Quality of Life through Quality of Information
J. Mantas et al. (Eds.)
IOS Press, 2012

doi:10.3233/978-1-61499-101-4-83

Mapping SNOMED CT to ICD-10

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Abstract. A collaboration between the International Health Terminology Standards Development Organisation (IHTSDO®) and the World Health Organization (WHO) has resulted in a priority set of cross maps from SNOMED CT® to ICD-10® to support the epidemiological, statistical and administrative reporting needs of the IHTSDO member countries, WHO Collaborating Centres, and other interested parties. Overseen by the Joint Advisory Group (JAG), approximately 20,000 SNOMED CT concepts have been mapped to ICD-10 using a stand-alone mapping tool. The IHTSDO Map Special Interest Group (MapSIG) developed the mapping heuristics and established the validation process in conjunction with the JAG. Mapping team personnel were selected and then required to participate in a training session using the heuristics and tool. Quality metrics were used to assess the training program. An independent validation of cross map content was conducted under the supervision of the American Health Information Management Association. Lessons learned are being incorporated into the plans to complete the mapping of the remaining SNOMED CT concepts to ICD-10.

Keywords. SNOMED CT, ICD-10, Mapping. Terminology, Classification

Introduction

A number of systems are utilised in healthcare to identify clinical content. Two systems used internationally are the Systematized Nomenclature of Medicine Clinical Terms (SNOMED CT®), a clinical terminology, and the International Classification of Diseases and Health Related Problems, 10th Revision (ICD-10®), a clinical classification. ICD-10 organises content into meaningful standardised categories enabling the storage and retrieval of diagnostic information for epidemiological and research purposes and providing the basis for the compilation of national mortality and morbidity statistics by WHO Member States [1]. SNOMED CT is a comprehensive clinical terminology that provides the core general terminology for the electronic health record. SNOMED CT contributes to the improvement of the quality and safety of healthcare and provides effective access to information required for decision support and consistent reporting and analysis [2]. While each is designed for distinctly different reasons, creating a map between them makes data reuse possible, that is, maps allow clinical information captured at a very granular level to be aggregated for administrative reporting purposes and statistical analysis [3].

The creation of maps between SNOMED CT to ICD is not new. For example, the UK's National Health Service SNOMED to ICD-10 map existed for a number of years

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and uses a methodology involving a series of flags to apply UK ICD standards, rules and conventions [4]. Other examples of maps from SNOMED CT include those to ICD-9-CM [5, 6].

In 2010, the owners of SNOMED CT and ICD-10, the International Health Terminology Standards Development Organisation (IHTSDO) and the World Health Organization (WHO), agreed to a collaborative arrangement to develop cross maps between them. According to the press release, "This new agreement supports the aims of WHO and IHTSDO to enhance health through better health information [7].

Using foundational work of the IHTSDO Map Special Interest Group (MapSIG), the Mapping SNOMED CT to ICD-10 Project Group created a process and methodology for mapping SNOMED CT (July 2010) to ICD-10 Second Edition (2008) classification codes. Review by the IHTSDO Management Board of the project plan resulted in approval to develop a map for a priority list of SNOMED CT concepts. Prerequisites to beginning the work included:

- Establishment of a collaborative tooling environment.
- Assemblage of SNOMED CT and ICD-10 frequency use data from IHTSDO Member countries.
- Identification of a priority SNOMED CT subset.
- Development of mapping heuristics, methodology, and training materials.
- Recruitment and delivery of education and training to mapping personnel.
- Development of a validation and quality assurance procedure.

1. Methods

A map is defined as "a one-way or directed methodical link from individual concepts within one or more domains of a controlled vocabulary to one or more appropriate categories or concepts within another [8]." In the case of this project, the map is a link directed from the source SNOMED CT concept to one or more target ICD-10 Second Edition classification codes.

Two sub-project groups were established in the early stages of the project. The Education group was responsible for the development and deployment of the training plan for mapping personnel. The IHTSDO SNOMED CT to ICD-10 Map Tooling group was charged with creating a collaborative map tooling environment. A screen shot of the tool is shown in figure 1.

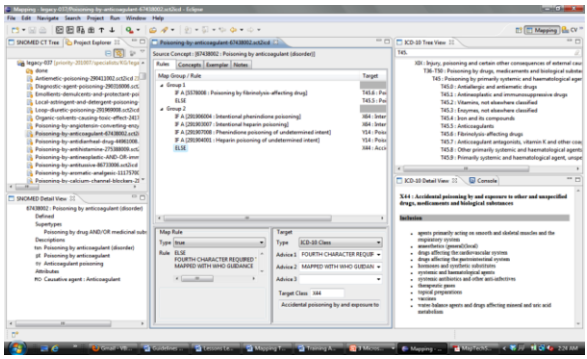

Figure 1. SNOMED CT to ICD-10 Mapping Tool Screen Shot

Three roles, map lead, map specialist, and consensus manager, were identified as being key to ensuring optimal quality, utility and reproducibility of the resulting map. These roles were the basis for creating workflow diagrams and procedures used by the Tooling group in tool development. They were also used in the preparation of the Education group's training plan prepared following the framework set out in Guidance on the Preparation of Terminology/Classification Mapping Personnel. This framework included role requirements, expected competencies, and the curriculum outline as well as annexes that provided examples of position descriptions, course syllabus, and core curriculum [9].

