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Development of a New International Classification of Health Interventions Based on an Ontology Framework

Béatrice Trombert PAVIOT[a, b,1], Richard MADDEN[d], Lori MOSKAL[e], Albrecht ZAISS[f] Cédric BOUSQUET[a, b], Anand KUMAR[a], Pierre LEWALLE[a], Jean Marie RODRIGUES[a,b,c]

[a] *University of Saint Etienne, CHU, Department of public health and medical informatics, Saint Etienne, France*

[b] *INSERM UMR 872 Eq 20, Paris, France*

[c] *WHO Collaborating center for International Classifications in French Language, Paris, France*

[d] *University of Sydney WHO-FIC network, Sydney, Australia*

[e] *Canadian Institute for Health Information, Toronto, Canada*

[f] *Universitätklinikum, Medizincontrolling, Freiburg, Germany*

Abstract: The WHO International Classification of Diseases is used in many national applications to plan, manage and fund through case mix health care systems and allows international comparisons of the performance of these systems. There is no such measuring tool for health interventions or procedures. To fulfil this requirement the WHO-FIC Network recommended in 2006 to develop an International Classification of Health Interventions (ICHI). This initiative is aimed to harmonise the existing national classifications and to provide a basic system for the countries which have not developed their own classification systems. It is based on the CEN/ISO ontology framework standard named Categorial Structure defined from a non formal bottom up ontology approach. The process of populating the framework is ongoing to start from a common model structure encompassing the ICD 9CM Volume 3 granularity.

Keywords: Classifications; Standard; Ontology; Intervention;

1. Introduction

Since the beginning of medical informatics clinical terminological systems, classifications and coding systems have been developed by independent, divergent and uncoordinated approaches which have produced non reusable systems on overlapping fields for different needs. Most of developed countries have kept on maintaining, updating and modifying their own coding systems for procedures, as well as national adaptations of ICD [1], in order to manage and to fund their health care delivery. The most significant efforts were done in Australia with ACHI (Australian Classification of Health Interventions) or ICD10 AM [2], in Canada with the Canadian

[1] Corresponding author : Jean Marie Rodrigues, CHU de St Etienne, SSPIM, Chemin de la Marandière, 42 270 Saint Priest en Jarez, France, E-mail: rodrigues@univ-st-etienne.fr

Classification of Health Interventions (CCI) [3] developed by the Canadian Institute for Health Information (CIHI) and in France with CCAM (Classification Commune des Actes Médicaux)[4]. For some decades several broad pre-coordinated or compositional systems have been proposed to users targeting different goals. The most well known are the UMLS (Unified Medical Language System) [5], LOINC [6] for clinical laboratories, DICOM SDM [7] for imaging, SNOMED CT [8], Convergent Medical Terminology (CMT) [9].

Standardisation in health informatics started in the US with the HL7 user group. The European Standard Body CEN TC 251 WG2 (Comité Européen de Normalisation Technical Committee 251 Working Group 2) and later the International Standard Organisation ISO TC 215 WG3 elaborated and developed a standard approach for biomedical terminology named Categorial Structure which is a bottom up non formal ontology approach. We describe the application of this standard to the ICHI initiative and give the specifications of this classification system in Section 2 (Material and Method). In Section 3 (Results) we discus the perspectives to further develop and accommodate existing classifications rather than creating new ones.

2. Material and method

2.1. Overview

At the 2010 WHO FIC meeting the following definition of health intervention was agreed [10]: an activity performed for, with or on behalf of a client(s) whose purpose is to improve individual or population health, to alter or diagnose the course of a health condition, or to improve functioning. This definition includes interventions that apply to more than one client or to a population group. As a consequence the prospective international classification would include interventions across the whole health system. It would include interventions provided by all types of providers: doctors, dentists, nurses, allied and community health workers, traditional medicine providers and public health practitioners. The aims of this international classification are to:

- Describe and compare the provision and effectiveness of health interventions at the local, national or international level.
- Provide a classification of appropriate scope and detail to which countries may align their more finely grained national or specialty classifications.
- Ensure that a classification is available that can be used without adaptation in countries which do not wish to further refine the classification.
- Take into account that interventions include elements of ‘western’ and ‘traditional’ medicine.

