



Guidelines for Translation of SNOMED CT®

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Table of Contents

1 Introduction.....	6
1.1 Purpose and scope of this document	6
1.1.1 Assessment of translation quality	7
1.1.2 Change requests	7
1.1.3 Feedback	7
1.2 Target group	8
2 An introduction to terminological principles	9
2.1 Concepts and terms	10
2.2 Concept systems.....	11
2.3 Definitions	12
3 SNOMED CT® as a health terminology	13
3.1 The multi-hierarchical and multi-axial structure of SNOMED CT®.....	13
3.2 Fully specified names (FSNs) and Preferred terms (PTs).....	15
3.3 IHTSDO Style Guides/Editorial policies.....	16
3.4 SNOMED CT® definitions, attributes and relationships	16
4 Translating SNOMED CT®	18
4.1 Basic approach	18
4.1.1 The principle of concept based translation: a key issue!	19
4.2 General linguistic principles.....	20
4.2.1 What to do with ambiguities in the source language	21
4.2.2 Selecting the best term for the concept	21
4.2.3 Concept equivalence problems	22
4.2.4 Translation techniques and syntactical issues	23
4.2.5 Choice of lexical variants	25
4.3 Specific linguistic principles	25
4.3.1 Organism names (bacteria, viruses, plants, animals, etc.).....	25
4.3.2 Chemical and biochemical designations, ingredients in medications, enzyme and hormone names ..	26
4.3.3 Foreign (loan) words and foreign abbreviations	26
4.3.4 Eponyms.....	27
4.3.5 Determinate <i>versus</i> naked form	27
4.3.6 Plural <i>versus</i> singular	27
4.3.7 Lower case <i>versus</i> upper case letters	28
4.3.8 Punctuation, typographical signs, symbols, and digits	28
4.3.9 Abbreviations and measurement units	29
4.3.10 Hyphens.....	29
4.3.11 Other issues.....	29
5 Sources of information	31
5.1 References made available in electronic form	31
5.2 Recommended internet references	32
6 Translation process and post-translation issues.....	33

6.1 Translation	33
6.2 Review	33
6.3 Editing.....	33
6.4 Progress monitoring and follow-up	34
6.5 Post-translation issues	34
7 Supporting documents	35
8 Appendix A: Translation Quality Assessment.....	37

Table of Figures

Figure 1 – The semasiological approach as opposed to the onomasiological approach.	9
Figure 2 – Ogden-Richard's triangle	10
Figure 3 – Generic versus partitive concept system.....	12
Figure 4 - The SNOMED CT® Root Concept and the immediate subordinate concepts	13
Figure 5 - Example of how concepts are arranged in a hierarchy	14
Figure 6 - Example of how concepts may have more than one superordinate concept	15
Figure 7 - Example of literal translations performed without an understanding of the underlying meaning.....	19
Figure 8 - Suggested process for translation workflow steps	20
Figure 9 - Examples of translation techniques with description of the morpho-syntactical structure of the source language and the target language terms	24

1 Introduction

SNOMED Clinical Terms® (Systematized Nomenclature of Medicine Clinical Terms) is a comprehensive clinical **terminology** that is used to code, retrieve, and analyze health data. It constitutes a basis on which healthcare organizations can plan and document health processes, perform outcome and result researches, analyze healthcare quality and costs, and develop effective therapeutic recommendations. It resulted from the merger of SNOMED RT® and Clinical Terms Version 3. The terminology is comprised of concepts, terms and relationships that are necessary to precisely represent clinical information across the scope of health care.

SNOMED CT® comprises 350,000 active concepts represented by some 1,000,000 descriptions, i.e. "Fully specified names", "Preferred terms", and synonyms. Thus, one concept may be **represented** by several descriptions. The concepts are arranged in so-called **hierarchies** (systems of concepts) covering areas like symptoms and signs, disorders, operations, treatments, drugs, administrative items, etc. – i.e. all these categories of information are needed in a health record.

As explained by Spackman and Reynoso (Spackman et al. 2004), it is "a terminological resource designed to be implemented in software applications to represent clinically relevant information reliably and reproducibly" (further information concerning the history of SNOMED CT® may be found in the introductory sections of their article).

