

Assessment of the GALEN methodology on holistic classifications for Professions Allied to Medicine

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Abstract In the field of health care terminology it has proven to be difficult, but not impossible, to build a formal Reference Model (knowledge-model) for medical terminology.

The intuition is that it is even more difficult to build such a reference model for the so called 'holistic' classification schemes as used by Nursing and Allied Health Care Professionals.

There is a growing perceived need for formal reference models for specific professional groups. These reference models are used in many different ways, such as for building, maintaining and manipulating classification schemes.

This paper focuses on the usability of the GALEN methodology for the formalisation of the Dutch Classification of Pain (NCP) as an example of such a 'holistic classification'.

The first results of this exploration show that the GALEN methodology is very useful for analysing and understanding a 'holistic classification'. A high number of necessary concepts from the NCP already exist within the OpenGalen Common Reference Model-2 (OCRM2). A substantial number of concepts from the NCP do not yet exist in the OCRM2 or are underspecified.

Additional modeling of the OCRM2 has to be performed, to enrich the expressivity of the model.

Keywords:

Assessment, Classifications, requirements, Electronic Data Management Systems, Reference Models, Nursing, Allied Health Professions.

Introduction

Health Care Professionals like Nurses and Allied Health Care workers often claim that the classifications they use are holistic classifications because they are based on a conceptual framework in which the person is described as a 'whole'. In other words, the conceptual framework and the classification profess a way of describing a person completely and from different perspectives and not merely in terms of a disease. In this context 'conceptual framework' is viewed as an interpretation in usage of the classification, e.g. the introduction in Part 1 and Part3 of the ICD10 [??].

Another example of such a conceptual framework is the introduction to the ICIDH from the WHO. The ICIDH also claims an integrated approach to the person.

In the Netherlands a comprehensive classification for pain has been developed: The Nijmegen Classification of Pain (NCP) [??]. This classification is in fact a selection, rearrangement and refinement of sets of relevant rubrics from several international and national classification schemes like the ICIDH, ICD-10, International Classification for Procedures in Medicine and Drug terms with ACT-codes. It has been developed with the intention of serving as a universal language for interdisciplinary use on aspects of, or related to, pain. It provides both a classification and a conceptual framework on how pain should be viewed. Pain is presented as a multidimensional phenomenon with the focus on the person as a whole, and not as a pain syndrome only. In this sense the classification is a 'holistic classification'. It contrasts with most medical classifications, such as the ICD-10, which are in fact reductive. When the classification is used for designing things like protocols and registration-systems, the multidimensional view of the classification should be reflected.

The development of the NCP is one of the four main projects of the National Pain Program in the Netherlands. Another project in this program is the development of a Pain Data Management System (PDMS). The prime use of the NCP is through this PDMS.

The PDMS needs to be knowledge driven if it is to function as an intelligent data-entry system. For this reason we explored the possibility of expressing concepts from the NCP in a formal reference model. These models can be used for applications which support clinical practice via functions such as data entry and retrieval, data analysis for e.g. decision support, and automatic coding or mapping to billing categories.

We have chosen the OCRM2 [].

The Galen methodology has proven to be useful for:

- building the Classification Commune des Actes Medicaux (CCAM), a new French national coding system for surgical procedures [],
- analysing of similarities and differences between the READ and GALEN ontologies [],
- analysing the Draft Classifications of Procedures for Oral Hygienists and Dieticians in the Netherlands [],
- development of a reference terminology for drugs in the UK [],
- analyzing the WHO ICIDH2-Beta2 draft [] .

Our experiment is concerned with concepts from the Activity and Disability Dimension of the NCP as a selection of rubrics, relevant to Pain, from the Activity Dimensions of the ICIDH.

Results from other terminological projects, such as in Field Trial 8 from the World Health Organization on the ICDH-2 Beta-2 will be taken in account [].

