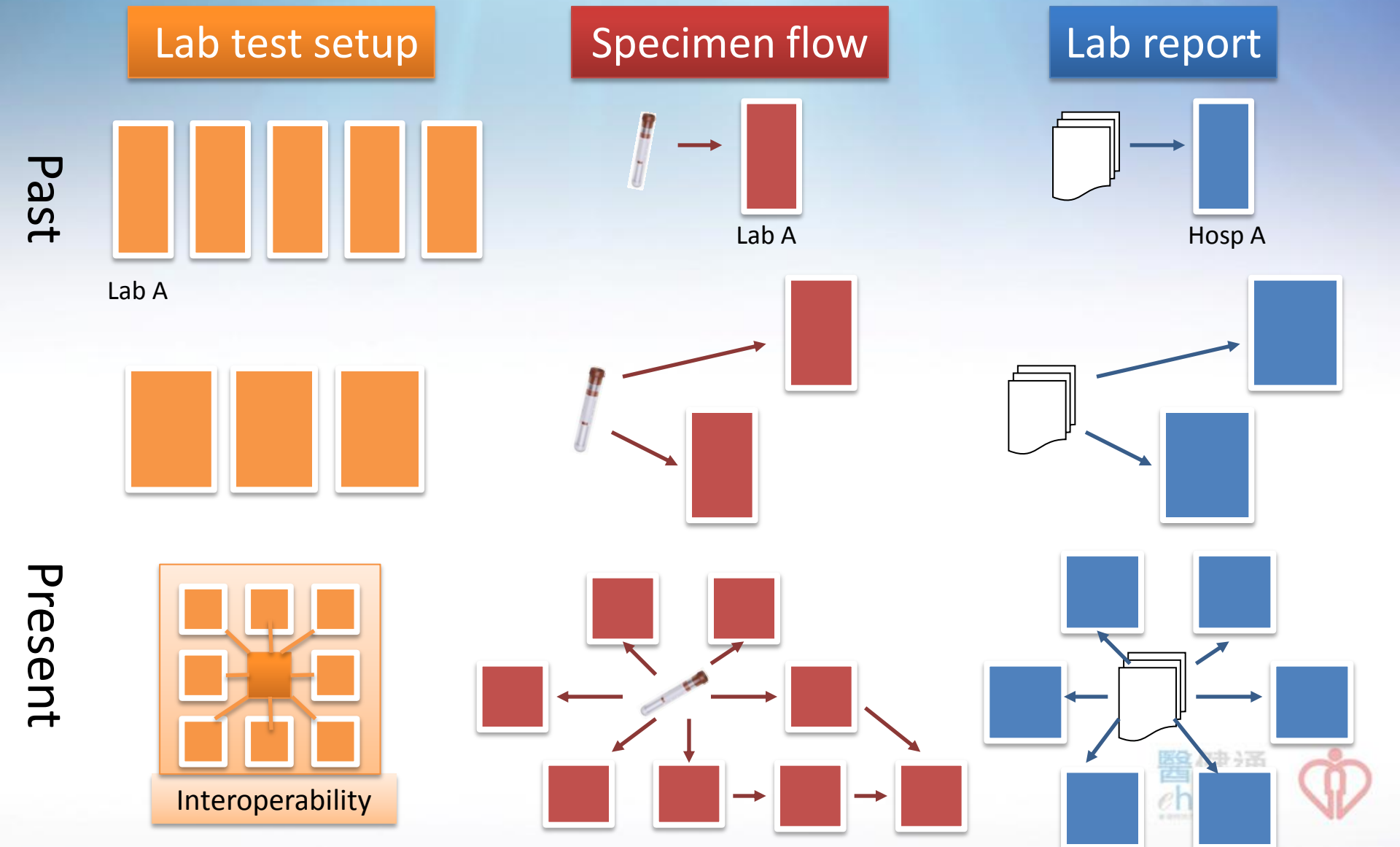
Preparation of Laboratory Record for eHR

John MOK
Health Informatician
eHR Information Standards Office

Outline

- Understand the importance of using reference terminology for laboratory record in eHR
- Support interoperable results exchange via report structure model with reference terminology
- Adopt guidelines to define test display name for eHR
- Suggest the levels of compliance for General laboratory report in eHR

Evolving Laboratory Business



Hospital Authority Statistical Report
醫院管理局統計報告 2009 - 2010

Hospital Authority Workload 醫院管理局服務數量統計

In-patient Discharges and Deaths 2009 二零零九年住院病人出院人次及死亡人數	Out-patient Attendances 2009/10 二零零九/一零年度門診就診人次	Total Accident and Emergency Attendances 2009/10 二零零九/一零年度急症室就診人次
1,341,885	Specialist out-patient 專科門診- 6,198,016 General out-patient 普通科門診 - 4,638,482	2,214,422

醫院管理局
HOSPITAL AUTHORITY

Sources from the **HA Statistical Report 2009-2010**

Pathology Tests Performed in Hospital Authority

Hospital 醫院	Pathology workload units 病理學工作量單位
Major Hospital **主要醫院**	
Alice Ho Miu Ling Nethersole Hospital 雅麗氏何妙齡那打素醫院	6,843,489
Caritas Medical Centre 明愛醫院	4,343,587
Kwong Wah Hospital 廣華醫院	13,412,849
North District Hospital 北區醫院	4,731,280
Pamela Youde Nethersole Eastern Hospital 東區尤德夫人那打素醫院	12,961,209
Pok Oi Hospital 博愛醫院	1,340,277
Prince of Wales Hospital 威爾斯親王醫院	33,977,251
Princess Margaret Hospital 瑪嘉烈醫院	19,658,630
Queen Elizabeth Hospital 伊利沙伯醫院	28,375,284
Queen Mary Hospital 瑪麗醫院	29,222,421
Ruttonjee and Tang Shiu Kin Hospitals 律敦治及鄧肇堅醫院	2,512,669
Tseung Kwan O Hospital 將軍澳醫院	4,366,155
Tuen Mun Hospital 屯門醫院	24,329,702
United Christian Hospital 基督教聯合醫院	13,296,532
Yan Chai Hospital 仁濟醫院	2,958,720
Major Hospitals Sub-total **主要醫院小計**	**202,330,055**

Over 200 million of laboratory tests performed in 2009/10

Sources from the **HA Statistical Report 2009-2010**

Sample of Priority Health Conditions and Related Laboratory Tests

Health condition	Examples of laboratory tests used in diagnosis and/or patient management	Number of Americans Affected
Heart disease	Lipid panel, troponin	79.4 million (2004)[a]
Respiratory disease[I]	Blood gas test, bacterial culture, viral culture	15.7 million[II] (asthma); 1.3 million[III] (pneumonia)[c,d]
Cervical cancer	Pap smear, human papillomavirus DNA testing	11,150 cervical cancer diagnoses (2007)[e]
Colorectal cancer	Fecal-occult blood test	112,340 colon cancer diagnoses (2007)[e]
Diabetes	Glucose, HbA1c	20.8 million (2005)[g]
End-stage renal disease	Creatinine, BUN	472,000 (2004)[h]
HIV/AIDS	Antibody testing, CD4 testing, RNA	1.2 million (2006)[i]
Maternal health (prenatal care)	Blood and Rh type with antibody screen	83.9% pregnant women began prenatal care in first trimester; 3.6% began prenatal care in third trimester or not at all (2004)[j]
Mental health/ substance abuse	Drug tests, liver function	24.6 million adults[IV] (classified with serious psychological distress) (2005); 22.2 million people[V] (classified with substance dependence or abuse) (2005)[l]
Influenza	Viral culture, serology, rapid antigen testing	5-20% of the U.S. population is infected with the influenza virus each year[n]
Health care-associated infections	Viral culture, molecular typing of microbial pathogens	1.7 million (2006)[p]