Individuals from the MapSIG led efforts to assemble SNOMED CT and ICD-10 frequency use data from IHTSDO Member countries and then identify a priority SNOMED CT subset based upon frequency of SNOMED CT concept use in clinical data repositories in IHTSDO Member countries. In the course of the analysis, around 7,000 concepts were found to have legacy maps, i.e., a map already existed between SNOMED CT and ICD-10, and approximately 2,800 concepts did not have legacy maps. The final selected subset consisted of approximately 9,800 pre-coordinated concepts with active status from the source domains of clinical findings, event, and situation with explicit context.

Mapping heuristics had previously been developed and tested by the MapSIG over the course of three separate prototype mapping exercises and was deemed ready for use by the mapping team. Heuristics were created based on editorial rules, conventions, structure, and purpose of the source and target systems. Examples include the definition of ambiguity, rules when the source concept asserts context, and situations where multiple target codes are necessary.

Map advice statements were also created. These statements are human-readable textual advice that a software vendor may employ to inform the clinician user or the classification expert during a semi-automated mapping session[10]. An example of map advice statement is "Possible requirement for morphology code."

A call for volunteers went out in hopes of recruiting individuals. Two map leads, one training and statistics coordinator, two consensus managers, and four map specialists volunteered. A third consensus manager was appointed by WHO. However, none committed to a full-time work load. After further analysis of project time lines and approval of funds from IHTSDO, two full-time contract map specialists were hired. The final mapping team was comprised of individuals from the United Kingdom, Canada, Sweden, and the United States. All were required to participate in the education and training program and to meet certain competency levels.

The mapping procedure consisted of grouping SNOMED CT concepts into batches of around 25 concepts and assigning them to a map specialist by the map lead. Legacy maps went to one map specialist. If there was discordance between a legacy map and map specialist map, the concept was assigned to an additional map specialist. Concepts without legacy maps were assigned to two map specialists.

Using the mapping tool, the mapping specialist mapped the SNOMED CT concept to one or more ICD-10 codes. Once a batch was completed, the map specialist submitted it via the tool to the map lead for review. The two maps were compared and the map lead reviewed the results. Discordances were discussed with the map specialists. At the conclusion of the discussion the team either reached an agreement on the map or it was forwarded to the consensus panel for a ruling. Consensus review involved an IHTSDO and WHO representative along with a third consensus manager who served as facilitator with final vote should one be needed.

To test the heuristics and methodology as well as the tool, 500 SNOMED CT concepts from the 9,800 were mapped. Results were discussed at the MapSIG meetings. Substantial revisions were not necessary so the work on the remaining concepts began March 2011 following an education and training session.

An independent validation of cross map content under the supervision of the American Health Information Management Association was conducted by a team of three content validation map specialists along with a statistician and project manager. The JAG was involved with development of the agreed methodology, activities and processes. A set of criteria for error types was established to support meaningful analysis of issues and patterns of discordance in the map affecting reliability and reproducibility.

2. Results

After the first 1000 maps were finalized, it was determined due to the difficulty of applying exclusion rule criteria stated in the technical documentation, a new exclusion handling rule procedure was needed along with new map advice. The rule involved the number of descendants of the concept being mapped. With this change, the expected project outcome grew from 9,800 to approximately 20,000 concepts.

Map specialists on average mapped 6.5 SNOMED CT concepts an hour. This was in line with budgeted expectations. Twenty-nine concepts required consensus review. Comments from an informal survey of the map leads and specialists included:

- Mapping requires specific knowledge and skills.
- Face-to-face training essential.
- Mapping work requires great attention to details.
- Hold regular team meetings throughout the project.
- Map specialists need to perform at a regular pace to keep the work moving.

A preview release of around 6,600 cross maps was made available September 2011. Included with the release was the Mapping SNOMED CT to ICD-10 Technical Specifications, Mapping SNOMED CT to ICD-10 Glossary, and a tab delimited UTF-8 dataset which can be imported into spreadsheet software such as Microsoft Excel®. Comments received included minor edits to the documentation with none on the map itself. The expected date of publication of the approximately 20,000 concepts is 31 May 2012.

Content validation discordance is undergoing analysis for patterns and the results will be included in the final report prepared for the JAG in the second quarter of 2012.

3. Discussion

While the publication of approximately 20,000 concepts is a good start to having all SNOMED CT concepts within scope mapped to ICD-10 codes, there are many without maps. Plans are being formulated to complete the mapping of the remaining SNOMED CT concepts to ICD-10 based on IHTSDO Member country priorities as well as establishment of a maintenance process, a procedure on how best to gather and respond to feedback from users, a help desk mechanism, and implementation guidance. Improvements to the training program, mapping technical specifications, and mapping

tool based on lessons learned are also underway. For example, one suggestion was to create an evolving handbook specifically for posting issues and decisions from team discussions.

A future usage validation process based on documentation from the "SNOMED CT to ICD-10 MAP Quality Assurance Plan" which establishes quality metrics for meaningful analysis of project results is also being prepared. This usage validation process is intended to address the map's purposes of providing a semi-automated coding of ICD-10 classification data from a clinical record which is clinically encoded in SNOMED CT and development of ICD-10 classification codes from SNOMED CT encoded records for use in registries and diagnosis groupers. Another purpose of the map is to serve as a SNOMED CT to ICD-10 map validated and sanctioned by WHO and the IHTSDO which may serve as a source for development of maps to ICD-10 extension classifications developed and maintained by a member country. One country, the United States, is using the SNOMED CT to ICD-10 map to create a SNOMED CT to ICD-10-CM map.

It is also anticipated any feedback on the May 2012 release of the map will be used towards improvement of it, updating to the latest versions of both SNOMED CT and ICD10, and assessing the overall maintenance process. In addition, the mapping methodology is being utilised in the development of a map between a reference set of SNOMED CT concepts to the International Classification of Primary Care, Version 2.

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