Interface Terminology

capturing structured clinical information from health care provider

This presentation is a summary of reading some basic articles about terminologies freely available on the net, mainly from the review of Rosenbloom and all.

sources

- Interface terminology (Rosenbloom 2006)

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1513664/pdf/277.pdf

Rosenbloom ST, Miller RA, Johnson KB, Elkin PL, Brown SH.
Interface terminologies: facilitating direct entry of clinical data into electronic health record systems.
J Am Med Inform Assoc. 2006 May-Jun;13(3):277-88. 2006 Feb 24.

- From definition to definition" Proc AMIA Symp. 2001: 463–467. (Michael 2001)

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2243376/pdf/procamiasymp00002-0502.pdf

- From aristotelician logic to formal logic (Campbell 1994)

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC116201/pdf/0010218.pdf

- Limite of compositionality (McKnight 1999)

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2232608/pdf/procamiasymp00004-0357.pdf

- Structured Methods of Information Management for Medical Records PhD. Manchester Univ. Doctor of Philosophy in the Faculty of Medicine.1993 (Nowlan 1993)

http://www.opengalen.org/download/WANowlanThesis.pdf

Qualitative/ colloquial / flexible / expressive
Pre-coordination

Quantitative/ formal / structured/rigid/
coded/ pre & post-coordination

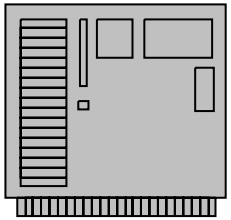
Human thinks

natural language

Interface terminology

formal language

Machine Computes



Processing terminologies

Reference terminologies

Linked to

ICD
ICPC
ICF
ATC
..

Administrative terminologies

Analysis

Human readable text

Table 3 ■ The Three Terminology Classes[89] by Spackman et al.[89]

Terminology Class	Intended Usage Task
Interface	Support a user-friendly structured data entry interface
Processing	Optimize natural language processing
Reference	Enable storage, retrieval, and analysis of clinical data

Definition of Terminologies

- Terminologies consist of collections of words or phrases, called terms, aggregated in a systematic fashion to represent the conceptual information that makes up a given knowledge domain, such as clinical cardiology or pediatric orthopedic (or family practice)

Ex:

- Systematized Nomenclature of Medicine Clinical Terms ([SNOMED CT]
- Logical Observation Identifiers Names and Codes ([LOINC]
- National Drug File Reference Terminologie
- Unified Medical Language System (UMLS)

definition for

clinical interface terminology

- a systematic collection of health care–related phrases (terms) that supports clinicians'entry of patient-related information into computer programs, such as clinical ‘‘note capture’’ and decision support tools.
- one other function of an interface terminology is to facilitate the selection or linkage to the reference terminology (Ray Simkus)
- Also called ;
  - » Colloquial terminology
  - » Entry terminology
  - » Application terminology

Clinical interface terminologies have been used for

- problem list entry
- clinical documentation in EHR
- text generation
- care provider order entry with decision support
- diagnostic expert programs.

six possible tasks for terminologies (Rector, 1998)

1. Support efficient data entry and query formulation;
2. Record and archive clinical information
3. Support sharing and reuse of clinical information
4. infer and suggest knowledge according to decision support algorithms
5. Support terminology maintenance
6. To create a natural language output from manual structured input

number and size of available clinical terminologies have expanded over time as the result of three phenomena.

• the information-intensive domains of clinical practice have expanded rapidly since 1960

• availability of computer systems that are able to handle the complexities of knowledge representation, storage, retrieval, and maintenance

•intended uses for clinical terminologies have expanded comprehensive representation of clinical domains,

- ✓data storage,
- ✓data mining,
- ✓algorithmic discovery of relationships among concepts,
- ✓systems messaging,
- ✓decision support,
- ✓clinical documentation

The medical community require
a ‘‘common, uniform, and comprehensive approach to the representation of medical information.’’ The CANON Group 1994

Concept orientation (basic building bloks)

1. Language independant
2. Favored terms
3. Relational
4. Compositional
5. Synonymy
6. Non ambiguous (exhaustivity)
7. Non overlapping (exclusivity)
8. Coverage of domain (comprehensiveness)
9. Scope
10. Purpose
11. Mapped

Domain coverage

complete coverage of a specified domain by formally defined concepts (ISO. 2001)

Pre-coordinated concepts (human logic)

Chest Pain

Chest pain

substernal chest pain

crushing substernal chest pain

Clinically significant

Post-coordinated concepts (machine) (atomic or kernel concepts)

Chest

+

Pain

+

substernal

+

crushing

Allows more expressivity but limits !