Laboratory Medicine: A National Status Report. The Lewin Group- Under subcontract to Battelle Memorial Institute. 2008

Morbidity and Mortality Statistics for Selected Diseases 2005 - 2009

Disease 疾病類別	Detailed list number ICD 10th revision 《疾病和有關健康問題的國際統計分類》第十次修訂本的詳細序號	Number of patient discharges and deaths in Hospital Authority hospitals 在醫院管理局轄下醫院出院人次及死亡人數				
		2005	2006	2007	2008	2009
1. Cancer 癌症	C00-C97	82,465	85,421	95,042	101,982	128,978
2. Cerebrovascular Disease 腦血管病	I60-I69	24,742	24,910	25,053	25,190	25,614
3. Ischaemic Heart Disease 缺血性心臟病	I20-I25	24,666	25,220	25,640	26,331	29,263
4. End Stage Renal Failure 末期腎衰竭	N18	79,531	76,945	82,658	88,293	103,615
5. Chronic Lung Disease 慢性肺病	J40-J47, J67	41,083	36,638	40,184	41,028	37,401
6. Diabetes Mellitus 糖尿病	E10-E14	14,029	13,652	15,379	18,495	24,502
	Total 合計	**266,516**	**262,786**	**283,956**	**301,319**	**349,373**

Sources from the **HA Statistical Report 2009-2010**

醫健通

ehealth

香港特別行政區政府 HKSAR G

eHR Content Standards Guid

(V 1.0)

Coordinating Group on eHR Content & Informati

Jun 2009

Table 3 : eHR Implementation Phases

	Level 1	Level 2	Level 3
Person			
Healthcare practitioner			
Encounters			
Referral			
Episode summary			
Adverse reactions / allergies			
Problems			
Procedures			
Assessment / physical examination			
Social history			
Past medical history			
Family history			
Medication			
Immunization			
Clinical requests			
Diagnostic test results			
Care & treatment plan			

Key :

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5

Where are we today?

eHR Information Standards Domain Group on Laboratory Records - Membership

We had three meeting taken place in 2011. The use of reference terminologies, eHR lab report contents and editorial guidelines for test display name were being discussed.

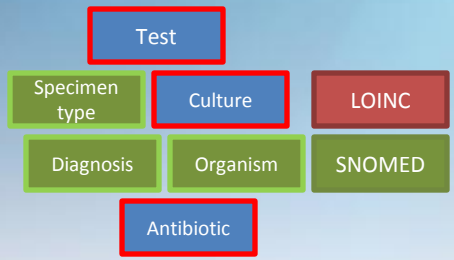
Laboratory data Terminology Adoption

Like a Question –
Urine Culture?

SNOMED CT

Like an Answer –
Escherichia coli

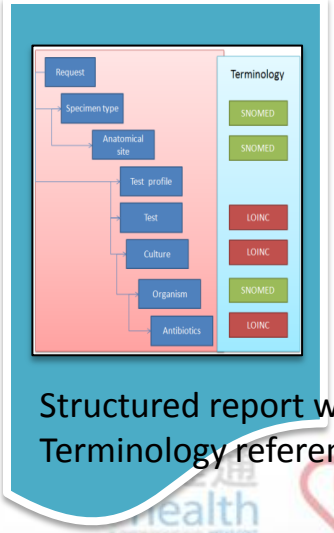
Laboratory Standards Roadmap



Lab Data

Test Mapping List

Editorial policy



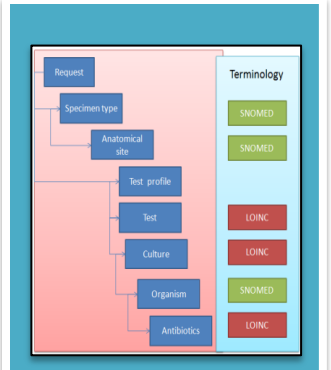
Structured report with Terminology reference

