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Health Informatics — Terminology resource map quality measures (MapQual)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 215, *Health Informatics*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

Healthcare organizations and software vendors are increasingly using maps to convert data from one code system to another code system. In the past, data in health information systems was largely used for organizations' administrative planning and decision making. Data captured in Electronic Health Records (EHR) systems for patient care has a significant impact on patient safety. The use of this data as the source of data for other purposes and for information exchange in clinical care through the use of information technology is an emerging problem. Where that data is translated through maps from one code system to another, the safety and quality issues associated with data use can be significant. The increasing use of maps is costly.

The objective of this work is to support the definition of quality requirements for map sets to

a) establish standard quality conformance requirements for a map for a purpose,

b) assess the quality of a map for a purpose,

c) guide decision makers in map project requirements and processes, and

d) establish pathways to improvement.

Maps are widely used but the quality of these maps cannot be accurately and consistently assessed and compared against their intended use. It is not currently possible for decision makers to assess whether a map will be worth the cost of building and whether the scope and map processes will deliver a map which is able to meet the intended business case.

This document is based upon ISO/TR 12300[1]. Some terminological resources are so different in their content and purpose that they will never map closely to a resource designed and structured differently. Therefore, the decision maker might need to consider whether to map at all or to move to a new terminological resource.

Quality measures consider a wide range of requirements and processes relevant to the creation and maintenance of data maps and their use (including manual and tool-based mapping), as well as for the map sets delivered as a result of using that process.

0.2 Stakeholders and audience

This document is focused on the needs of

a) implementers and software vendors developing and implementing maps sets,

b) health information and data managers developing and using maps sets,

c) data users such as researchers, government, decision makers, and

d) developers of map sets including all in mapping teams including terminologists, coders, clinical users, epidemiologists and statisticians, project managers.

Additionally, the target audience for this document might include

— procurement officers who establish requirements of map product capacity and quality, or

— decision makers to determine and assess resources needed in projects and services associated with map produce, maintenance or use.

0.3 Challenges of mapping

Healthcare organizations and software vendors are increasingly using maps to convert data from one terminological resource to another terminological resource. In the past, data in health information systems was largely used for organizations' administrative planning and decision making.

Today, maps are being used for a much broader range of use cases and the challenges of their use include the following:

a) Map purpose — a map built for one purpose might or might not suit use for other purposes. It is important to establish the purpose and use of a map at the beginning of a project to ensure the best result when building a map from a source code to a target code. When the purpose changes, the resultant map content is likely to need to be different.

b) Map accuracy — there are three broad aspects to accuracy. The first is whether the map development and maintained. The second is how closely the results of applying the map deliver an outcome consistent in meaning to that of original source data. The third is the ability of the outcome of the map to be used for the purpose intended.

c) Map effectiveness — Information retrieval is a critical functionality of maps.

The actual consequence of assigned map links imposed between terms of different code schemes impacts the effectiveness of information retrieval searches. Map purpose and accuracy might both impact the potential safety and appropriateness of the use of that map in healthcare. If the original meaning is changed through use of a map, this might impact clinical safety. There is also the consideration of whether the map is applied consistently to defined data elements in the health record. The data element in which the original source data is recorded might add meaning to the code allocated (e.g. family history of condition versus clinical diagnosis of the individual).

Another significant issue is the cost of creation and maintenance of a map and the ongoing risk and difficulties of maintaining currency of the map.

More information on this topic is available in ISO/TR 12300.

If map quality is neglected, maps will continue to be classified in non-standard ways, increasing barriers to establishing the purpose, accuracy, effectiveness of the quality of terminological maps. The longer the international community is without a publication in this area, the more expensive the problem will be to resolve due to the persistence of legacy metadata and the cost of modifying existing mapping processes to fit an agreed specification; therefore, a TS solution is highly desirable.

Health Informatics — Terminology resource map quality measures (MapQual)

1 Scope

This document provides quality requirements for producing a quality map between terminological systems.

This document establishes measures which can be used to assess the quality and utility of a map between terminological resources in order to determine the types and levels of measure required for common use cases in healthcare.

