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Abstract

Introduction: Well developed and agreed standard for the categorial structure allows standard terminologies, which have been used in different areas and different countries, to be mapped to each other. And it is important to guarantee the interoperability over the diverse systems as well. Here we report a categorial structure, in progress under ISO, which will be used for a conceptual guideline of terminology development on Symptoms, signs, and their combination patterns. **Methods:** Methodologically this work is based on ISO/DTS 22789 (conceptual framework for patient findings and problems), EN 1828:2002 (Health Informatics — Categorial structure for classifications and coding systems of surgical procedures), and other basic terminologies related to standards of ISO. This categorial structure consists of several basic and higher semantic categories, twenty one semantic links, and their minimal constraints and logical operators for generating well formed terminological phrases. **Results:** The High level relevant concepts for the semantic categories ‘Symptoms and Signs(症候)’ and their ‘Combination Patterns(證)’ were gathered for the first in WHO International Standard Terminology (WHOIST) and will be later in national classifications from China, Japan and Korea. And then we gave them hierarchical structure. The semantic links were defined based on two principles. One is compatibility with existing relevant standards such as ISO/DTS 22789 and EN 1828:2002 that will be accompany with our work, the other one is to include unique items from the area of traditional medicine, specially for East Asian countries including China, Japan, and Korea. All the semantic links were defined with their domains and ranges in manner of description logic and also explained with examples. This structure was implemented into an ontology system based on description logic by *protégé* v3.4 so that it was able to be validated logically. **Discussion and conclusion:** Using this categorial structure, the relationships between our concepts and other related concepts will be determined in compositional manner in individual terminology systems. Furthermore, in many application systems using the terminology systems, compositional conceptual representation will be available to represent individual patient findings, for instance a patient’s symptoms that are related to each other in the space of time and procedure, as well as complicated concepts that haven’t been registered in a existing terminology system. We will discuss these more with experts from both of health informatics international standards and domain of traditional medicine.

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INTRODUCTION

Needs for categorial structure in the area of traditional medicine

In most countries, there is a so called traditional medicine separated from the health care system based on biomedicine. In some countries this traditional medicine has been also institutionalized, in other countries it is going to be occupying a considerable portion in health care as an alternative medicine. The traditional medicine of East Asian countries has been spread from eastern China to other Asian regions including Japan and Korea, over thousands years and contemporarily is used mainly with its own diagnostic method of pattern identification and its treatment methods such as acupuncture and herbs. Some terminologies of the traditional medicine are going to be world-widely used by the Electronic Health Record (EHR) systems in the form of independent or combined systems with biomedicine. Therefore, it is important to guarantee the interoperability over the diverse systems.

There have been some researches to develop terminology systems of traditional medicine by mapping traditional medicine terms to the UMLS¹⁾ meta-thesaurus. But this method cannot be a good solution because knowledge structure of traditional medicine is totally different from that of biomedicine, and even same named terms can be used with other meaning. So it's difficult to map between them.

Template for representing patient findings

Developing a categorial structure is not only for mapping between terms but also being a template which can be used for the representation of patient findings. Because EHR systems, for an instance, patient findings will be represented by fixed format in the EHR systems and the format follows the structure of terminology system used by the EHR systems. Hence, the categorial structure of reference terminology influence directly to the EHR system. It means that developer of categorial structure should consider the granularity of representation so that it should not contain unnecessary structures. If not so, it will be an obstacle to process in order to validate the medical records or extract additional information for medical services.

Here we report a categorial structure, in progress under ISO/TC 215, which will be used for a conceptual guideline of terminology development on symptoms, signs, and their combination patterns.

METHODS

ISO/DTS 22789²⁾ is a model with which patient findings can be represented. This model has similar goal with our model in terms of representing patient findings, so our model was basically based on this model and modified in some classes and relations of it.

