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2. Background

The Public Health Information Network Notifiable Condition Mapping Tables (PHIN NCMTs) are a set of resources for public health reporting. The tables associate disease conditions reportable to public health with laboratory tests that are indicative of those conditions. They can be used to filter the output of clinical labs for test results of public health importance. Their intended scope is all conditions that are notifiable in the United States nationally, at the state level, in sub-state jurisdictions, and in US territories.

The PHIN NCMTs update and extend the Dwyer Tables – the original mappings of lab tests to notifiable conditions. Diane Dwyer did these mappings in 1997 at the University of Maryland. Since then contributors from various institutions have added to the Dwyer Tables, including the Regenstrief Institute, the New York State Department of Public Health, and the Epidemiology Program Office at the Centers for Disease Control and Prevention (CDC).

CDC's Information Resources Management Office (IRMO) produces, maintains, and distributes the PHIN Notifiable Condition Mapping Tables as part of its Public Health Information Network (PHIN). The data in the tables is based on three standard coding systems that are publicly available in the United States:

- LOINC® – for lab test names
- SNOMED® – for organism names
- Nationally Notifiable Disease Surveillance System (NNDSS) Event Code List – for notifiable conditions

These coding systems are described in this document and elsewhere in the documentation.

3. What is a mapping table?

Coding systems make it possible to code data in a consistent manner. For example ICD-9-CM is used to code hospital discharge diagnoses throughout the United States, thus making it possible to aggregate and analyze diagnostic data. However, to aggregate data coded by more than one coding system a mapping between the coding systems is needed. The simple mapping table below shows how data coded with both ICD-9-CM and ICD-10 can be aggregated.

ICD-9-CM		ICD-10	
004	Shigellosis	A03	Shigellosis
004.0	Shigella dysenteriae	A03.0	Shigellosis due to Shigella dysenteriae
004.1	Shigella flexneri	A03.1	Shigellosis due to Shigella flexneri
004.2	Shigella boydii	A03.2	Shigellosis due to Shigella boydii

Most terminology mapping tables are of this sort: They map diseases in one coding system to diseases in another coding system, or procedures to procedures, organisms to organisms, etc. The PHIN Notifiable Condition Mapping Tables are more complex mappings because they map one type of entity to another – i.e., laboratory tests to disease conditions. Mappings of this sort are repositories of facts,

or knowledge bases, as well as connections between coding systems. The examples below demonstrate the kinds of the facts that are contained in the PHIN NCMTs.

LOINC to Condition Table

NNDSS Code	Condition	LOINC code	LOINC test name
10660	Yellow fever	8056-4	Yellow fever virus Ab.IgM : ACnc : Pt : Ser : Qn : EIA
12010	Babesiosis	21089-8	Babesia microti DNA : ACnc : Pt : Bld : Ord : Probe.Amp.Tar
10040	Diphtheria	16676-9	Corynebacterium diphtheriae identified : ACnc : Pt : xxx : Ord : Organism specific culture

The LOINC to Condition table maps LOINC codes to notifiable conditions. This table contains the LOINC codes that are indicative of notifiable conditions.

SNOMED to Condition Table

NNDSS Code	Condition	SNOMED code	SNOMED organism name
10660	Yellow fever	L-32301	Yellow fever virus
12010	Babesiosis	L-52B02	Babesia microti
10040	Diphtheria	L-14401	Corynebacterium diphtheriae

The SNOMED to Condition Table contains mappings of causative agents in SNOMED to conditions in the NNDSS Event Code List.

SNOMED to Organism List

Organism List	SNOMED code	SNOMED organism name
Ehrlichia (HGE) list	L-2A603	Ehrlichia equi
Ehrlichia (HGE) list	L-2A60C	Ehrlichia ewingii
Ehrlichia (HGE) list	L-2A602	Ehrlichia phagocytophila

The Organism List table aggregates SNOMED codes into lists containing all of the infectious agents in SNOMED that can cause particular diseases. The table above shows the Organism List for Human granulocytic ehrlichiosis. These Organism Lists can be used to identify all of a lab's culture results of public health importance.

4. What these tables are (and are not)

A*pplications* – The PHIN Notifiable Condition Mapping Tables don't actually do anything. They are not applications or software. They are, however, designed to be incorporated into applications that search for laboratory test results indicative of notifiable conditions. They are repositories of facts that are needed by public health applications to do that filtering.

B*reakable* – These are large tables with hundreds or thousands of rows – more information than many users will need. The tables can be edited to remove rows that aren't needed in a particular jurisdiction or by a particular public health program. They can also be subsetted to create more specific lab test filters. For example, a public health agency can subset the tables to create an STD test result filter, or a heavy metal toxicity filter, etc. In other words these tables are "breakable." They can and should be broken in this way to meet users' needs.