2.2. Method

The development is built on an ontology framework standard method following the CEN TC 251/ISO TC 215 work named Categorial Structure, as several recent national classifications within Europe and Canada did. The CEN/ISO Categorial Structure is defined in the last standards[11-12], as a minimal semantic structure describing the main properties of the different artefacts used as terminology (controlled vocabularies, nomenclatures, coding systems and classifications): a model of knowledge restricted to

1) a list of semantic categories; 2) the goal of the Categorial Structure; 3) the list of semantic links between semantic categories authorised with their associated semantic categories; 4) the minimal constraints allowing the generation and the validation of well formed terminological phrases. Any biomedical artefact claiming conformance to the standard shall attach with the data sent the Categorial Structure of the terminology used. The Categorial Structure shall satisfy the 4 constraints but can add more constraints. The ICHI Categorial Structure is as following:

2.2.1. List of Semantic Categories

- The Action semantic category is the set of deeds done by an actor. The top level hierarchy value sets are: Investigation, Treating, Managing, Informing, Assisting, Preventing.
- The Target semantic categories on which the action is carried out are: Anatomy, Human function, Person/client, Group/population.
- The Means semantic categories describing the processes and methods by which the action is carried out are: Approach, Technique, Method, and Miscellaneous as devices.

2.2.2. Semantic Links

The first semantic link named "hasFocus" connects the Action and the Target semantic categories. The second semantic link called "hasMeans" connects the Action and the Means semantic categories

2.2.3. Minimal Domain Constraints

It is necessary to have at least one deed value from the semantic category Action. It is necessary to have at least one semantic link "hasFocus" connecting one deed value to a value of the Target semantic categories. It is authorised to have several semantic links "hasFocus" for one deed value (e.g Anatomy and Human Function, person/client and group/population). The semantic link "hasMeans" is optional.

2.2.4. Development of a Coding Scheme

In line with the Categorial Structure, the coding scheme comprises a 7 characters structure for the three axes: 3 letters for the Target, 2 letters for the Action, 2 letters for the Means plus up to x digits. The current intention is that the granularity will be at least equivalent to the granularity of ICD-9-CM Volume 3.

3. Results

3.1. Validation

The semantic structure was validated first by a mapping exercise between existing classifications of health intervention from different languages [13] and different fields. The number and type of interventions from existing classification systems mapped are as follows (see Table 1):

Table 1. Mapping of The semantic structure towards existing classifications of health intervention from different languages and different fields.

Languages	Number of Interventions in the Field
ACHI (Australia):	100 from Orthopaedics
CCI (Canada):	100 from Random selection
CCHI (China):	75 from Random selection
OPS (Germany):	100 from Endovascular
NCSP (Nordic countries):	100 from Random selection
KTL (Germany):	50 from Rehabilitation
WCPT (USA):	257 from Physiotherapy
CCAM (France):	100 from Cardiology
(CCI/CCAM) (Australia):	23 from Obstretrics
ICNP(USA and Korea)	278 from Nursing practise

More recently the 5338 procedure labels of ICD 9 CM Volume 3 have been mapped to this structure by a Korean team [14]

3.2. Discussion

First the strategy of this ICHI initiative can be challenge. Why not taking an internationally used coding system of health interventions as the previous ICPM (International Classification of Procedure in Medicine)[15] or the procedure part of SNOMED CT? In fact there is no an international terminology artefact taking care of the wide field of health interventions needed for the WHO FIC network activities for instance traditional medicine, public health or nursing. Nevertheless the ICHI system is based on the same existing systems semantic model and will be quickly available with the ICD 9 CM Volume 3 coarseness and further on can be populated with the value sets of different national or international systems of health interventions. Among different standardization strategies for biomedical terminologies it was considered not possible to agree on a reference clinical terminology or to standardize a detailed language independent biomedical ontology based on a formal upper level ontology as recommended by the OBO foundry[16]. On the other hand if the feasibility was good for diagnostic, medical and surgical interventions more work is needed to complete the semantic categories for interventions on functioning, public health and traditional medicine.

4. Conclusion

This international classification which has not yet been included in the formal program of WHO for financial reasons is not proposed to be used all around the world as ICD for diagnosis. It is rather considered as an incentive to harmonisation. Countries having developed their own classifications of health interventions and interested in comparability of data including case mix systems across countries should modify their existing systems partially to be compliant with the ontology framework but are not

mandated to change the full terminology they use. For countries without an interventions classification and namely developing countries it can be used directly starting from the level of granularity of ICD-9-CM Volume 3 or as a framework to develop national applications.

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