1.1 Purpose and scope of this document

This document describes, formulates recommendations, and establishes guidelines on important and common issues relevant to the translation of SNOMED CT®. Some guidance will also be provided for actual terminology issues such as inconsistencies.

It is crucial that those involved in the translation, verification, validation, and approval processes are familiar with the terminological principles on which SNOMED CT® is based. It is equally important that they comply with IHTSDO Style Guides and that they are conscious of issues such as the choice of lexical variant, term requirements, translation techniques, and the importance of ensuring linguistic consistency.

These general guidelines may be used as a template to develop national guidelines. In addition to linguistic and terminological guidelines, this document includes general recommendations about the steps involved in a translation workflow process, and, information about source documents or references that must be made available to those involved in the translation process.

It is not within the scope of these guidelines to discuss the types of inconsistencies and mistakes on a term as well as a concept level that are inevitably contained in a terminology of this amplitude. However, it is important that those involved in the translation process are aware that sometimes, their inability to understand a given term or concept may be caused not by their own lack on insight, but actually by a mistake or an ambiguity in the core terminology (international release) that need to be corrected. SNOMED CT® undergoes constant improvement, mistakes are corrected, and ambiguities are dealt with. To ensure this constant enhancement of SNOMED CT®, any translation team should

register questions, comments or suggestions and forward these to the IHTSDO in order to avoid spending extra time on unsolvable issues and at the same time contribute to discovering any mistakes and ambiguities. Currently, questions and remarks from the translation teams are dealt with by the IHTSDO request submission process.

This document is a companion guideline for use in conjunction with the “*Guidelines for Management of Translation of SNOMED CT®*”, which comprises recommendations regarding management of a translation project.

1.1.1 Assessment of translation quality

Translation Project Owners (TPOs) should strive to ensure that translations comply with the principles on which SNOMED CT® was originally based (comprehensibility, reproducibility, usefulness) and that the information contained in the translated concepts is semantically equivalent to that contained in the core source terminology (international release). The IHTSDO has developed a document describing how to assess translation quality and evaluate the level of compliance. The document entitled “A methodology and toolkit for evaluating SNOMED CT® translation quality”, outlines and defines a number of requirements or “quality characteristics” (QCs) and associated metrics.

There are three types of QCs. In the context of translation quality, structure QCs that relate to the management and organisation of the translation project, process QCs that relate to the activities taking place during the actual translation, and outcome QCs that relate to the target language translation result. A “short-list” of (9) QCs was identified and for each QC, quality metrics (what and how to measure, how to evaluate, etc.), sample questionnaires (to assist with the evaluation) were developed, and, an overall “rating” assigned.

It is recommended that TPOs refer to Appendix A of this guideline and to the methodology and toolkit document to ensure that they incorporate any quality metrics designated **mandatory** for use into their project and quality plans. Metrics to measure translation quality may also be re-formulated as contractual clauses in formal agreements between a TPO and a Translation Services Provider (TSP) for services and service levels to be provided.

1.1.2 Change requests

As mentioned, queries regarding inconsistencies, mistakes, or suggestions of changes to the core terminology (international release) should be addressed via the IHTSDO request submission process.

1.1.3 Feedback

This document was originally created as one of the key deliverables of the former Translation Standard Processes Project Group (TSPPG), under the guidance and direction of the Translation Special Interest Group (SIG).

The Translation Special Interest Group (SIG) collect suggestions for changes or amendments to the present guidelines. At least one month prior to an IHTSDO annual meeting, feedback should be sent to the Chair of the SIG and the IHTSDO Chief Quality Officer who will review the feedback submitted and determine how any necessary updates to the Guidelines will be made.

1.2 Target group

The target group for this document is all those directly involved in the process of translating SNOMED CT® into another language, i.e. translators, reviewers, subject matter experts, validators, as well as managers and members of an editorial board or equivalent group of experts who establish the linguistic and terminological guidelines for the specific target language translation.

2 An introduction to terminological principles

This section is dedicated to the explanation of basic concepts and ideas within the science of terminology.