Compositional balance

Pre and post coordination (Campbell 1994)

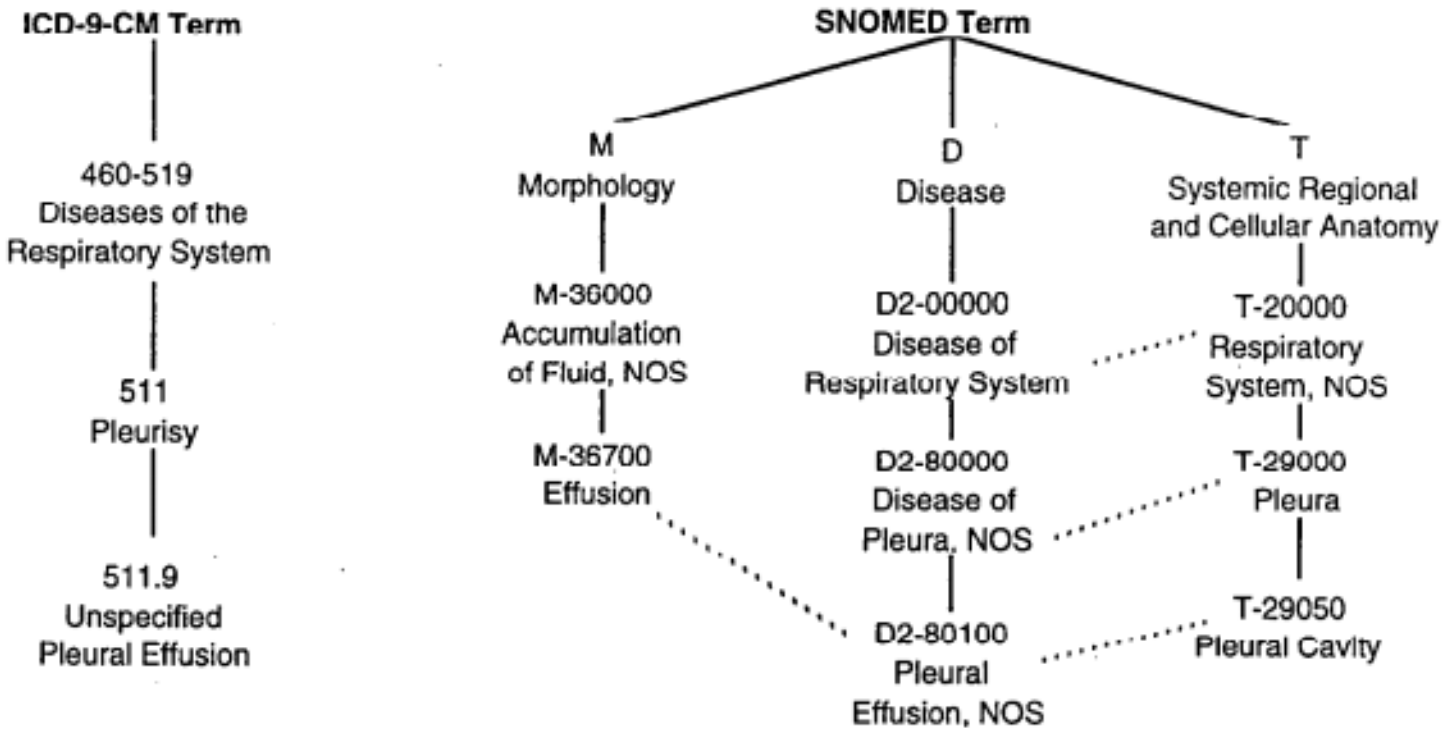
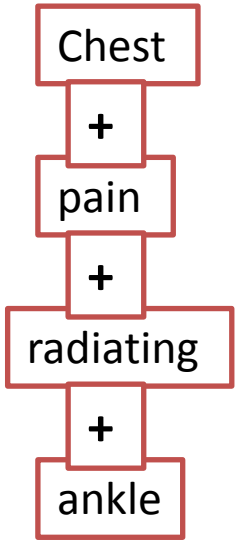


Figure 1 ICD-9-CM type hierarchy (left) and SNOMED type hierarchy (right) showing classification of "pleural effusion." The dashed lines represent cross-reference links provided by SNOMED. There were no cross-references for the ICD-9-CM terms. The SNOMED cross-references are discussed in Section 8.2.

