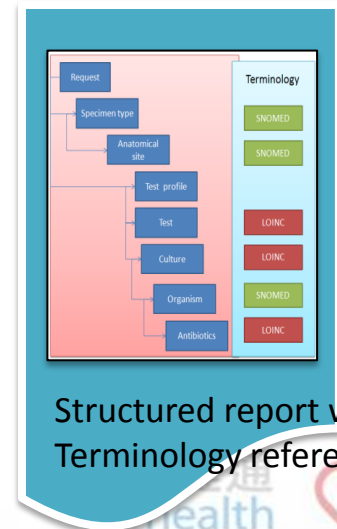
eHR



HL7 message



Interchange
Format
Specification



Structured report with
Terminology reference

Thank You