In this model, *clinical finding* class and *value only* class are inherited from *concept* class. And *clinical finding* is connected with other *classes* (called *characterising concept* in this

model) *value only by relations* (called semantic links in this model) to represent information about the *clinical finding*. For example, *Pleuritic pain* is linked with *Pleura structure* by *HasAnatomicalSite* relation, so that it represents that focal point of *Pleuritic pain* is *Pleura structure*. This model which has simple structure, defined many relations and classes, and some of them had to be modified to fit our model.

The patient findings are classified as symptoms, signs and their combination patterns(證). Symptoms are mainly subjective findings that are reported by patient or observed by clinical staffs, and signs are relatively objective findings that can be observed or scored by clinical staffs or medical devices. These two concepts are somehow overlapped with the same concepts of biomedicine. But, at the same time, they are always when disease is defined to be a theoretical medical concepts that denotes a disorder of structure or function in a human; especially, one that produces specific signs or symptoms or that affects a specific location and is not simply a direct result of physical injury while illness is a generic concept defined as a state of poor health, patterns/syndromes, that can be comparable with disease of biomedicine. Patterns are diagnostic conclusion of the pathological changes which is at a certain stage of a disease and at the same time exists over a variety of diseases.

Selection of relations

First, we analyzed each of the relations whether they are fit to represent patient findings for traditional medicine. Then, some of them are excluded or changed their names, and some relations which cannot be represented by existing relations are added. Because traditional medicine has different range to represent information of symptoms and sings, and to represent patterns additional relations are needed so that patterns can be handled as a kind of patient finding.

Considerations to represent conceptual concepts

Traditional medicine does not understand human body or objects in the perspectives of biomedicine. Instead, it uses the concepts that look to represent anatomical structure but actually indicate the notional concepts such as ‘viscera and bowels(臟腑)’, and these concepts refer to the functional system in the perspective of the traditional medicine. And also, it uses conceptual substance, for example, qi(氣), blood(血) and so on. Because of these differences, our model should separate conceptual concepts and relations, and existing concepts and relations (not conceptual) so that it may not be confused by names represented of each other.

RESULTS

Our model was implemented into an ontology system based on description logic by protégé v3.4 so that it can be validated logically. And it contains *Concept* as top of the hierarchy, and includes *Entity*, *Value* and *Event* class. *Entity* represents clinical findings, structures and substance. And *Value* is to describe detail information of clinical findings, and it includes *Event* which is not information about clinical findings but to describe phenomenon or process, activities and diagnostic procedure (Fig 1. Hierarchy of the terminology model). And this includes conceptual concepts like *conceptual structure*, *conceptual substance* and *conceptual function* to represent traditional medicine idea. For the relations, basically we keep some of the

existing relations from ISO 22789 and others are removed or added to fit our model (Table 1).