Domain coverage (foll.)



Chest pain radiating to the ankle

Clinically not meaningfull

Limits of postcoordination

- Meaningfullness
- Duplicate
- Inefficiency

terminologies allowing post-coordination are better able to represent phrases and concepts extracted from clinical documents than existing pre-coordinated terminologies

a limitation of post coordination is the problem of 'equivalency'. This relates to the difficulty in knowing if two different post-coordinated expressions describe the same concept or not. As an example is 'pneumonia' the same thing as 'infection with location lung'? (Ray S)

Limits of postcoordination

- Meaningfullness

- Sanctioning (Horrocks -1995) composition allowed if medically sensible
- Lowest level of significance (Masarie - 1991)

Generic findings (modifyers & qualifyers)

Instantiated findings

Users could post-coordinate generic findings into more specific concepts, called instantiated findings, only by using the constrained item lists and qualifiers. In all cases, rules for sanctioning must be added on a concept-by-concept basis, increasing the effort required for terminology development

Limits of postcoordination

❖Duplicate

single concepts can be composed using unanticipated combinations of relatively atomic concepts

Table 2 ■ Duplication Due to Compositionality: Four Ways to Compose "Appendicitis" in SNOMED RT

D5-46210 01 Acute appendicitis, NOS	G-A231 01 Acute D5-46100 01 Appendicitis, NOS
M-41000 01 Acute inflammation, NOS G-CO06 01 In T-59200 01 Appendix, NOS	G-A231 01 Acute M-40000 01 Inflammation, NOS G-CO06 01 In T-59200 01 Appendix, NOS

From the CANON Group.[43]
NOS = Not otherwise specified.

(Rosenbloom 2006)

Limits of postcoordination

❖Inefficiency

single concepts can be composed using unanticipated combinations of relatively atomic concepts

but

McKnight et al. study suggests that composing complex concepts from simpler concepts as part of standard documentation processes may be inefficient for the general practice of most health care providers.

→ Poor clinical usability

The ‘‘usability’’ of an interface terminology refers to the ease (e.g., speed, level of comfort, accuracy) with which its users can accomplish their intended tasks

balance domain coverage with clinical usability

→ build terminologies designed for specific usage categories.

the usability of a clinical interface terminology designed for capturing structured documentation correlates with

1. presence of relevant assertional medical knowledge
2. Adequacy of synonymy
3. balance between pre-coordination and post-coordination
4. mapping to terminologies having formal concept representations.

1.Assertional knowledge

Assertional knowledge may define attributes distinguishing ‘‘thorax pain’’ from ‘‘chest pain’’ by including relevant synonyms, associated diagnoses, common symptoms, usual modifiers, and describing prevalence in a given patient population.

Assertional knowledge in an interface terminology can be made up of lists of associated concepts, synonyms, and common modifiers and may be more relevant to clinical users than definitional knowledge.

An assertion about a concept is a statement about a concept (Nowland 1993)

terminological knowledge	–	that which corresponds to the intensional interpretation
assertional knowledge	–	other more general facts about a concept

Assertional knowledge (follow.)

Interface terminologies can associate concepts with their assertional knowledge by using links to what the National Library of Medicine (describing MeSH) and Wang have each called ‘‘allowable qualifiers.’’

Allowable qualifiers explicitly define the relationships between concepts and their relevant modifiers and corollary concepts

2.Synonymy refers to a number of individual terms that can correctly represent a unique concept.

Synonym types may include:

- ❖alternate phrases (e.g., ‘‘dyspnea’’ and ‘‘shortness of breath’’),
- ❖acronyms (e.g., SOB for ‘‘shortness of breath’’),
- ❖definitional phrases (e.g., ‘‘a sensation of not getting enough air during breathing’’),
- ❖eponyms(name of a person)

But also homonyms, polysyms , antonyms

→ More expressivity and accuracy.

3.balance between pre-coordination and post-coordination

4. mapping to terminologies having formal concept representations.

See slide 2

The Role of Definitions in Biomedical Concept Representation (Michael 2001)

Dictionary

- In dictionaries the unit of information is a term and definitions specify the meanings of terms
- The sequence of terms is dictated by the alphabet and the definition of a given term bears no relationship to that of its neighbors.

(Michael 2001)

Ontologies

- The role of definitions in an ontology is to specify defining attributes in a consistent manner, thus assuring their transitive inheritance through a type hierarchy.
- . One of these terms may be selected as the preferred name and the others may be associated with the concept as synonyms.