Materials and Methods

Materials that were used:

- the Nijmegen Classification of Pain (NCP),
- the *OpenGALEN* Common Reference Model-2 (OCRM2),
- Galen authoring software: ClaW and SPET.

For the process of analysing the NCP, and comparing concept of the NCP with OCRM2 concepts, the Galen Methodology will be used. This methodology is an iterative process, consisting of:

1. Terminological Scoping
2. Identifying the ontology of the classification; identifying the categories, descriptors and required links between categories,
3. Dissecting,
4. Link & concept mapping; links between descriptors must be mapped to appropriate OCRM2 attributes or attribute-concept-attribute chains,
5. Descriptor mapping; the NCP descriptors are mapped to appropriate OCRM2 concepts,
6. Automatic translating and classification of the 'dissection' into OCRM2.

The Terminological Scoping is an extensive exploring of the meaning and purpose of the terminology, within the contextual framework of, or as presented by the classification scheme.

Step 2 and 3 are in fact concerned with the atomisation of the of the NCP rubrics. This atomisation or dissecting, is done within a specifically designed tool, the SPET. In SPET 'dissections' are created in an intermediate representation to author semantic representation of 'medical' concepts without having to endure the complexity of description logics like GRAIL. In addition, this technology independent representation makes it possible, in principle, to map to other formalisms such as Snomed CT.

This paper focuses on the first five steps of the methodology.

Results

Terminological Scoping.

The Terminological Scoping on the Activity and Disability Dimension gave an understanding of the meaning of activity within the classification. As an example activities like 'walking', 'dressing' and

'personal hygiene', will serve here as cases to describe the terminological exploration.

In the context of e.g. Chronic Pain, it is mentioned that the pain people experience can have an important impact on their ability to perform of normal activities. Within the taxonomical structure of the NCP, these activities are defined as activities on the level of the person as a whole. Walking, dressing and personal hygiene are considered as complex activities, involving a number of more basic actions and body functions simultaneously. The operational definition of 'walking' within the NCP is that it is about the movement of the whole body, but involves mental activities, proprioception and external sensory orientation. In fact, this information cannot be derived from the structure of the NCP classification itself but it is implied in the conceptual framework. The classification aims at offering a terminology for a multidimensional description of a person, on certain instances, over a period of time. It is stressed in the introduction that the classification schemes are not about processes. In our view this view of walking *not* being a process term is not consistent with the meaning of the term within the classification. It refers to the perception of walking or personal hygiene within the context of an assessment tool.

What actually can be derived from the NCP-scheme is that walking and personal hygiene are activities. They are more complex than elementary activities, and less complex than e.g. social activities, like playing. Walking is a movement activity and personal hygiene are personal care activities. What is stated is that all acts are volitional.

Identifying the ontology.

Variances for the ontology:

- it is about phenomena that are in fact process-kind of things, so the top ontology would be: Process, or Body Process
- a lower level ontology could be: Volitional Activity, followed by Movement Activity and Self Care Activity
- also possible is regarding movement in the context of Voluntary and Involuntary movement

This would allow for walking to have multiple parents.

Personal hygiene is a more abstract concept. In the ICDH it is further elaborated in washing and drying oneself, and in kinds_of washing. In the GRAIL model personal hygiene would probably only need one parent.

Dissecting

To describe unambiguously the concepts that the NCP rubrics refer to, a categorial structure and the relations between these categories is required.

For this purpose two things are needed:

- a standard for the categorial structure, and
- the categories and its describing components – the descriptors – have to be identified.

The Surgical Procedures in the NCP can be described using the standard categorial structure from the European Federation of Classification Centres (EFCC), which is an adaptation of CEN ENV 1828 [].