The basic idea in the science of terminology is an **onomasiological approach** (concept-based approach) as opposed to a **semasiological approach** (term/word based approach) that is applied in lexicography. With an onomasiological approach, the starting point is the **concept**; with a semasiological approach, the starting point is the linguistic expression, i.e. the **word/term**.

While a lexicographer would ask the question "How many meanings could this term have/how many different concepts could be reflected by this term?" a terminologist will ask "Which terms could reflect this particular concept?"

The semasiological approach will reveal the existence of **homonymy** and/or **polysemy**: **homonyms** are identical designations representing different concepts (for example *race* = taxonomic distinction of human beings and *race* = competition of speed); in case the designations have the same origin/if they share etymologies, they are referred to as **polysemes** (for example *bed* = piece of furniture and *bed* = the ground under a body of water).

The onomasiological approach will reveal the existence of **synonymy**: synonyms are different designations representing the same concept.

Figure 1 below illustrates the difference between the semasiological and the onomasiological approach, respectively:

- The word *drug* may represent various different concepts (polysemy);
- The concept "green jasper with red spots" may be represented by the words "heliotrope" or "bloodstone" (synonymy).

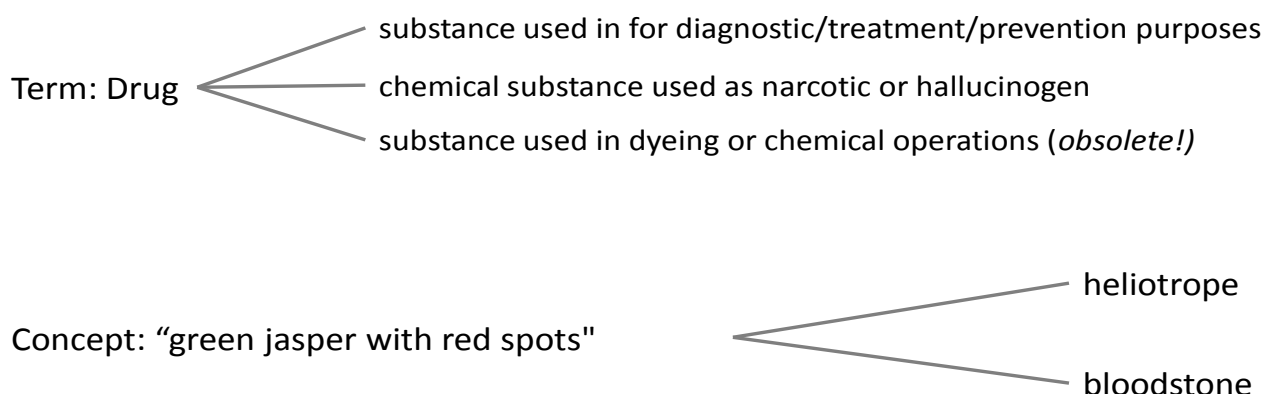


Figure 1 – The semasiological approach as opposed to the onomasiological approach.

The recommended approach to use is that applied within terminology, i.e. the onomasiological approach.

2.1 Concepts and terms

According to ISO Standard 1087-1:2000, a **concept** is a "unit of knowledge created by a unique combination of characteristics". In other words, the concept corresponds to the image or idea created in our brains when we are presented with an **object** in our surroundings. The object may be physical, such as a car, or abstract, such as speed.

Any concept may be represented by a **designation**, which, in this context, would be a **term**. In other contexts, the designation could be a drawing or a photograph.

The concept, i.e. the unit of knowledge/idea/thought, forms the connection between the object and the designation.

In ISO Standard 1087-1:2000, this designation is defined as a "representation of a concept by a sign which denotes it", and a term is the "verbal designation of a general concept in a specific subject field". The term will denote a concept, and a concept will refer to a particular object.