Definitions (follow.)

Dictionary

- A dictionary accommodates different meanings of a term(e.g., 'palm' considered in a botanical or anatomical context) by defining such homonyms individually in the contexts in which they are used.
- "Aristotelian" hierarchy constructed on the basis of inheritance,

(Michael 2001)

Ontologies

- The position of a concept will enrich its own definition by the definition of all of its parents within the hierarchy.
- a definition of a concept within an ontology is incomplete without that of all of its parents.

Definitions (follow.)

Dictionnary

- "Aristotelian" hierarchy constructed on the basis of inheritance
- Anatomical entity

  is a biological entity,

  which constitutes the structural organization

  of a biological organism,

  Or is an attribute of that organization.

(Michael 2001)

Ontologies

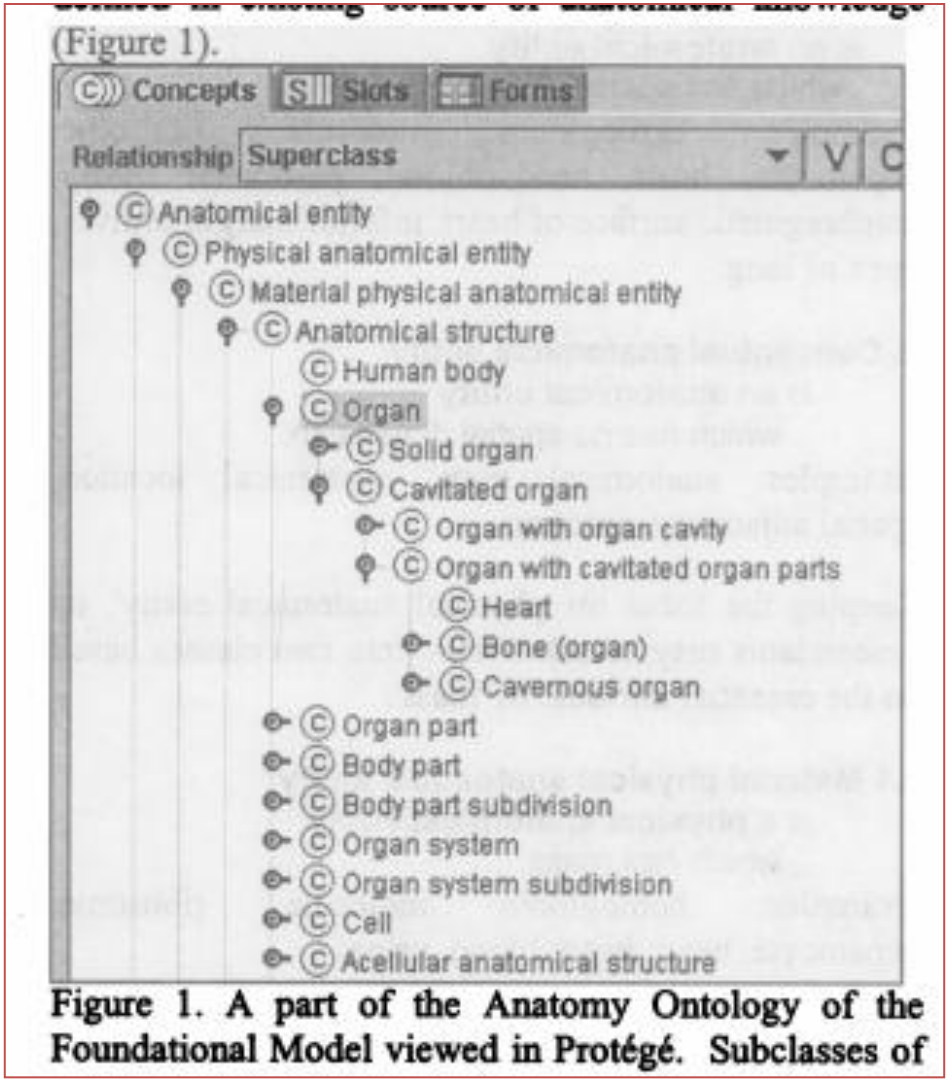


Figure 1. A part of the Anatomy Ontology of the Foundational Model viewed in Protégé. Subclasses of

evaluation

Improving and evolving interface terminologies require evaluation metrics such as adequacy of attributes, degree of synonym coverage, quantity and quality of relevant assertional knowledge