TEMPLATE

MAIN_deed

ACTS_ON lesion/device
HAS_LOCATION anatomy
HAS_LATERALITY side
HAS_APPROACH approach_value
HAS_EXTENT extent_value
BY_TECHNIQUE procedure
TO_ACHIEVE physiological_process
MOTIVATED_OVERALL_BY care_act

EXAMPLE DISSECTION

RUBRIC: "left open ureterolithotomy"

MAIN Removing

ACTS_ON Stone
HAS_LOCATION Ureter
HAS_LATERALITY left
HAS_APPROACH abdominal
HAS_EXTENT total
TO_ACHIEVE Obstruction_Relieving
MOTIVATED_OVERALL_BY Curing

In the above relations are in Capitals, characteristics are in lower case. Such a categorial structure does not, however, already exist for describing NCP Activities in a structured way. On the one hand it could be as complex as for Surgical Procedures because there are similarities between Deeds and Acts, as both imply human actions. On the other hand there are activities which have a simpler categorial structure, e.g. walking,

A possible adaptation of a categorial structure for Activities was proposed, based on the EFCC template:

TEMPLATE

MAIN_activity

ACTS_ON anatomy/ device
HAS_LATERALITY side
HAS_EXTENT extent_value
BY_TECHNIQUE action
TO_ACHIEVE physiological process/state

EXAMPLE DISSECTION 1

RUBRIC: Washing whole body

MAIN Washing

ACTS_ON body
HAS_EXTENT complete
BY_TECHNIQUE bathing
TO_ACHIEVE cleanliness

OR_MAIN Washing

ACTS_ON body
HAS_EXTENT complete
BY_TECHNIQUE showering
TO_ACHIEVE cleanliness

In the scope note to the rubric 'Washing whole body', washing is defined as either taking a bath or a shower. In this example dissection 1, two possible dissections are therefore required.

EXAMPLE DISSECTION 2

RUBRIC: Walking

MAIN Walking

In the above relations are in Capitals, characteristics are in lower case

Example Dissection 2 requires no further detail.

Link & descriptor mapping.

In order to map links required for the NCP categories to appropriate OCRM2 attributes or concepts, the OCRM2 has been explored on how concepts like walking, dressing and personal hygiene are formalised. It was not certain if the concepts were existing in the model, because the OCRM2 had initially been developed for surgical procedures and subsequently for disease modeling.

However, in the OCRM2 concepts like 'walking', 'activity', and 'washing' are present.

Although the number of kind_of activities is very limited, the structure for activities within the OCRM2 model is in line with the concept of activities within the NCP. In the ontology of the OCRM2, Process is the higher level ontology for Activities. For the NCP it is required that all activities can be mapped to OCRM2.

The earlier identified NCP ontology concepts - Process, or Body Process, Volitional Activity, Movement Activity and Self Care Activity - are similar to OCRM2 concepts. In OCRM2 they are named:

- Process and BodyProcess
- VolitionalAct; MovementAct and SelfCareAct

In OCRM2 'walking' is defined as an elementary concept, but additional annotations inform that it is a voluntary movement and that it involves the lower extremity. This is a reductive way of defining, sufficient for a purely medical approach. Also walking is not yet defined as an activity as well.

Though OCRM2 is contains a 'walking' concept, the full meaning of walking as defined in the NCP

and the ICIDH would be lost. In OCRM2, 'walking' therefore needs to be refined through further annotation.

The origins of the corpus in modeling surgical procedures are yet more highly visible in the concept of 'washing'. In OCRM2 two kinds of washing are present, but both defined as accompanying process of surgical procedures.

For 'washing' as a child of 'personal hygiene', and on a higher level as a SelfCareAct, this mapping would be doubtful. This OCRM2 concept 'washing' therefore needs reconsideration whether the GRAIL concept needs to be remodeled.

Discussion

Analysing the holistic classification schemes, the question arises what makes these schemes 'holistic'. A classification scheme is in fact and by definition 'reducing' a phenomena to its essentials. 'Holistic' and 'classification' are in that sense conflicting terms.