Traditionally, these principles are represented in the so-called Ogden-Richard's triangle showing the relation between the object, the concept, and the designation = the term:

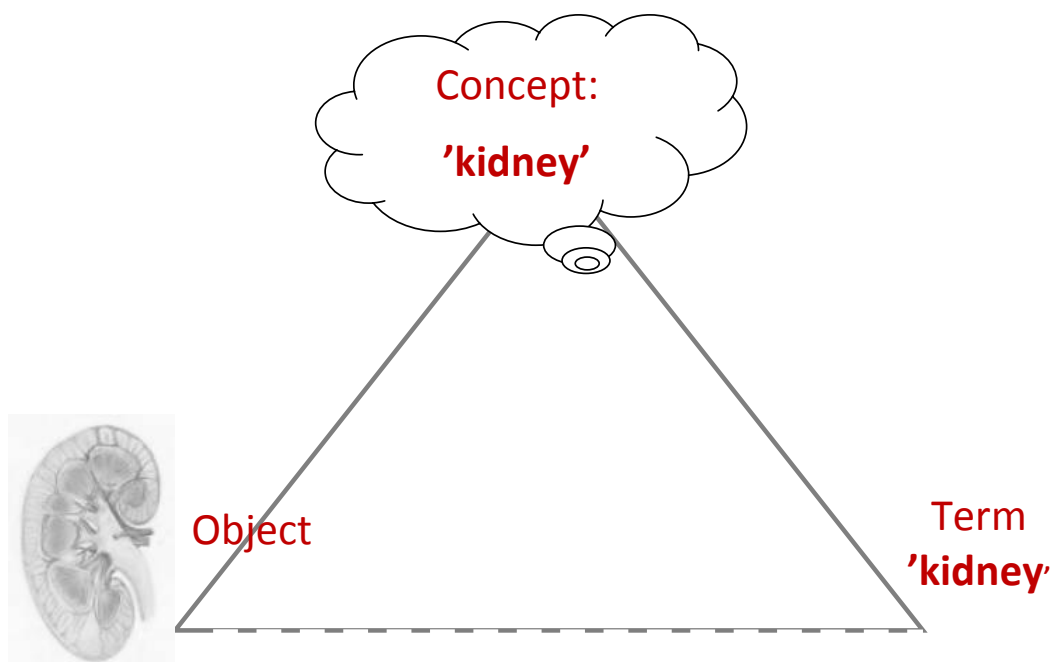


Figure 2 – Ogden-Richard's triangle

The dotted line between the object and the term indicates that there is not a direct connection between the two, since, in order to designate the object, an intellectual activity in the form of concept representation in the brain is necessary.

From a terminology perspective, a kidney is an existing, physical object. The idea of “kidney” that is formed in our brain when we are presented with such an object, is the concept. If we want to express this concept or idea, this can be done by using a term – *kidney*.

Even with an abstract object like democracy, the same procedure would be valid: it becomes a concept once we form the idea in our brain, and it may be represented linguistically by the word/the term *democracy*.

2.2 Concept systems

Whenever we are presented with an object, we automatically perceive its position in some kind of organised system – provided, of course, that experience tells us where it belongs. In the case of *democracy*, a concept known to most people, it would automatically be placed in our mind as a “type of government” – i.e. we would conceive it as belonging to the level right below the concept *government*. Therefore, utilising **concept systems** is an extremely valuable and useful exercise in many contexts.

They allow us to place an unknown concept in a semantic context and give us a good idea of the importance, or, the “size” (magnitude) of specific concepts in relation to other concepts. Therefore for didactic purposes, in connection with translation work as well as for storing and retrieving information in a systematic way, concept systems are also extremely useful.

There are various principles that may be used when establishing a concept system: typology, partition, chronology to name a few. The most common systems are based on **generic relationships** (IS-A - relationships) and **partitive relationships** (PART OF - relationships). In these systems, each concept belonging to the hierarchy is a TYPE OF and respectively a PART OF the immediate **superordinate concept**. In a generic system, a *metacarpal bone* could be considered as “a type of bone of hand”, whereas in a partitive system, a *metacarpal bone* could be considered as “part of the bone structure of hand”.

In a generic system, the **subordinate concept** will be differentiated from its superordinate concept by means of at least one particular, distinguishing characteristic.