Interchange Format Specification

HL7 message

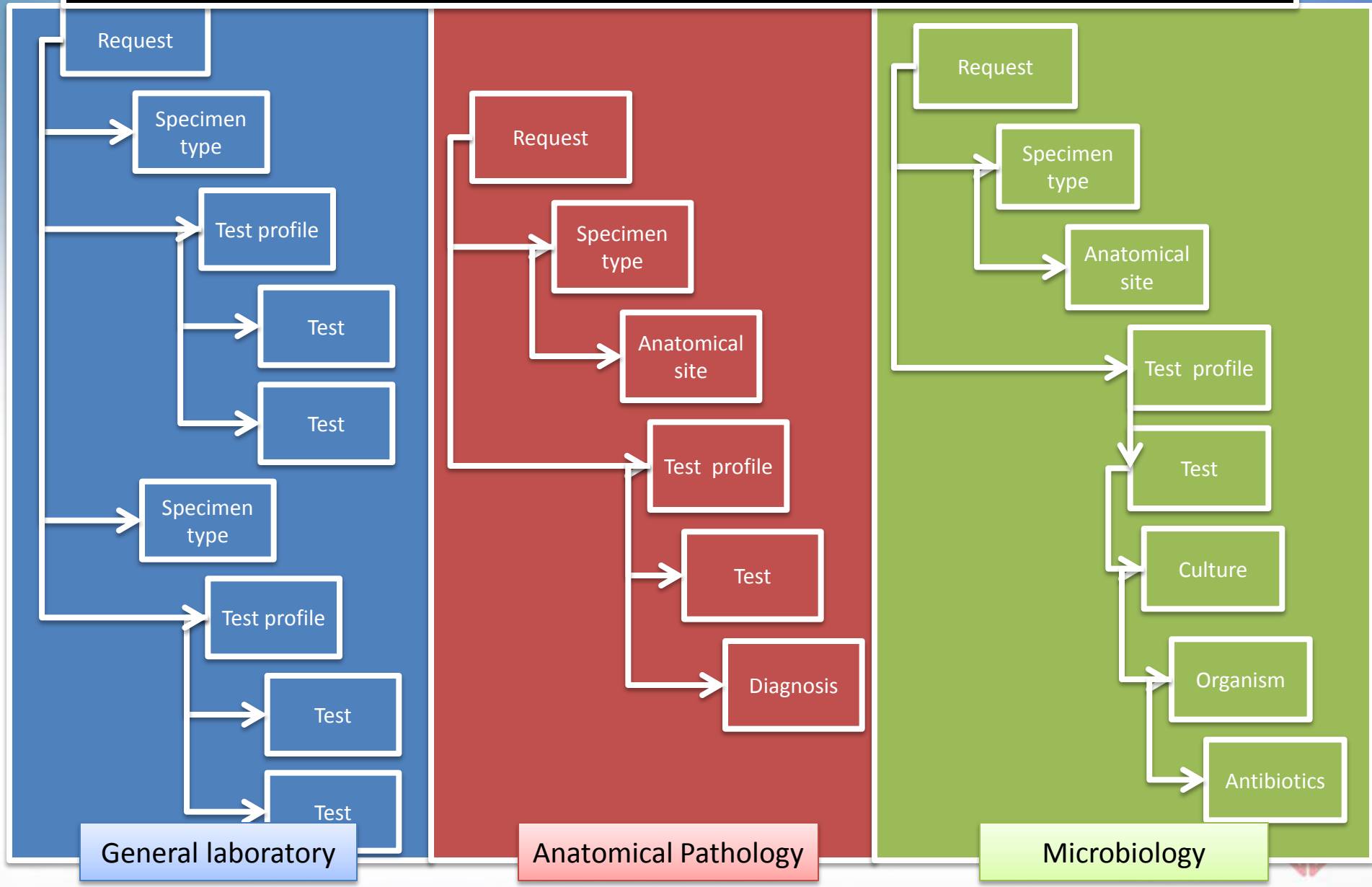
eHR

Laboratory Report Structure Model with Reference Terminology

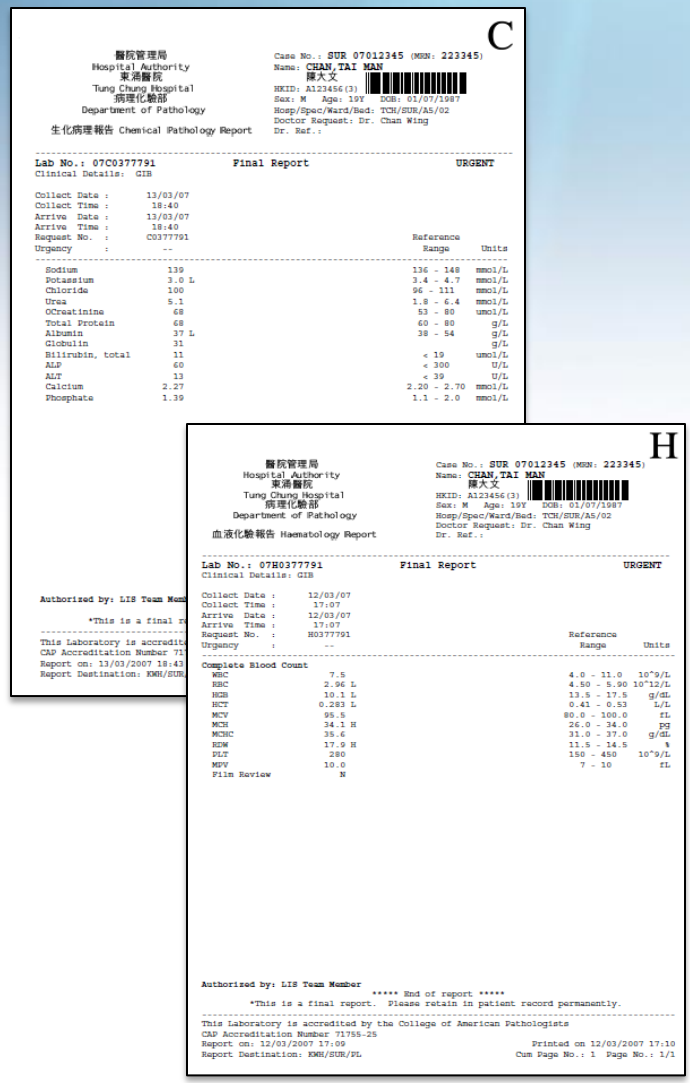


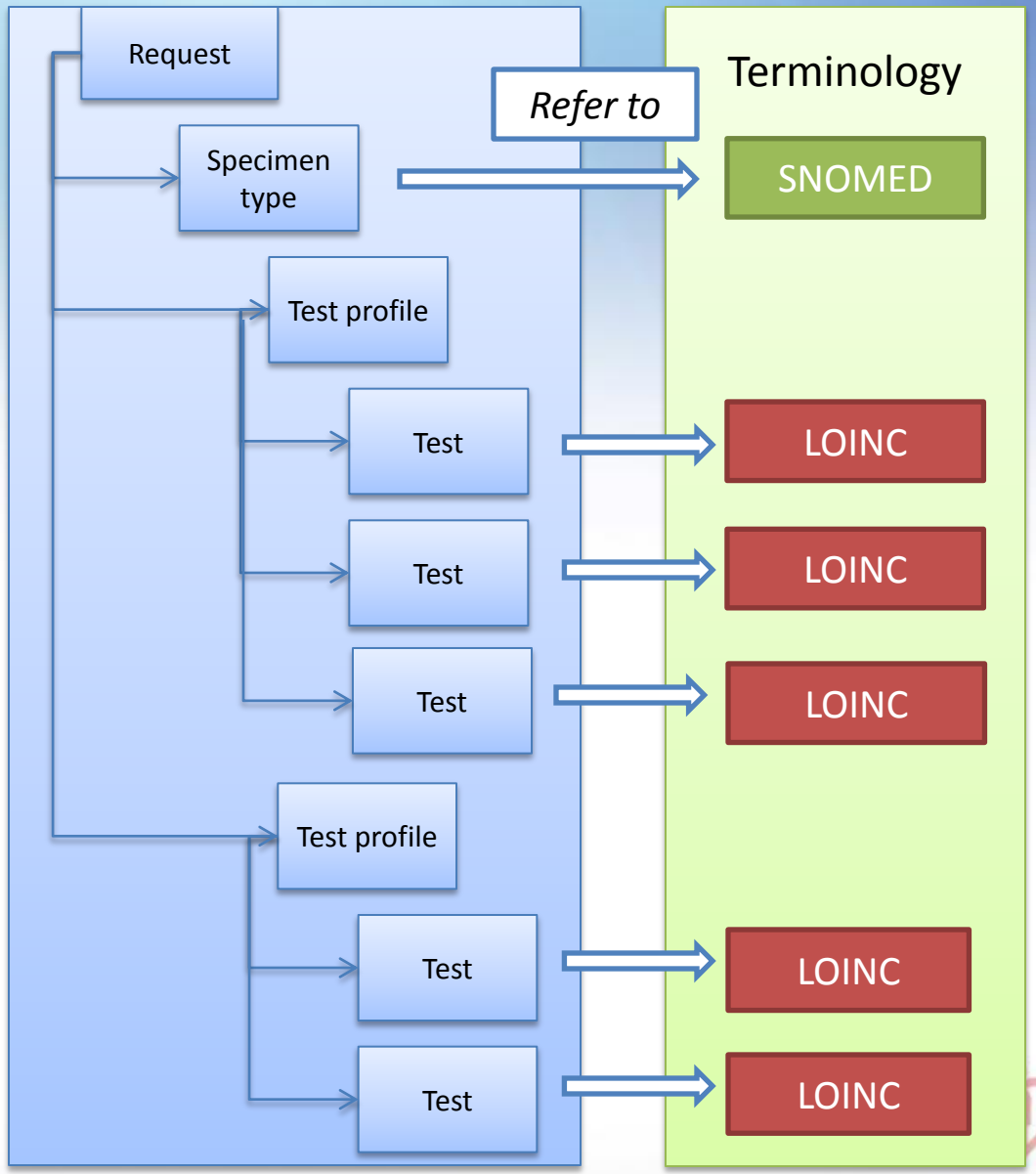
Structured report with Terminology reference