NOTE Examples of such cases include conformity assessment.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
auto-matching
computational mapping task, undertaken using an algorithm based upon the relationship between *concepts* (3.5)

3.2
categorial structure
reduced system of concepts to describe the organization of the semantic categories in a particular system of concepts

Note 1 to entry: A categorial structure for body structure representation could include the categories for body system (e.g. skin, digestive) and anatomical location (upper body, abdomen).

3.3
classification
exhaustive set of mutually exclusive categories to aggregate data at a pre-prescribed level of specialization for a specific purpose

3.4
code system
organized, managed collection of codes each of which has associated designations, meanings and in some cases relationships, properties or rules

Note 1 to entry: Code systems are often described as collections of uniquely identifiable concepts such as ICD-10, SNOMED CT and LOINC. Code systems are often established and maintained by authoritative sources such as standards development organisations.

3.5
concept
unit of knowledge created by a unique combination of characteristics

Note 1 to entry: Concepts are not necessarily bound to particular languages. They are, however, influenced by the social or cultural background, often leading to different categorizations.

3.6
context
related conditions and situations that provide a useful understanding and meaning of a subject

3.7
currency of the map
map currency
difference between the date of release of the target and source terminological resources and the *map set* (3.16)

3.8
determinant
influencing element or factor

3.9
equivalence
semantic equivalence
condition of being equal or the same in value, worth or function

Note 1 to entry: In terminological systems, two concepts are (semantically) equivalent if their domain of meaning overlaps and their semantic definitions are interpreted as identical. In the context of terminological resources equivalence and semantic equivalence are often considered as synonyms.

3.10
individual map
index from one term to another, sometimes using rules that allow translation from one representation to another indicating degree of equivalence

Note 1 to entry: Entry in a map which indicates how to translate from an individual source concept to a target concept. The term map is often used to indicate a table of individual map entries. It is for this reason that the individual and map tables are being differentiated. A map is often computable. A map is the outcome of the mapping process. The use of this term is often used in ways which are confusing. It is essential to always make it clear whether one is referring to an individual map, or a map table (or set). In SNOMED CT, each individual map is represented as a row or group of rows in a map reference set. It links a single map source concept code (e.g. SNOMED CT Concept ID) to one or more codes in a map target (e.g. ICD Code).

3.11
priority map content
individual maps (3.10) in a *map set* (3.16) which are most important for a use case

Note 1 to entry: Importance might reflect the frequency of use or impact of the specific concepts being mapped. For example: a propriety map content set might be established to represent the most common diagnoses in hospitals for morbidity reporting and this could be the priority map content for a map from SNOMED CT to ICD based classification.

3.12
map
conversion
transformation
cross-map
device which provides an index from one *term* (3.19) to another, sometimes using rules that allow translation from one representation to another indicating degree of *equivalence* (3.9)

Note 1 to entry: The index is used to convert concepts in one code system or representation into concepts in an alternative code system or representation.

3.13
map quality determinant
attribute of a *map* (3.12), map development process, or map metadata that is considered a reliable measure of the suitability of the map to a use case

3.14
map quality measure
quantitative measure of the characteristics and attributes of a *map* (3.12)

3.15
map source
source mapping
terminology (3.21), coding scheme or *classification* (3.3) used as the starting point for map production

3.16
map set
map table
group of *individual maps* (3.10) used to convert a range of entries from source to target *code system* (3.4)

3.17
mapping
process of defining, building or using a relationship between *concepts* (3.5) in one coding system to concepts in another coding system in accordance with a documented rationale, for a given purpose

Note 1 to entry: Quality mapping will produce a usable map table, be a reproducible and understandable process. It is the relation with the best semantic correspondence between an element in one set and an element in another set.

3.18
semantic domain
semantic space
area of meaning covered by a *terminological resource* (3.20)

Note 1 to entry: This is used to evaluate the lexical or formal overlap between such resources. In value set specification this might also be called a value set domain.

Note 2 to entry: Terminology resources can include value sets, code systems, and subsets.

EXAMPLE One code system might have the domain of anatomy while another might have the domain of disease. Though these are related concepts, the semantic domain of each code system is different.