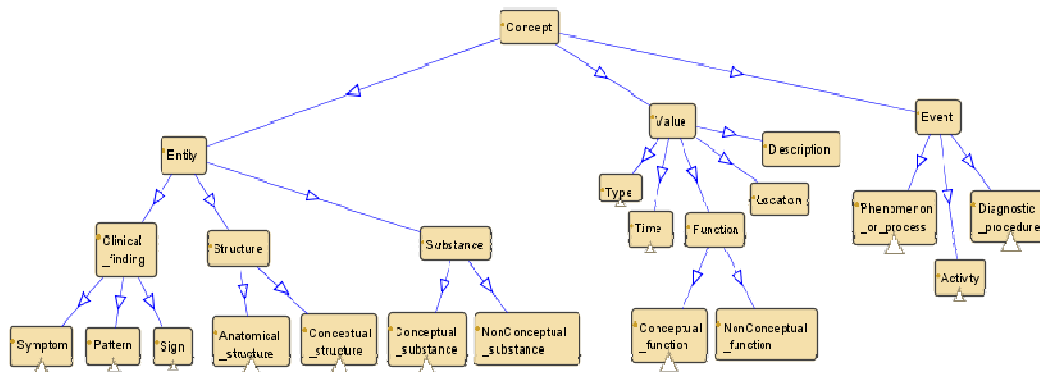


Fig 1. Hierarchy of the terminology model

Table 1. Comparison of relations between ISO/DTS 22789 and our result

ISO/DTS 22789	Categorical structure in traditional medicine	note
HasAbnormalAnatomicalLocation	HasAbnormalAnatomicalLocation	keep
HasAnatomicalSite	HasAnatomicalSite	keep
-	HasTRPart1AnatomicalSite	added
HasStructuralEmbryologicalDefect	-	removed
HasOnset	HasOnset	keep
HasEpisodicity	HasEpisodicity	keep
HasCourse	HasCourse	keep
HasOccurrence	HasOccurrence	keep
HasMorphology	HasMorphology	keep
HasCausativeAgent	HasCausativeAgent	keep
-	HasTRPart1CausativeAgent	added
HasSeverity	HasSeverity	keep
HasStage	-	removed
HasPathologicalProcess	HasPathologicalProcess	keep
HasExternalCause	-	removed
HasPlaceOfOccurrence	HasPlaceOfOccurrence	keep
HasSubjectOfInformation	HasSubjectOfInformation	keep
HasQuantity	-	removed
HasPsychosocialAspect	-	removed
HasAssociatedFinding	HasAssociatedFinding	keep
HasAssociatedFunction	HasAssociatedFunction	keep
-	HasTRPart1AssociatedFunction	added
HasInterpretation	HasInterpretation	keep
HasAssociatedTest	HasAssociatedTest	keep
-	HasTRPart1AssociatedPattern	added
-	HasTRPart1AssociatedSign	added

Discussions

The role of the categorical structure

Clinical terminology systems take a role of basic systems for EHR (Electronic Health Record) systems so that they can support managing or searching of medical information, and providing intelligent services. Recently, these terminology systems have usually been developed by ontology structure. But the terminology systems have been developing with

different structure and terms, and consequently, interoperability between them cannot be guaranteed. To solve this problem, some terminology systems called ‘reference terminology’ are developed and existing terminologies can transfer information to other terminologies by mapping to the reference terminology keeping their meaning.

SNOMED-CT(Systematized Nomenclature of Medicine-Clinical Terms)³⁾, UMLS(Unified Medical Language System)¹⁾, HL7 CDA(Clinical Document Architecture)⁴⁾, and ICNP (International Classification for Nursing Practice)⁵⁾ are the examples of reference terminology. And CEN, ISO developed the structures with the name including ‘categorial structure’, ‘conceptual framework’, ‘reference terminology model’. These structures are the kinds of ontology, and the ontologies provide common structures to those which communicate with other terminologies.

ISO/DTS 22789 for example, main purpose of it is to specify a categorial structure, within the subject field of patient findings and problems, by defining a set of common domain constraints for use within terminology systems including a classification, coding scheme, coding system, reference terminology and clinical terminology. And in this document, it shows the potential use of this structure as to support developers of new terminology systems, and even new detailed content areas of existing terminology systems. As mentioned, it covers wide range in a point of practical use of terminology system. And its role is also overlapped with the role of reference terminology.

‘Categorial structure’ used in the document, is originally from ISO 17115⁶⁾, and it means ‘a set of common domain constraints’ as mentioned above. So it can be called a ‘class model of the reference terminologies’ instead of ‘reference terminology’ itself. It is similar to GALEN⁷⁾ model, a higher level ontology to take a role of providing common structures to be able to cover any other ontologies in medical area.

ACKNOWLEDGEMENT

This research was supported by the MKE (Ministry of Knowledge Economy), Korea, under the ITRC(Information Technology Research Center) support program supervised by the NIPA(National IT Industry Promotion Agency), (NIPA-2009-(C1090-0902-0002))

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