C*ase definitions* – The PHIN NCMTs are not laboratory criteria for diagnosing notifiable conditions and they cannot be used to confirm cases. All of the tests in the mapping tables are related to notifiable conditions but the strength of that relationship varies. Some tests, like blood cultures, can be diagnostic of current infections. Others, like IgG antibody tests, can only be evaluated in conjunction with other tests because they may indicate past infection.

D*ecision support* – Decision support software requires tables of facts like those provided by the mapping tables. They also need explicit rules for ruling in or ruling out various situations. Some of the information in these tables could be valuable to a decision support system. But since the tables do not contain rules or criteria, they are not sufficient for decision support.

E*LR* – The PHIN Notifiable Condition Mapping Tables are designed primarily for Electronic Laboratory Reporting (ELR). They should be used to filter the output of clinical labs for those test results that need to be routed to public health programs for data aggregation and analysis. They can also be used for other purposes because they contain a lot of information about notifiable conditions and about the LOINC and SNOMED coding systems. First and foremost though, they are tools for ELR.

F*inished* – These tables are not finished or complete. Every year there are changes in the lists of notifiable conditions at the national, state, and sub-state levels. New diseases emerge unpredictably, new lab tests are developed, organism taxonomies are revised, medical knowledge expands, and coding systems like LOINC and SNOMED try to keep up. So keeping the PHIN NCMTs current is an ongoing project.

5. Condition codes, LOINC codes and SNOMED codes

Terminology coding systems all contain some combination of terms, names, concepts, and codes. Beyond this similarity, coding systems are all different. The three coding systems used in the PHIN Notifiable Condition Mapping Tables are about as different as coding systems can be. Since this can make the mapping tables confusing to users, these coding systems are described briefly here.

NNDSS Event Code List

This coding system of notifiable conditions is produced by CDC's Epidemiology Program Office (EPO) and the Council of State and Territorial Epidemiologists (CSTE). It is a simple list of disease conditions that are or were nationally notifiable in the US. In addition, the list contains some conditions that are or were notifiable at the state level but not nationally.

The NNDSS Event Code List does not attempt to be a comprehensive or structured list of conditions. Its main purpose is to provide public health agencies with codes for reporting to CDC. It is updated annually in December for the following calendar year. In addition, unscheduled updates sometimes occur when new diseases emerge.

The conditions in the NNDSS Event Code List all have five-digit numerical codes. The table below gives some examples.

NNDSS Event Code	Condition name
10560	AIDS
10054	Encephalitis/meningitis, California serogroup viral
10240	Typhoid fever (caused by Salmonella typhi)

LOINC

LOINC stands for "Logical Observation Identifiers Names and Codes." The observations that LOINC identifies and names are primarily lab tests. LOINC also includes some non-laboratory tests like blood pressure measurements, X-Ray examinations, and other clinical observations. These clinical (non-lab) LOINC tests are not used in the PHIN Notifiable Condition Mapping Tables.

LOINC uses a highly structured system for naming laboratory tests, in which each test name consists of six pieces of information:

Component – The analyte or that which is tested.
Examples: Cefoperazone, Norwalk virus, Plasmodium falciparum Ag, Lead, etc.

Property – The property of the Component that is measured.
Examples: Susceptibility, Presence or Identity, Mass concentration, Arbitrary concentration, etc.

Time aspect – The duration of the test period.
Examples: Usually "Point in time" but can be 1 hr, 12 hrs, 24 hrs, etc.

System – The specimen type
Examples: Isolate, Stool, Serum or Plasma, Blood, etc.

Scale type – This determines how the test result is expressed and the type of units used.
Examples: Quantitative, Nominal, Ordinal (Positive, Negative, Intermediate, Resistant, etc.)

Method type – The method used in the test procedure.
Examples: Agar diffusion, Electron microscopy, Immunofluorescence, etc.

The table below shows some LOINC codes and names.

LOINC Num	LOINC Name
101-6	Cefoperazone : Susc : Pt : Islt : OrdQn : Agar diffusion
10696-3	Norwalk virus : PrId : Pt : Stl : Nom : Microscopy.Electron
10912-4	Lead : MCnc : Pt : Ser/Plas : Qn :
10709-4	Plasmodium falciparum Ag : ACnc : Pt : Bld : Qn : IF

Like the NNDSS Event Code List, LOINC uses numeric codes called the *LOINC Number*. Each LOINC Number consists of 3-5 digits followed by a hyphen and then a check digit.

