Mapping from a Clinical Terminology to a Classification

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The paper discusses mapping and the relationships of SNOMED CT® to a statistical and administrative classification system such as ICD-9-CM. It explores the purpose and differences encountered in creating a mapping and provides a brief overview of SNOMED® and its evolution.

The Terminology- SNOMED CT®, an Evolving Clinical Reference Terminology

SNOMED® is the Systemized Nomenclature of Medicine. It is a controlled medical terminology (CMT). At its simplest, a SNOMED is a coded vocabulary of medical concepts and expressions used in healthcare. It is designed to provide the terminology needed to code the entire medical record. Controlled means that the content of the terminology is validated with careful quality assurance procedures in place to ensure that the terminology is structurally sound, biomedically accurate and consistent with current practice. SNOMED is a work of the College of American Pathologists (CAP), a medical specialty organization of Board-certified pathologists. Oversight of the "content" is provided by a multi-disciplinary editorial board with broad representation from clinical practice and academia.

What is a Clinical Reference Terminology?

A reference terminology is defined as *"a set of concepts and relationships that provide a common reference point for comparisons and aggregation of data about the entire health care process, recorded by multiple different individuals, systems or institutions."*

A reference terminology is an ontology of concepts and the relationships linking them. An ontology is a collection of terms, similar to a dictionary or glossary, that is organized by meaning rather than alphabetically. A reference terminology can allow the concepts to be defined in a formal and computer-processable way. For example, hierarchical relationships can be defined using the "is a" link to identify which concepts are included within broader concepts. Along with other relationships, a network of meaning is created that is useful for computer representation and processing that allows a computer to answer basic questions such as: "Is angina pectoris a type of heart disease?"

By creating computable definitions, a reference terminology supports reproducible transmission of patient data between information systems. It supports consistent and understandable coding of clinical concepts and so is a central feature for the function of computerized patient records.

Origins of SNOMED CT

Introduced in 1965, the Systematized Nomenclature of Pathology (SNOP) was the precursor to SNOMED. SNOP consisted of logically organized codes for the key terms that describe the pathology case:

- Topography - The part of the body from which the specimen came
- Morphology - The pathologic change documented in the report
- Procedure - The method by which the specimen was obtained

In the mid-1970s, work began to expand the coded vocabulary beyond pathology and develop a terminology that would encompass the entire medical record. The first edition of

the Systematized Nomenclature of Medicine (SNOMED) was published in 1977 and was soon followed by SNOMED II in 1980. This work was refined with another release, in 1993, of SNOMED International, which was updated annually through 1998. Work continued with the release of SNOMED RT version 1.0 in January 2001 and SNOMED RT 1.1 in July of 2001.

Is SNOMED only for pathology applications? While one of SNOMED CT's precursors focused mainly upon pathology, today's SNOMED CT has a broad scope that encompasses all of healthcare. SNOMED CT is the merger of SNOMED RT and the United Kingdom's CTV 3 terminology, formerly known as the Read codes. SNOMED CT's 19 hierarchies provide coverage in diseases, findings, procedures, body structures, pharmacy products and other health care concepts.

The hierarchical nature of SNOMED CT enables recording and documentation of clinical data at the appropriate level of detail that can later be analyzed from other perspectives and groupings.

The integration of a clinical terminology such as SNOMED CT into computer-based patient records provides a comprehensive and functional terminology for clinical care. SNOMED CT can be utilized to index, store and retrieve patient information for clinical purposes. SNOMED CT helps ensure comparability of data records between multiple practitioners, across diverse platforms and computer systems.

What is a Classification System?

A classification system has been defined as: A systematic arrangement into classes or groups based on perceived common characteristics; a means of giving order to a group of disconnected facts. The groups or classes may have similar or like characteristics or may even be synonymous.

The Classification ICD-9-CM

International Classification of Disease, Ninth Revision (ICD-9) was originally designed to classify patient morbidity and mortality for reporting. The clinical modifications provided a way to classify morbidity data for indexing of medical records, medical case reviews, and ambulatory and other medical care programs, as well as for basic health statistics, resulting in International Classifications of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). ICD-9-CM codes are commonly used for reporting, analysis, and payment of healthcare services.