Laboratory Report Structure Model

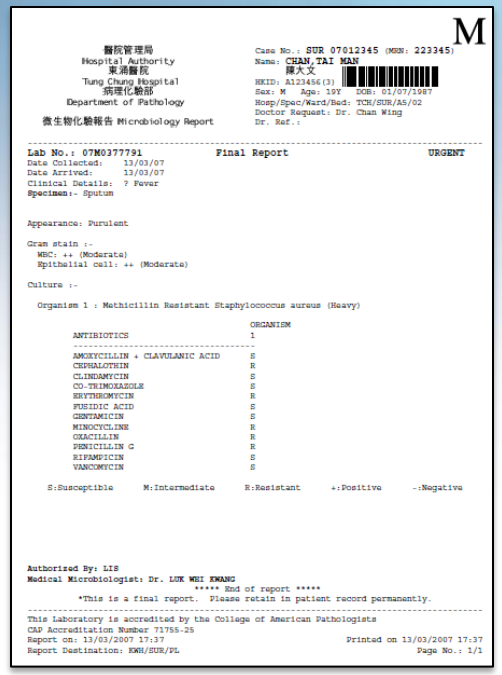


Structured report model - Clinical Pathology





Structured report model - Microbiology



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

Case No.: SUR 07012345 (MRN: 223345)
Name: CHAN,TAI MAN
陳大文
HKID: A123456(3)
Sex: M Age: 19Y DOB: 01/07/1987
Hosp/Spec/Ward/Bed: TCH/SUR/A5/02
Doctor Request: Dr. Chan Wing
Dr. Ref.:

Lab No.: 07M0377791 Final Report URGENT
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	ORGANISM 1
AMOXYCILLIN + CLAVULANIC ACID	S
CEPHALOTHIN	R
CLINDAMYCIN	S
CO-TRIMOXAZOLE	S
ERYTHROMYCIN	R
FUSIDIC ACID	S
GENTAMICIN	S
MINOCYCLINE	R
OXACILLIN	R
PENICILLIN G	R
RIFAMPICIN	S
VANCOMYCIN	S

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

Authorized By: LIS
Medical Microbiologist: Dr. LUK WAI KWANG
***** End of report *****
*This is a final report. Please retain in patient record permanently.

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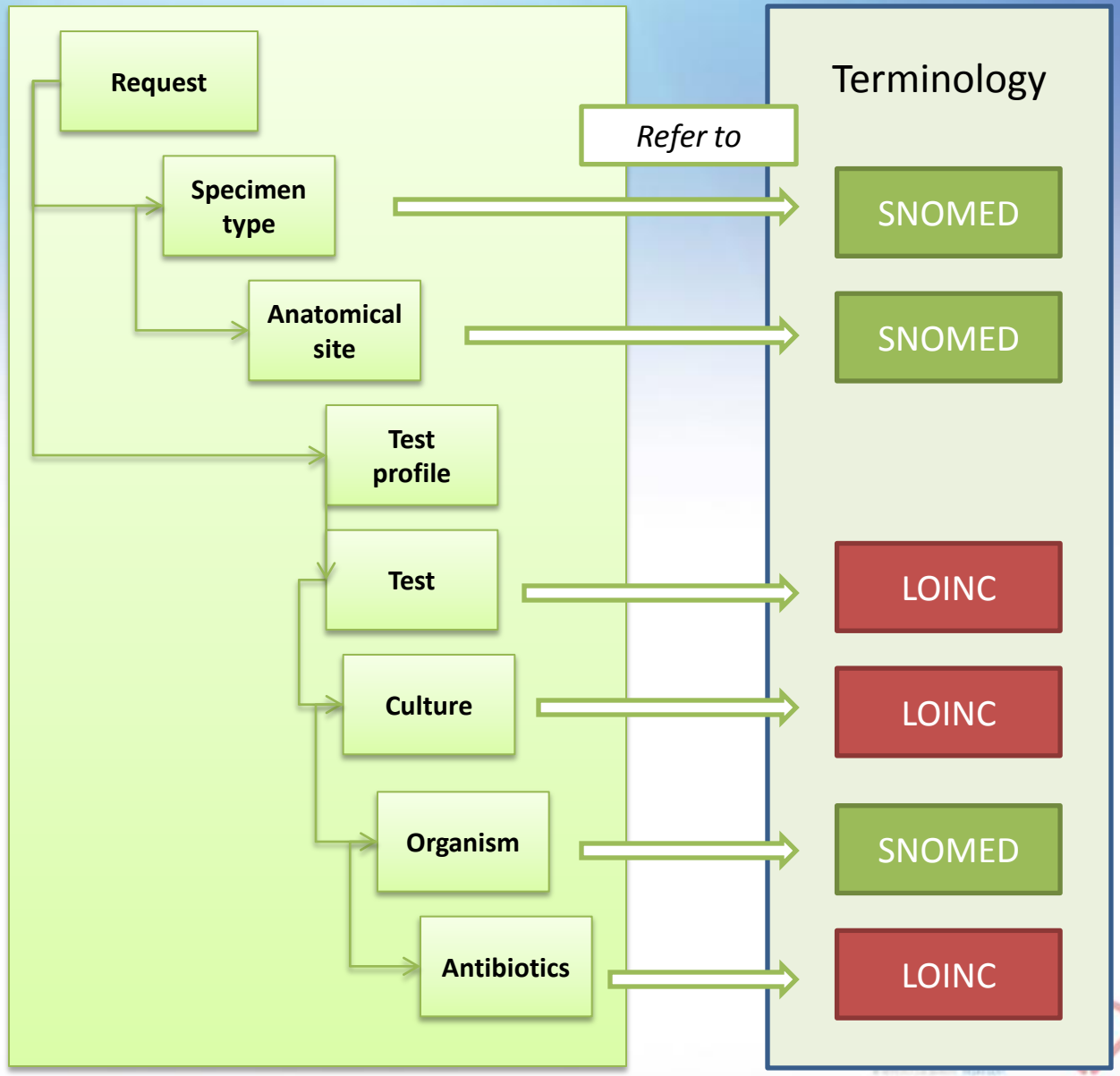
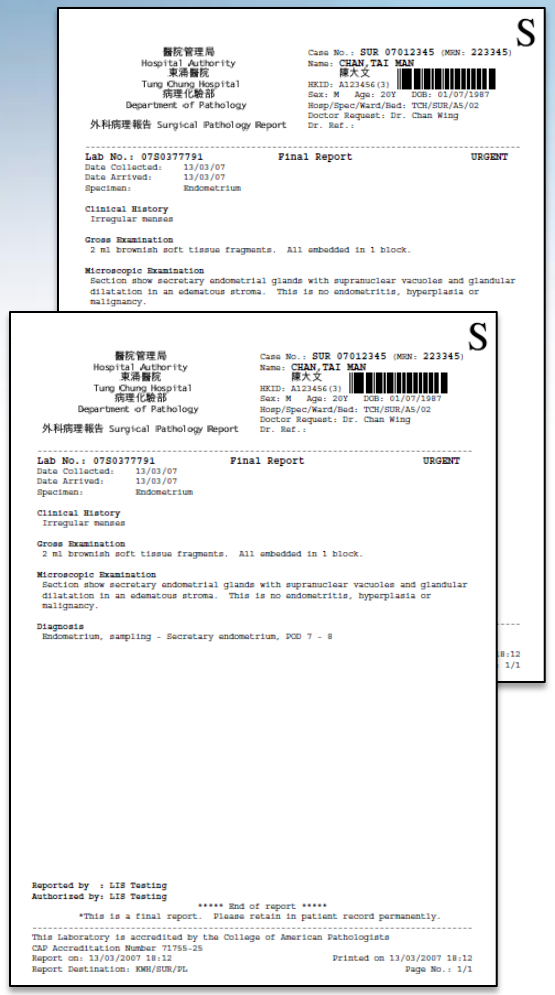
CAP Accreditation Number 71755-25
Report on: 13/03/2007 17:37 Printed on 13/03/2007 17:37
Report Destination: KWH/SUR/PL Page No.: 1/1