3.19
term
linguistic representation of a *concept* (3.5)

Note 1 to entry: A term can contain symbols and have variants, e.g. different forms of spelling terms are members of a terminology; a defined or limited vocabulary of terms or concepts, for example, ICD, SNOMED CT, LOINC.

3.20
terminological resource
controlled set of terms in healthcare

Note 1 to entry: These terms are usually designed and controlled for use with computers for specific healthcare purpose, such as data entry, aggregation, retrieval and analysis.

3.21
terminology
structured, human and machine-readable representation of *concepts* (3.5)

Note 1 to entry: This includes the relationship of the terminology to the specifications for organizing, communicating and interpreting such a set of concepts. The use of the term terminology in healthcare implies a terminology that is designed for use in computer systems. The word 'vocabulary' or 'health' or 'medical language' is used to indicate the broader idea of linguistic representation without the specification of computability.

4 Determinants of map quality

4.1 General

This document defines a set of quality determinants which cover the development and maintenance of map content, and the precision of the map between source and target content. The precision represents accuracy but also maintainability and usability.

Each determinant shall be measured separately in order to allow evaluation of purpose for use case, and in that sense, stand alone. The specific measures are listed for each determinant under "Measure". The lower the number allocated to the measure, the higher the quality of the map. These measures are intended to be used to assess the quality of a map. The required level of conformance for each determinant differs according to the use case for which the map is intended. Clause 5 covers map quality measurement and requirement specification for specific use cases, explaining how to apply the determinant measures of map quality.

4.2 Terminological resource capacity

4.2.1 General

To assess the quality of a map, it is necessary to understand the capacity and intent of the source code system and target code system, and the relationship between how each of these code systems represent concepts.

4.2.2 Determinant 1: Common categorial structure

Evaluate whether the target and the source terminological resource share the same categorial structure.

This determinant seeks to specify whether the structure of each system is common.

EXAMPLE

If one terminological resource has a structure which includes

— clinical findings,

— substances, and

— events

And the other has a structure of

— body systems

The terminological resources do not share a common categorial structure.

The degree of commonality affects the ability to produce a meaningful map. If there is no categorial structure, or such a structure is not applied to the terminological resources, the ability to map between terminological resources is less likely to deliver a high-quality product. The impact upon quality might differ depending on the intended use case.

Categorial structure represents the structure within a semantic domain. Maps may be developed across an entire categorial structure or a part of that structure, depending upon the semantic domain intended for use in the map.

Measure:

0 — source and target terminological resources share the same categorial structure.

4 — source and target do not share the same categorial structure.

4.2.3 Determinant 2: Shared semantic domain

The ability to map one terminological resource to another assumes that each terminological resource shares a common scope of meaning, i.e. that the code system for apples applies to apples and the second code system for fruit also includes apples, if each code system does not share some concepts, it is not possible to produce a meaningful map between these code systems. It is necessary to assess whether the semantic domains are the same, overlapping, inclusive or without overlap. To evaluate the likely utility of a map, it is necessary to consider the amount of overlap.

The same semantic domain is where both terminological resources describe the same content, though they may describe it in different ways, with different categorial structures.

EXAMPLE

a) The categorial structure is different to the thing (the object the intangible concept of an apple – the apple itself) being described by the code (a code which represents an apple).

b) The semantic domain is different — one is describing the thing and its uses while the second describes the suitable uses — the intended meanings differ. This provides an overlap of semantic domain which might or might not impact the quality of the map or the usability of the map.

Terminological resource 1 describes apples as eating or cooking apples, this might include additional attributes such as apple colour, origin, cultivar, etc.

Terminological resource 2 describes apples by colour and suitable uses.

Each terminological resource describes apples though the categorial structures are different. In the example of apples, each concept has the attributes of colour and use, which are areas of overlap, between these terminological resources but do not share other key attributes such as origin, cultivar.

Where the attributes are represented differently in each code system but share a semantic domain, it can be possible to map these concepts. Table 1 shows a shared semantic domain which would result in a quality map. Table 2 indicates how shared semantic domain is to be measured.

Table 1 — Example of shared semantic domain

System A	System B	Meaning
1	M	Male
2	F	Female
3	I	Indeterminate
9	U	Unknown or not provided