ICD-9-CM employs multiple axes of classifications. Within individual chapters different axes are used in classifying different diseases. ICD-9-CM codes classify diseases or conditions that are similar which may or may not be synonymous. An example in which both diseases are both included in ICD-9-CM code 789.0x is:

- Abdominal pain
- Infantile colic

ICD-9-CM maybe described as a "closed" classification which means that each actual patient diagnosis is "bundled" into only one of the broad categories provided by the classification scheme.

Why Create a Map between SNOMED and ICD?

The purpose of mapping is to provide a link between one terminology and another in order to:

- use data collected for one purpose for another purpose
- retain the value of data when migrating to newer database formats and schemas
- avoid entering data multiple times with the risk of driving up cost and errors

A map there is, therefore, created with a specific purpose in mind and must be refined for particular use cases and users in diverse settings.

Since classifications such as ICD-9-CM are widely used in health care for administrative purposes, SNOMED International provides mapping resources that allow a linking from SNOMED clinical concepts to codes used in other schemas and for other purposes. As an example, the purpose of the cross mapping to ICD-9-CM is to support the process of deriving an ICD-9 CM code from patient data.

While SNOMED provides an ICD-9-CM mapping, each enterprise needs to review the content to ensure consistency with local policies and practices before integrating into the enterprise's processes and tools.

Are Coding and Mapping the Same?

Coding involves the use of clinician documentation and other clinical data contained in a particular patient health record as the source for determining the appropriate code assignment within a terminology, classification, or other controlled vocabulary. Coding conventions and guidelines are applied in determining code assignment.

Mapping is linking terminology content between two schemes. Unlike coding, it is not specific to a particular patient encounter. Coding selections may sometime depend upon the context of the patient record; context is not available for each patient when a mapping is developed.

Each mapping from source to target should have a purpose. The mapping begins with the development of heuristics and guidelines that support the use case or the purpose of the mapping, respecting the conventions of the source and target to preserve the granularity and flexibility of both.

Computer programs may use mapping files to translate codes and help automate the process. Full automation that takes into account the coding rules (e.g., such as disease during pregnancy) remains an elusive goal that requires knowledge-based software and some kind of human review.

How Do They Contrast or Compare?

ICD-9-CM contains about 10,500 code descriptors. ICD-9-CM also has limited coverage general symptom codes and two supplementary classifications: "Factors Influencing Health Status" and "External Causes of Injury and Poisoning."

SNOMED CT contains over 300,000 concepts, and over 900,000 descriptions with comprehensive coverage of diseases, clinical findings, etiologies, procedures and living organisms. Since the scope of content is much broader than ICD-9-CM, less than 30% of the content can be mapped to ICD-9-CM.

In total, approximately 96,000 concepts -- 59,244 disorders and 36,616 findings -- have been mapped to ICD-9-CM.

See diagram:

ICD-9-CM classifies diseases or conditions into broad code categories. In contrast, SNOMED CT provides a comprehensive number of disorder and finding concepts, that can result in a "many to one" mapping. Heuristics for categorization have been defined to help describe the rules followed in mapping the relationship between the SNOMED CT concept and the ICD-9-CM code descriptor. The mapping from SNOMED CT to ICD-9-CM identifies the target ICD classification that properly contains the fully defined SNOMED source concept.

The Mapping Schema

The SNOMED CT cross mapping schema supports mappings to more than one target terminology. The file design will support automated cross mapping (in future releases) by providing a technical structure that will support rule-based processing. This is an important step towards machine processable ICD coding from SNOMED-encoded patient data. The SNOMED CT to ICD-9-CM mapping approach supports the "code once" philosophy

The SNOMED CT to ICD-9-CM mapping table provides an approximation of the closest ICD code or codes that best represent the disorder or finding concept. The mapping assignment of ICD code or codes and mapping category utilize heuristics and guidelines of source and target.

In many instances, ICD guidelines may not be totally relevant nor applicable, as a result of the inherent differences between a **terminology** and a **classification system** and the differences in purpose or uses of each.

From an informatics perspective, three interrelated SNOMED CT Cross Mapping tables support the mapping:

Cross Maps Sets Table: The table contains general information about each cross mapping. The SNOMED structure provides for multiple maps. The ***MapSet Type*** field in this table provides information about the characteristics and type of mapping.