Structured report model - Anatomical Pathology


醫院管理局
Hospital Authority
東涌醫院
Tung Chung Hospital
病理化驗部
Department of Pathology
外科病理報告 Surgical Pathology Report

Case No.: SUR 07012345 (MRN: 223345)
Name: CHAN,TAI MAN 陳大文
HKID: A123456(3)
Sex: M Age: 20Y DOB: 01/07/1987
Hosp/Spec/Ward/Bed: TCH/SUR/A5/02
Doctor Request: Dr. Chan Wing
Dr. Ref.:

Lab No.: 07S0377791 Final Report URGENT
Date 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 secretary endometrial glands with supranuclear vacuoles and glandular dilatation in an edematous stroma. This is no endometritis, hyperplasia or malignancy.

Diagnosis
Endometrium, sampling - Secretary endometrium, POD 7 - 8

Reported by : LIS Testing
Authorised by: LIS Testing
***** End of report *****
*This is a final report. Please retain in patient record permanently.

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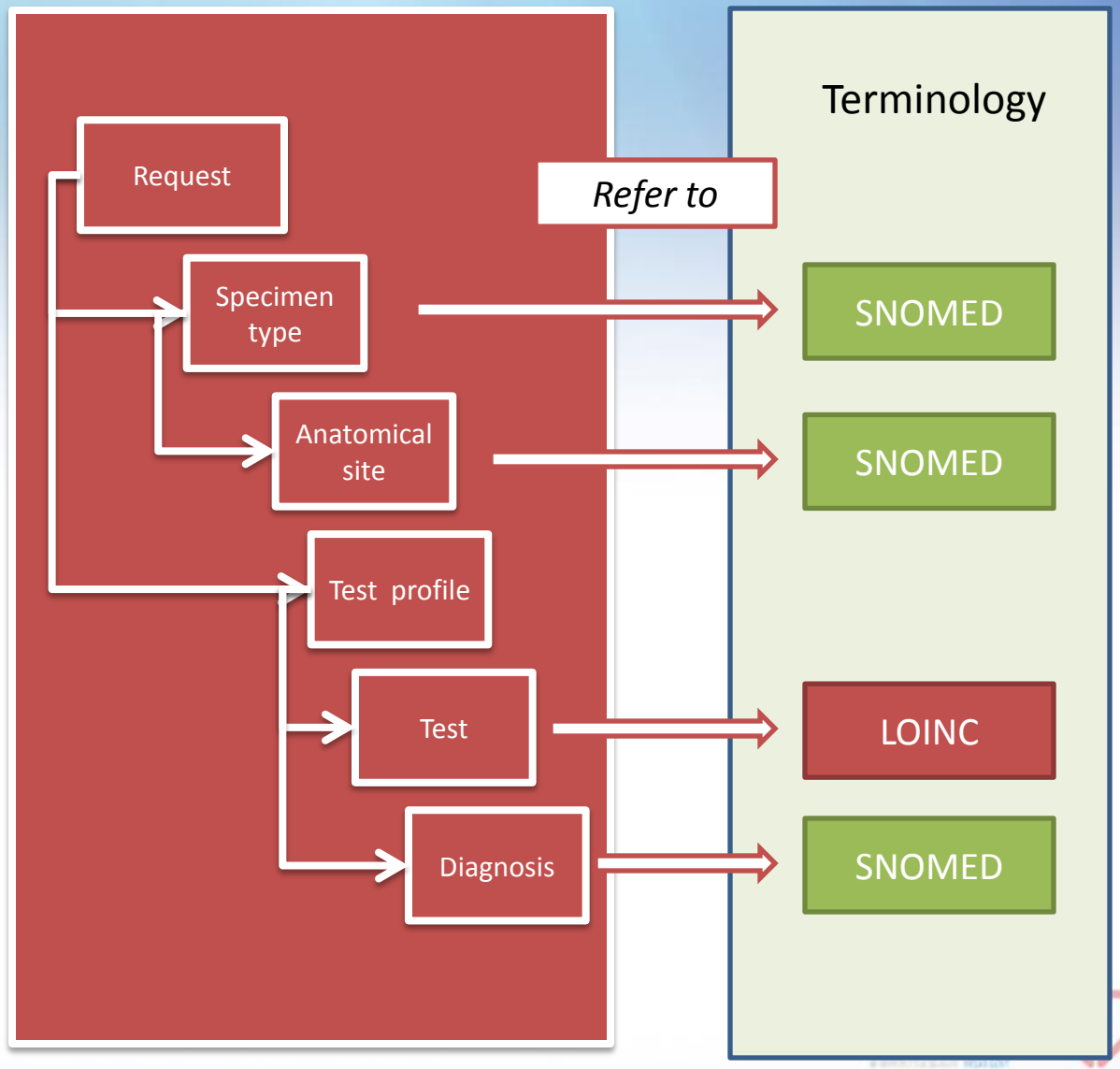
Report on: 13/03/2007 18:12 Printed on 13/03/2007 18:12
Report Destination: KWH/SUR/PL Page No.: 1/1