The LOINC name is a concatenation of six pieces of information. Every LOINC name must specify these six fields:

Component : Property : Time aspect : System : Scale type : Method type

LOINC is full of cryptic abbreviations that require understanding to interpret. Since the PHIN NCMTs are intended for people who are not coding system specialists all of the abbreviations are unabbreviated in the tables. These unabbreviated expressions are shown in separate columns (see below). The abbreviated LOINC names can be found in the *Concatenated name* column.

LOINC Num	Concatenated name	Property	Time aspect	System	Scale Type	Method
10709-4	Plasmodium falciparum Ag : ACnc : Pt : Bld : Qn : IF	Arbitrary concentration	Point in time	Blood.Whole blood	Quantitative	Immune fluorescence
10912-4	Lead : MCnc : Pt : Ser/Plas : Qn :	Mass concentration	Point in time	Serum or Plasma	Quantitative	[Method not specified]

Labs often do not specify the methods by which tests are done. In such cases the LOINC name is "methodless" – the *Method type* field is shown with no value in it. This can be seen above in LOINC 10912-4, which ends with a colon. The trailing colon means "The *Method type* is not specified for this test." Because this can be confusing, the PHIN NCMTs insert the string "[Method not specified]" into these null method fields.

LOINC is developed by the LOINC Committee and maintained by the Regenstrief Institute in Indianapolis, IN. In March 2003 the Department of Health and Human Services (HHS) announced its first set of uniform standards for the electronic exchange of medical and public health information. These standards require federal agencies to adopt various coding systems, including LOINC for clinical laboratory test results. More information about LOINC and the HHS announcement are available at:

http://www.loinc.org

http://www.hhs.gov/news/press/2003pres/20030321a.html

SNOMED

The Systematized Nomenclature of Medicine (SNOMED) has been in existence since 1976 and has evolved through several stages. The newest reorganization of SNOMED resulted in SNOMED Clinical Terms (SNOMED CT), which was first released in 2002. SNOMED CT is the most advanced medical terminology coding system in use anywhere. This is a good thing but its sophistication can make it challenging to understand SNOMED.

When SNOMED CT was in the planning stages a new system of codes was devised to make SNOMED fully computable. Everything in SNOMED got a new code – concepts, terms, relationships between concepts, the status of terms and concepts, etc. These new codes, called SNOMED Identifiers, are 7-9 digit numbers.

Previously only SNOMED concepts had codes. There were no synonym codes, relationship codes, status codes, etc. The old SNOMED codes consisted of 1-2 letters followed by a hyphen and a string of five characters (numbers and letters). Since SNOMED had been in use for 25 years by this time and users were familiar with the codes, the old SNOMED concept codes were retained in SNOMED CT. This means everything in SNOMED CT has a new SNOMED Identifier, and concepts have both an Identifier and an old SNOMED code.

Currently the PHIN NCMTs only use SNOMED for organism names and codes. For this purpose either the old SNOMED codes or the new SNOMED Identifiers can be used, and both are included in the tables. Many people prefer the old SNOMED codes because they are easier to read and remember. For computing purposes, however, the new SNOMED Identifiers are better.

SNOMED organism	SNOMED ID	SNOMED code
Dengue virus	34348001	L-32320
Blastomyces dermatitidis	65615007	L-44171
Listeria monocytogenes	36094007	L-20901

SNOMED is developed by the College of American Pathologists (CAP) in Northfield, IL. In June 2003 the National Library of Medicine signed a license agreement with CAP to make SNOMED available for no cost use within the U.S. by both U.S. government (federal, state, local, and territorial) and private organizations. The National Library of Medicine will distribute SNOMED CT in the U.S. through its Unified Medical Language System (UMLS), beginning in May 2004.

More information about SNOMED and its availability through the UMLS can be found at:
http://www.snomed.org
http://www.nlm.nih.gov/research/umls/Snomed/snomed_faq.html

6. Updating and versioning the tables

The three coding systems used in the PHIN NCMTs have the following update schedules:

NNDSS Event Code List – Updated yearly, and as needed for new conditions.
SNOMED – New releases twice yearly.
LOINC – New releases quarterly.

The PHIN Notifiable Condition Mapping Tables will be updated quarterly to keep up with the source coding systems. In addition minor updates might occur at other times to correct errors or omissions.

The current version of the PHIN Notifiable Condition Mapping Tables is the May 2004 release.

Development of the PHIN Notifiable Condition Mapping Tables is an ongoing project. Future development of the tables will be driven by users' needs as well as by changes in LOINC, SNOMED, and the NNDSS Event Code List. A PHIN Notifiable Condition Mapping Table maintenance group, including state health department participants, assists CDC's IRMO with table updates and modifications.

7. Contact information for questions and comments

Information about the PHIN Notifiable Condition Mapping Tables can be found at:
http://www.cdc.gov/phin/data_models/index.htm

General information about CDC's Public Health Information Network is at:
http://www.cdc.gov/phin/