In a representation of a concept system, one will always find the generic concepts at the top levels and the more specific or “granular” concepts further down. Following, are two examples of parts of simple concept systems based on generic and partitive relationships, respectively:

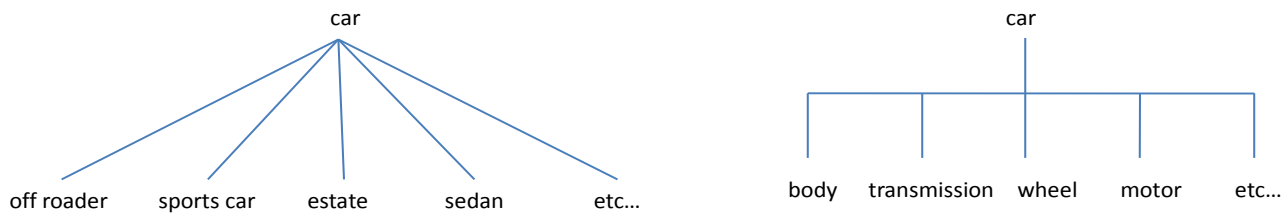


Figure 3 – Generic versus partitive concept system

It is possible to establish “combined” concept systems that contain both generic and partitive relationships. For these guidelines however, we are only considering systems where the hierarchical relationships are solely generic OR partitive.

It is obvious that an arrangement with oblique lines (when the relationships are generic) versus straight lines (when the relationships are partitive) would present serious layout problems because of the increasing number of permutations at lower levels. Therefore, it is very common to present the system on a vertical scale where each level is illustrated by means of a new tabulated paragraph. That way, concepts belonging to the same level (which are known as **coordinate concepts**), are lined up one beneath another, while any subordinate concept will be placed below and to the right of its superordinate concept.

This is the way concepts are presented of each of the SNOMED CT® hierarchies (see Figure 4 below).

2.3 Definitions

According to ISO 1087-1:2000, a **definition** is a "representation of a concept by a descriptive statement which serves to differentiate it from related concepts".

To define a concept may take just a few words or it may entail a long phrase. Ideally, the definition will be based on the immediate superordinate concept in the concept system.

In the example of *sedan* above, it could be defined as a "closed car having two or four doors and front and rear seats" (i.e. a type of *car*), and the *transmission* could be defined as a "set of mechanical parts in a car that transmits power from the engine to the wheels" (i.e. a part of *car*). In both cases, there is a reference to the immediate superordinate concept, and in the case of the generic definition, the particular, distinguishing characteristic(s) is/are added.

Instead of such narrative definitions, the “descriptive statements” which serve to differentiate concepts from one another may be expressed in description logic. This principle is applied in SNOMED CT® where the concepts are defined by their hierarchical and defining attribute relationships. See chapter 3.4 “SNOMED CT® definitions, attributes and relationships” for further explanations.

3 SNOMED CT® as a health terminology

The following sections outline the main characteristics of the structure of SNOMED CT® and particular aspects which are of interest for the translators. Further, definitive, information about the structure of SNOMED CT® is described in the SNOMED CT® User Guide and SNOMED CT® Technical Implementation Guide.

3.1 The multi-hierarchical and multi-axial structure of SNOMED CT®

The SNOMED CT® concepts belong to a system of concepts arranged in a number of generic (IS-A) **hierarchies** according to the **semantic** areas to which they belong. The concepts are arranged in hierarchies covering areas of medical or clinical information such as Body Structure, Clinical finding, Procedure, Substance, and others. Terms representing concepts related to non-clinical information needed for patients' health records are also included. They may be found in hierarchies such as Event, Environment or geographical location, or Physical object:

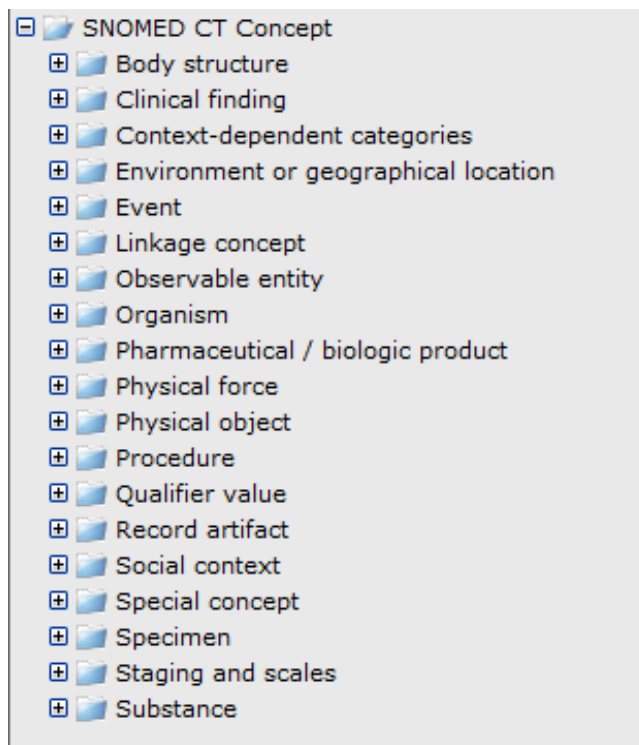


Figure 4 - The SNOMED CT® Root Concept and the immediate subordinate concepts

The further one descends in a hierarchy, the more specific are the concepts found. The lowest levels of a hierarchy such as Clinical finding, represent concepts carrying very detailed clinical characteristics. This principle is referred to as **granularity** – which increases within a hierarchy.

For practical reasons, all hierarchical relationships in SNOMED CT® are generic (IS-A relationships). Another way to express this is to say that all relationships within a hierarchy are "supertype-subtype relationships". As mentioned previously in connection with the explanation of generic concept systems, the subordinate SNOMED CT® concept will be differentiated from its superordinate concept by at least one particular, distinguishing characteristic.

A concept such as *diabetic cataract associated with type I diabetes mellitus* placed in the Finding hierarchy is a type of *diabetic cataract* which is a type of *diabetic oculopathy* which is a type of *diabetic complication* which is a *disease* which is a type of *clinical finding*:

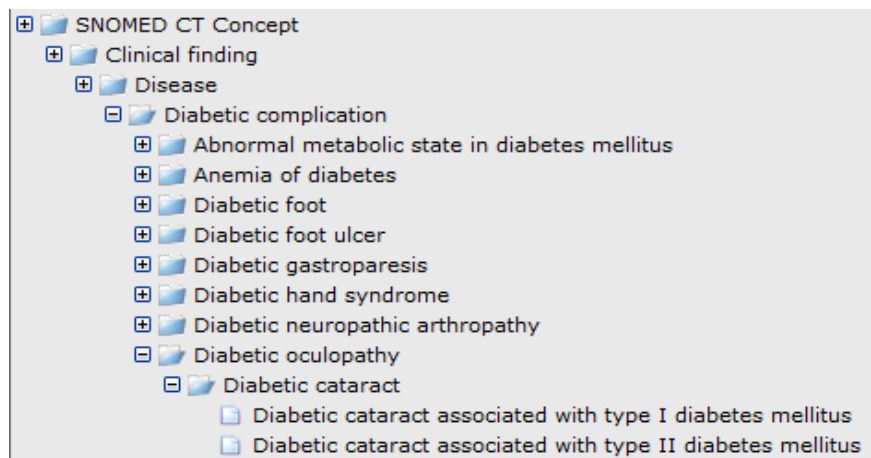


Figure 5 - Example of how concepts are arranged in a hierarchy

The concept *diabetic cataract associated with type I diabetes mellitus* is represented by one **fully specified name** (FSN) - *Diabetic cataract associated with type I diabetes mellitus (disorder)* and one suggested **default preferred term** (PT) – *Diabetic cataract associated with type I diabetes mellitus*. For this example, there are no synonyms attached to the concept.

The multi-axial aspect of the terminology means that a concept may have more than one superordinate concept. A concept such as *excision of fragment of bone belonging to the Procedure* hierarchy, for example, has two immediate superordinate concepts:

- it is a type of *excision of bone*, as well as
- a type of *removal of bone fragments*.