Editorial guidelines for Test display name

Editorial policy

Editorial guidelines – Test name

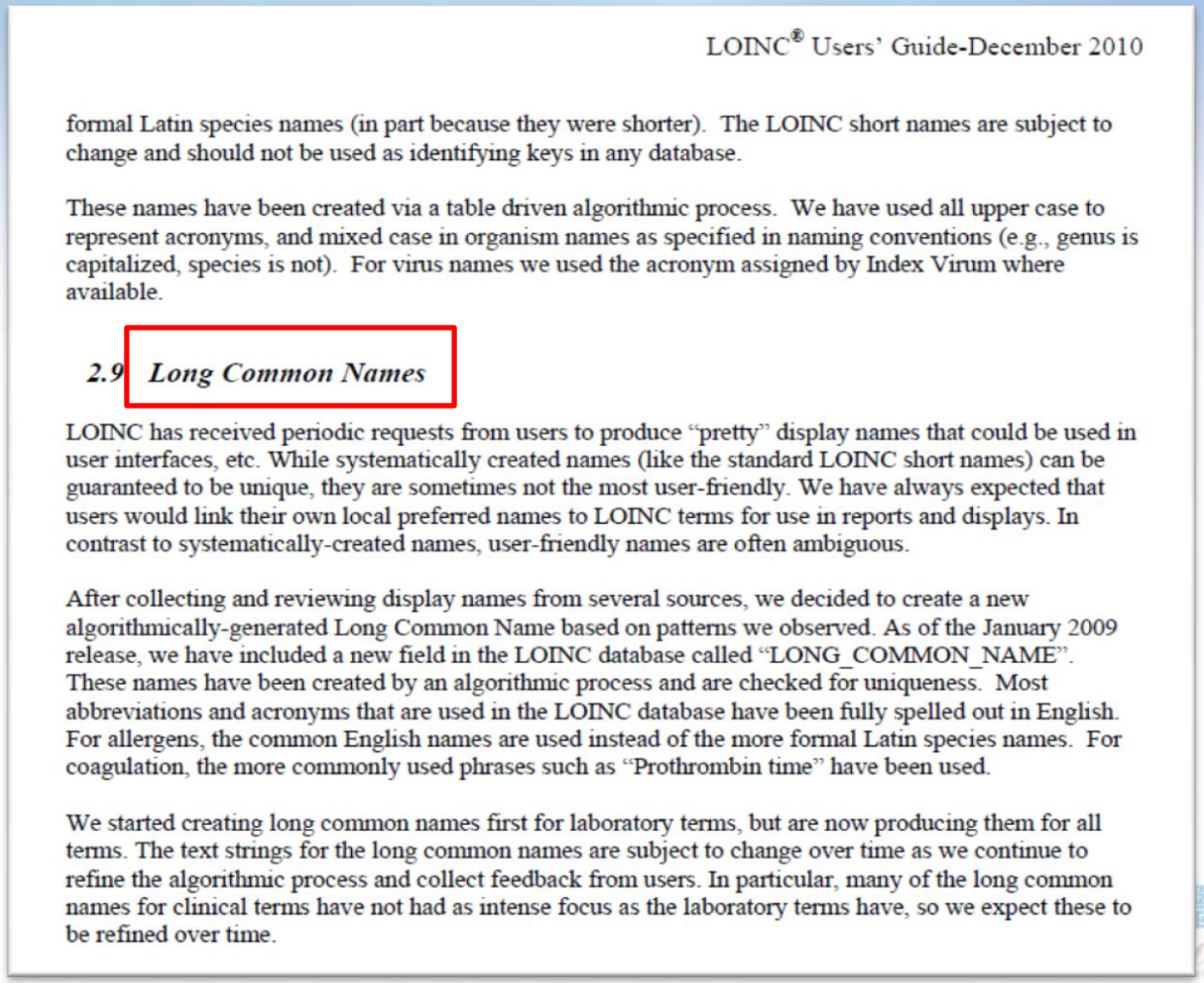
General principles:

- Test naming should be Clear, Precise and Concise.
- Tests are named according to the test, condition or disease rather than particular methodology.

Editorial policy

Editorial guideline – Approach

- Use LOINC as a base.



formal Latin species names (in part because they were shorter). The LOINC short names are subject to change and should not be used as identifying keys in any database.

These names have been created via a table driven algorithmic process. We have used all upper case to represent acronyms, and mixed case in organism names as specified in naming conventions (e.g., genus is capitalized, species is not). For virus names we used the acronym assigned by Index Virum where available.

2.9 Long Common Names

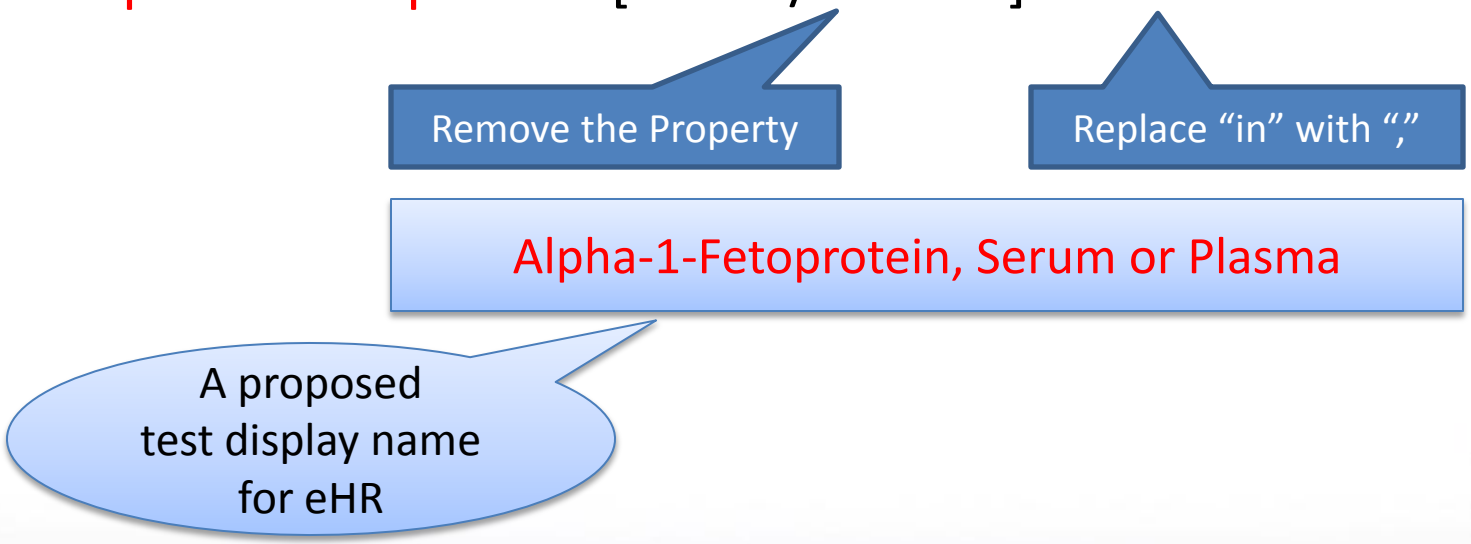
LOINC has received periodic requests from users to produce "pretty" display names that could be used in user interfaces, etc. While systematically created names (like the standard LOINC short names) can be guaranteed to be unique, they are sometimes not the most user-friendly. We have always expected that users would link their own local preferred names to LOINC terms for use in reports and displays. In contrast to systematically-created names, user-friendly names are often ambiguous.

After collecting and reviewing display names from several sources, we decided to create a new algorithmically-generated Long Common Name based on patterns we observed. As of the January 2009 release, we have included a new field in the LOINC database called "LONG_COMMON_NAME". These names have been created by an algorithmic process and are checked for uniqueness. Most abbreviations and acronyms that are used in the LOINC database have been fully spelled out in English. For allergens, the common English names are used instead of the more formal Latin species names. For coagulation, the more commonly used phrases such as "Prothrombin time" have been used.

We started creating long common names first for laboratory terms, but are now producing them for all terms. The text strings for the long common names are subject to change over time as we continue to refine the algorithmic process and collect feedback from users. In particular, many of the long common names for clinical terms have not had as intense focus as the laboratory terms have, so we expect these to be refined over time.