As these classification schemes are presented now, the holistic approach is reflected mainly in the conceptual frameworks, and to some extent in the separate dimensions the classifications are composed of.

The dimensions of the NCP and the ICIDH offer different views on the same subject in a more detailed way than most medical classifications like the ICD-10 offer. As both holistic and non-holistic schemes try to describe and order phenomena in the real world, they might be regarded as complementary and as defining a more or less integrated and complete approach if taken in combination. This can make them very attractive to represent in a Common Reference Model, which can then be used by all 'health care professionals', instead of separate models for nursing and allied health care professionals, and doctors as mentioned above. The concern however is that, should somebody ever succeed in uniting the holistic and non-holistic views and demonstrating that they were all really views on something else that was shared, then this work would be *de facto* rejected. Some professional groups chose to define themselves partially in terms of their possession and use of a unique model of the world. The idea that they might in fact share a common underlying view of the world can be professionally threatening.

An important question, therefore, is whether holistic approaches in general as declared in conceptual frameworks are to be part of any unifying model. What exactly is the framework about, and might this be represented in a different way, e.g. in the way an application is designed?

Can the Galen Methodology be used to support this research? We think it can. We have shown how

holistic classifications can be represented in formalisms such as GRAIL and techniques originally developed for analysis of non-holistic schemes still apply.

A separate question is whether a holistic ontology can be integrated within, or have any other meaningful relationship with, a non-holistic ontology. In other words, can terms from a holistic classification be presented using the same atoms used to represent a non-holistic classification. Can the NCP be presented within the OCRM2? This needs to be further investigated.

On the one hand the intuition is that there **is** some sort of relationship between e.g. walking as currently represented in the OCRM2 and the more holistic view as described. If there is such a relationship then it is likely that it can be represented in GRAIL or some more powerful formalism. Whether or not a given formalism can cope with representing ontological relationships is dependent on whether to do so requires particular logical constructs and whether these are supported by the formalism. The fitness of a formalism for a given purpose is, therefore, not strongly bound to the particular philosophical properties of the domain you wish to work with.

On the other hand, however, the expectation is that the nature of any relationship between holistic and non-holistic views could be very complicated.

In order to represent it you would need to develop a common ontology of primitives that could be used to express by composition both a holistic ontology and a non-holistic ontology. This might be an interesting philosophical thing to do, but how likely is it that people would take advantage of the resulting shared semantics in order to compute a transformation between the two ?

There is a difference between classifications of Nurses and Allied Health Care Professionals and classification schemes like the NCP and the ICIDH, in the sense that the first seem to serve a defining of the profession or distinction of the domain of the profession from other domains. It is part of the development of a professional identity. The DCP and ICIDH aim at serving the uniformity of language within the group of health care professionals e.g. for purpose of registration and research.

The question is, do they all share an interest in the same subject: paradigmatic aspects of persons and the environment in the context of health? If so, than an integrated approach for describing these aspects is required in establishing a shared ontology.

Conclusion

This exploratory research shows that the Galen Methodology is useful and usable for analysing and

understanding classification schemes. It has already proven to be useful for analysing and understanding 'medical' classification schemes, such as for surgical procedures, which are regarded as typically 'reductive' or 'non-holistic'. The methodology is also very useful for the analysis and understanding of schemes, which are regarded as 'holistic' classifications. The Terminological Scoping process is especially useful for investigating how 'holistic' is to be understood in the context of a particular classification of terms. Although holistic classification schemes can be handled by GRAIL, the conceptual meaning of the terms from the NCP is currently only partly captured in OCRM2. As far as 'holistic' can be translated into a terminology, GRAIL will gain highly in 'richness of expressivity' if the concepts from the NCP are modelled within the Core Reference Model.

Step 6 of the Galen Methodology has started.

Acknowledgements

I wish to thank Pieter Zanstra from the Department of Medical Informatics at the Medical University Centre in Nijmegen for his methodological support and discussions on this paper.

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