Cross Maps (Maps table): This table links the SNOMED CT concept with the code(s) in the target mapping scheme. These codes are in the Target Table.

Cross Maps Target Table: This table contains the target code(s) for each map. Each list consists of one or more codes in the target mapping scheme.

Example of a Mapping in which ICD-9-CM is the Target Scheme

Pulmonary hypertension with extreme obesity

This example involves a narrow to broad mapping from the SNOMED CT concept *Pulmonary hypertension with extreme obesity* to the ICD-9-CM classification represented by the codes 416.8 and 278.00. The example represents each segment in the relational table sequencing.

Concepts Table

This concept is active in the SNOMED CT Concepts Table. The Concepts Table, one of the SNOMED CT core tables, contains information about each concept in the terminology. It contains a unique numeric identifier for each concept, a unique fully-specified name, and references to the history of prior SNOMED works, SNOMED RT, 1.1, etc.

Concepts Table			
ConceptID	**Concept Status**	**FullySpecifiedName**	***SNOMED ID***
27679008	0	Pulmonary hypertension with extreme obesity	D3-40324

Cross Maps Sets Table

The relevant classification is ICD-9-CM.

MapSet Type = 2 means that each unique SNOMED concept maps to either one target code or a set of target codes. The SNOMED concept is never duplicated in more than one row; that is, for ICD-9-CM each concept has one and only one map. However, that map can contain more than one target code. SNOMED CT supports other types of maps.

MapSet ID	MapSet Name	MapSet Type	MapSet Scheme Id	MapSet Scheme Name	MapSet Scheme Version	MapSet Realm Id[1]	MapSet Separator	MapSet Rule Type[1]
100046	ICD-9-CM Map	2		International Classification of Diseases and Related Health Problems, 9th Revision, Clinical Modifications	2003		|	

Cross Maps Table (Maps Table)

The *Map TargetId* field identifies the row in the Targets Table with the target codes for this SNOMED concept. The *MapAdvice* field contains a value of 2 which is one of the map categories and means that the SNOMED concept is more specific than the ICD-9-CM code description.

MapSetId (taken from Maps table above)	Map ConceptId	Map Option[1]	Map Priority[1]	Map TargetId	Map Rule[1]	Map Advice
100046	27679008			306056		2

Cross Map Targets Table (Targets Table)

The *TargetCodes* are an approximation of the closest ICD-9-CM codes or codes (416.8|278.00) that best represent the SNOMED concept. Note the values are separated by a bar (|), as specified in the *MapSet Separator* field in the Cross Maps Set table.

TargetId	TargetSchemeId	TargetCodes	TargetRule[1]	TargetAdvice[1]
306056	ISO7963	416.8|278.00		

[1] Not currently used in SNOMED CT®. For Future Use.

Other SNOMED CT Maps

SNOMED also has maps for the following:

ICD-O
ICD 10
OPCS-4
North American Nursing Diagnosis Association (NANDA- International)
Nursing Interventions Classifications (NIC)

Implementing the Mapping

SNOMED CT mapping is designed to be integrated into a computerized patient record, therefore developers of software or systems might use it as follows.

A clinician utilizing a computerized patient record at the point of documenting the final diagnosis or assessment could select a concept(s) from a customized formulary or lexicon of disorders or findings to populate the diagnosis or assessment field. At that point the SNOMED CT concept would then populate the assessment field.

In an integrated world, after the assessment field is populated, the computer could then automatically generate the ICD-9-CM code that was linked to the disorder or findings concept that was used to document the patient diagnosis. Dependent on the use case for the

facility in which a clinician works, a report could be generated showing the SNOMED CT concept and the ICD code. A screen or report could be developed for administrative purposes where a SNOMED CT concept would be displayed as the final diagnosis and the linked ICD-9-CM code. This might then be reviewed by HIM coding experts.

In today's environment, the HIM coding expert would use the SNOMED-encoded diagnoses plus the transformation to ICD-9-CM using the mapping, along with more complete, more explicit, or other accessible information, to choose the most appropriate ICD code.

How the mapping is integrated and used is dependent on the use case and users of this type of data needs and local software implementation and HIM coding expertise.

Conclusion

The new era of clinical terminologies and the computerization of patient health records is very exciting and challenging. It will require the HIM professional to build upon hard-won existing skills and to master new knowledge in data management.

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