LOINC Common Name

- Use LOINC Common Name as a base to construct our test display name for eHR
- Advantages- They are Distinct, Clear and Consistent
- For example:
  - Alpha-1-Fetoprotein [Moles/volume] in Serum or Plasma



Editorial guideline – (1)

Test display name format

- **Analyte [(abbreviation)] [, Specimen] [, Qualifier] [, Methodology]**
  - e.g. Glucose, Body fluid
  - e.g. Sodium, Urine, 24 hour

- The qualifier is essential to specify what kind of analyte is measured.
  - e.g. Testosterone, Free, Serum or Plasma
  - e.g. Troponin I.cardiac, Serum or Plasma
  - e.g. Prothrombin time (PT), Platelet poor plasma

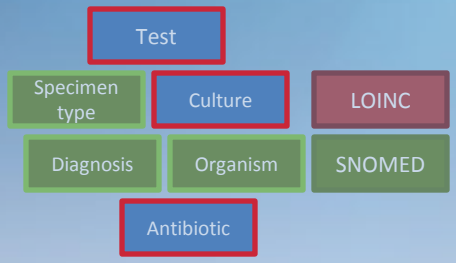
- …

So far, we are having 17 rules discussed in eHR lab DG to regulate the test display name format for eHR

Comments on some proposed Test display name for eHR

- the HA-ePR display name (most likely is UK-spelling) more readable than LOINC's test name (US-spelling),
  - E.g. Haemoglobin pattern
  - Suggestion: Favor UK but US spelling also acceptable
- Some biochemical analytes in LOINC may be difficult to read.
  - E.g. "Follicle stimulating hormone" instead of "Follitropin"
  - Suggestion: make reference to HA-ePR display name with DG or (Editorial board) approval

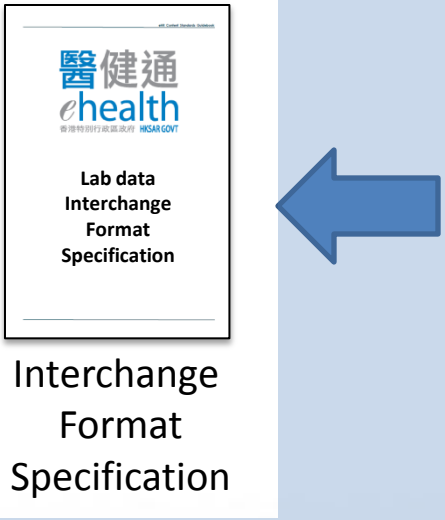
Laboratory Report Contents



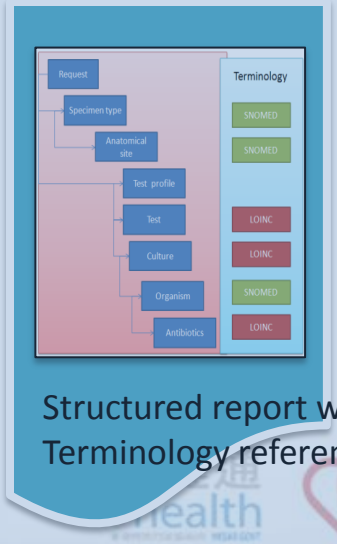
Lab Data

Test Mapping List

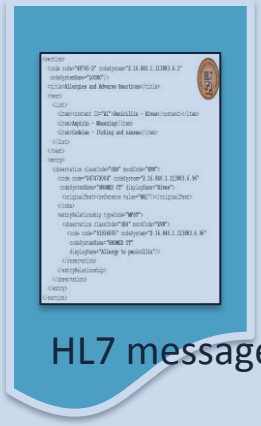
Editorial policy



Interchange Format Specification



Structured report with Terminology reference



HL7 message

eHR

eHR Laboratory Report Content

- Outline data elements designed for capture and storage regarding the level of compliance
  - Level 1 -> lab report in PDF
  - Level 2 -> structured lab data
  - Level 3 -> structured lab data with Reference Terminology
- Organize the laboratory data for clinical communications:
  - General laboratory
  - Microbiology
  - Anatomical pathology

Level of Compliance

- For general laboratory result: Level 1 or 3 are recommended.

Table 2 eHR Information Standards: Level of Compliance

HK eHR	HL7	Data field	Field Content	
			Value	PDF
1	1	institutional (free text) description	institutional (free text) description	Y
2.1	2	institute-defined code with institutional description	institutional (free text) description	Y
2.2	2	• institute-defined code • institutional description • international code (HK)	institutional description	Y
3.1	3	• institute-defined code • institutional description • international code (HK)	• institute-defined code • institutional description • international code (HK)	Y
3.2	3	• institute-defined code • institutional description • international code (HK) • fully specified	• institute-defined code • institutional description • international code (HK)	Y

General Laboratory report

Level 1

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.: SUR 07012345 (MRN: 223345)
Name: CHAN,TAI MAN
陳大文
HKID: A123456(3)
Sex: M Age: 19Y DOB: 01/07/1987
Hosp/Spec/Ward/Bed: TCH/SUR/A5/02
Doctor Request: Dr. Chan Wing
Dr. Ref.:

eHR Content - Header

Lab No.: 07C0377791 **Final Report**
Clinical Details: GIB

Collect Date : 13/03/07
Collect Time : 18:40
Arrive Date : 13/03/07
Arrive Time : 18:40
Request No. : C0377791
Urgency : --

		Reference Range	Units
Sodium	139	136 - 148	mmol/L
Potassium	3.0 L	3.4 - 4.7	mmol/L
Chloride	100	96 - 111	mmol/L
Urea	5.1	1.8 - 6.4	mmol/L
OCreatinine	68	53 - 80	umol/L
Total Protein	68	60 - 80	g/L
Albumin	37 L	38 - 54	g/L
Globulin	31		g/L
Bilirubin, total	11	< 19	umol/L
ALP	60	< 300	U/L
ALT	13	< 39	U/L
Calcium	2.27	2.20 - 2.70	mmol/L
Phosphate	1.39	1.1 - 2.0	mmol/L

Authorized by: LIS Team Member

***** End of report *****

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Report on: 13/03/2007 18:43 Printed on 13/03/2007 18:44
Report Destination: KWH/SUR/PL Cum Page No.: 1 Page No.: 1/1

醫健通 ehealth

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

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		Reference Range	Units
Sodium	139	136 - 148	mmol/L
Potassium	3.0 L	3.4 - 4.7	mmol/L
Chloride	100	96 - 111	mmol/L
Urea	5.1	1.8 - 6.4	mmol/L
OCreatinine	68	53 - 80	umol/L
Total Protein	68	60 - 80	g/L
Albumin	37 L	38 - 54	g/L
Globulin	31		g/L
Bilirubin, total	11	< 19	umol/L
ALP	60	< 300	U/L
ALT	13	< 39	U/L
Calcium	2.27	2.20 - 2.70	mmol/L
Phosphate	[illegible]	1.1 - 2.0	mmol/L

Test name:
Local codes &
LOINC code

Authorized by: LIS Team Member

***** End of report *****

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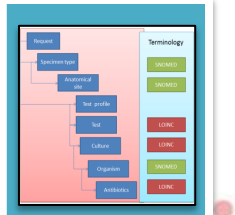
Report on: 13/03/2007 18:43
Report Destination: KWH/SUR/PL

Printed on 13/03/2007 18:44
Cum Page No.: 1 Page No.: 1/1

General Laboratory report

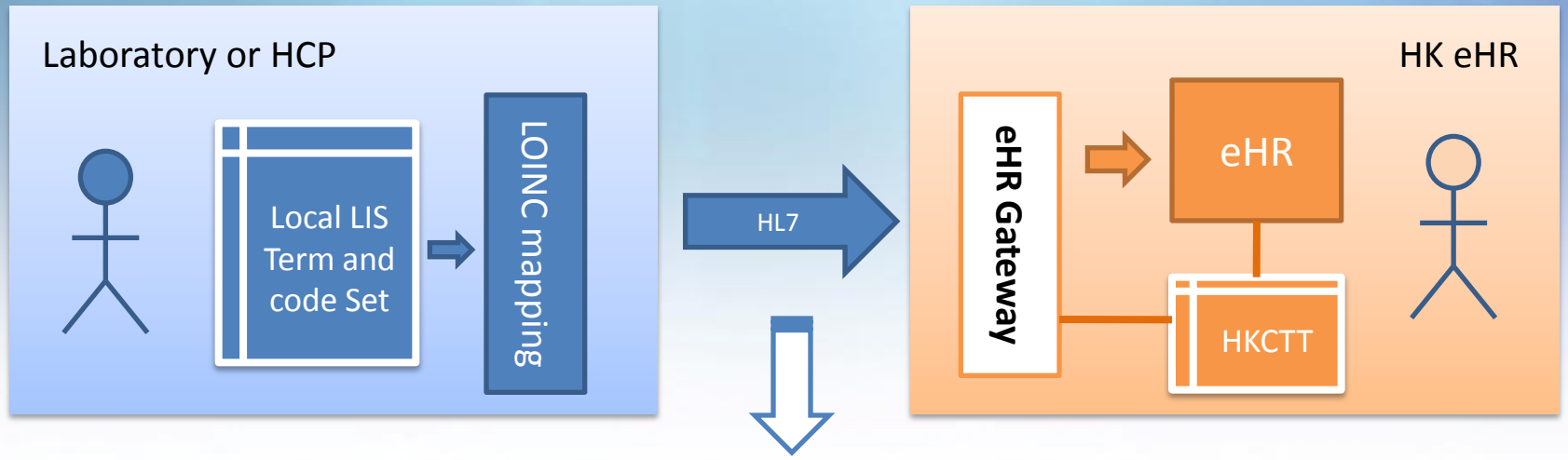
Level 3

Recommend for General Laboratory results – common chemical and haematology tests.
e.g. RFT, CBC,…



Structured report with Terminology reference

Level 3 compliance for General Laboratory data

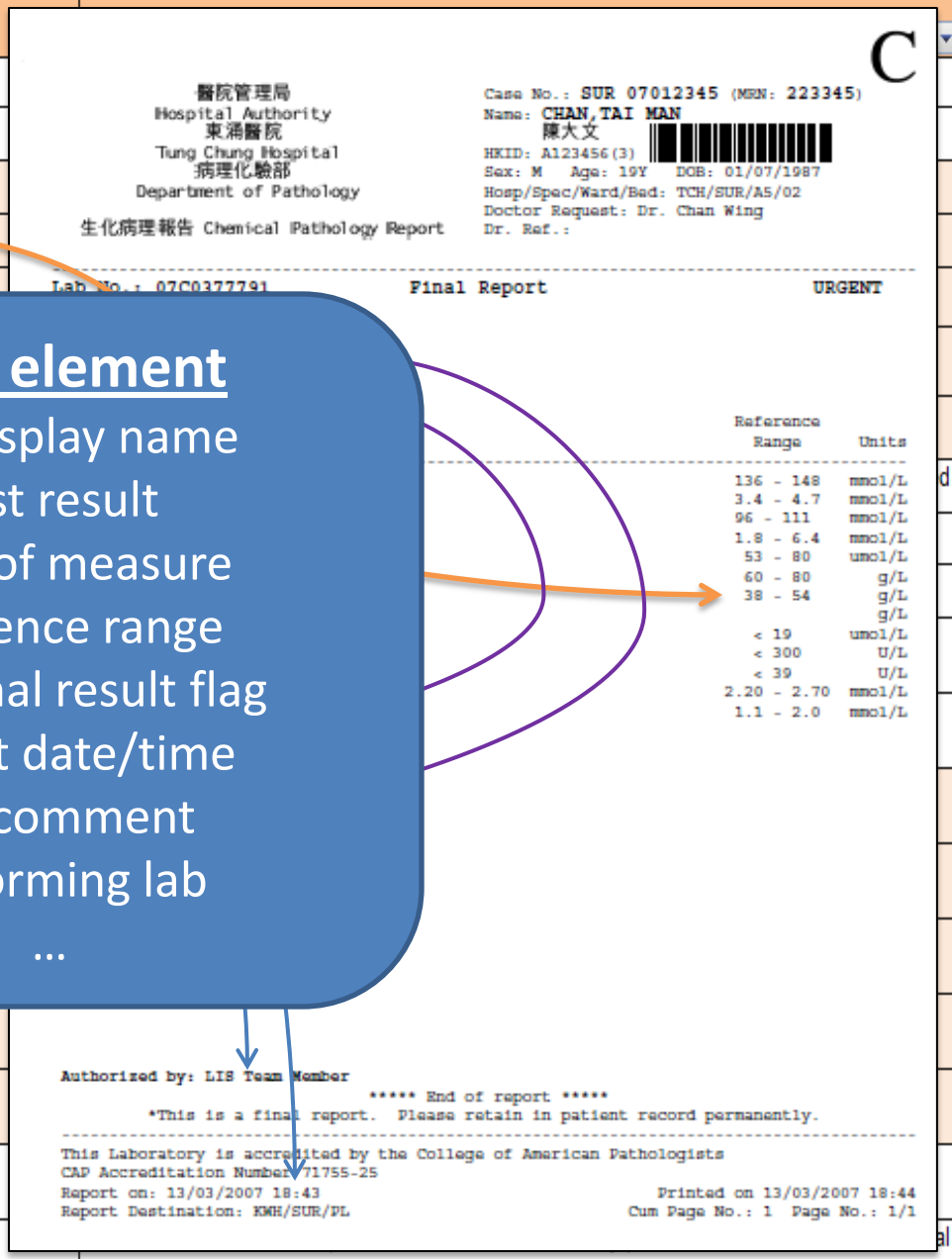


Benefits of Level 3 compliance

Better patient care with interoperable results sharing
Easier detection of medical abnormalities
Consistency of test display names
Reduction of risk due to misidentification of test result
Reduction in unnecessary testing
Reduction in the complexity of mapping
Easier epidemiological and statistical analysis

Laboratory Report Content in eHR (General Lab)

Data Level	Category 1 (Type)	Proposed Name
1	Laboratory Report	Laboratory Report - Image
1	Laboratory Report	Laboratory Report - Text
3	General Laboratory Test Result	General Laboratory Test - Enumerated result
3	General Laboratory Test Result	General Laboratory Test - Numeric result
3	General Laboratory Test Result	General Laboratory Test - Out of range result indicator
3	General Laboratory Test Result	General Laboratory Tes
3	General Laboratory Test Result	General Laboratory T
3	Laboratory Report	Laboratory report aut
3	Laboratory Report	Laboratory report aut
3	Laboratory Report	Laboratory report refe
3	Laboratory Report	Laboratory report res
3	Laboratory Report	Laboratory Report St
3	Specimen	Specimen - Arrival D
3	Specimen	Specimen - Collect D
3	Specimen	Specimen - Site (Ana
2	Specimen	Specimen Type local code
2	Specimen	Specimen Type local description
3	Test Panel	Test panel code
3	Test Panel	Test panel description



Data element

Test display name
Test result
Units of measure
Reference range
Abnormal result flag
Collect date/time
Lab comment
Performing lab
…

and/or "universal" codes.

Coming Tasks for eHR

- Microbiology and Anatomical Path report content
- Laboratory test codes (with LOINC mapping) and test display name
- Table cleansing and verification of the mappings
- Quality assurance and ongoing maintenance issues
- Procedures to handle the change and update on the standardized data set
- A set of standardized units of measure and profile code for common lab tests

Thank You

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