This is represented in the graphic view below:

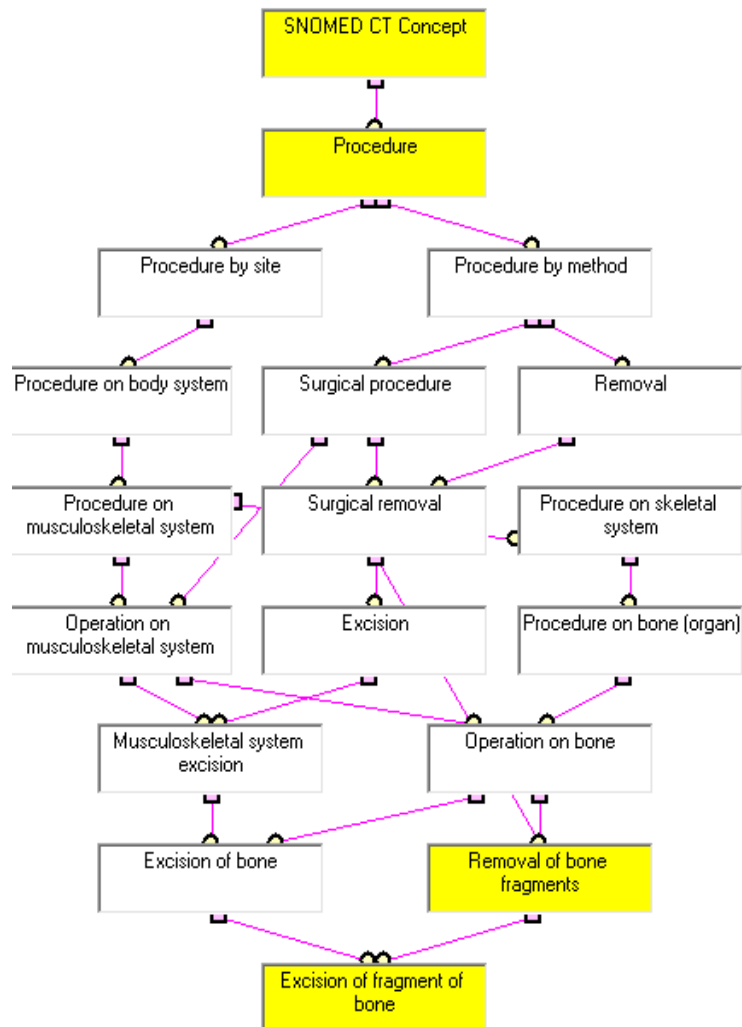


Figure 6 - Example of how concepts may have more than one superordinate concept

3.2 Fully specified names (FSNs) and Preferred terms (PTs)

Each concept is represented by one **fully specified name (FSN)** and one suggested **default preferred term (PT)**. Furthermore, a number of **synonyms** may be related to the concept.

While the fully specified name is intended as the full description of the underlying concept, the preferred term would normally be the one used to represent the concept in a clinical setting.

Each national edition of SNOMED CT® must include at least one fully specified name and one preferred term to represent every concept. In addition to a fully specified name and a preferred term, some SNOMED CT® concepts also include an explanation.

All fully specified names must be unique. For example, *Hematoma (morphologic abnormality)* is a fully specified name that represents the description of what the pathologist sees at the tissue level,

whereas *Hematoma (disorder)* is a fully specified name that indicates the term that would be used to describe the clinical diagnosis of a hematoma by a general practitioner. The preferred term *hematoma* could be used to represent both concepts.

More information about concept designations may be found in the SNOMED CT® User Guide.

3.3 IHTSDO Style Guides/Editorial policies

It is important that translators familiarise themselves with the IHTSDO Style Guides for each domain. For example, when translating the Body structure hierarchy, translators will be presented with a large number of concepts that are represented by terms containing the word "structure", "part of", "entire" and "all", which should be interpreted with caution. For a full explanation of this, translators and other translation team members should refer to the IHTSDO SNOMED CT® Editorial Guide, ver 3.2 (2012.07.31) .

3.4 SNOMED CT® definitions, attributes and relationships

Each concept is linked to the immediate superordinate concept by means of an IS-A relationship. In SNOMED CT®, a concept may have several supertype relationships, and it may be linked to one or more concepts in other hierarchies by means of attribute relationships.

Together with the hierarchical relationships, the attribute relationships make up a definition of the SNOMED CT® concept (as opposed to a textual definition). Each defining or qualifying characteristic of the concept is represented by a relationship composed of an **attribute + a value**.

A concept, such as *appendicitis*, may be represented in several ways. For example, from an etymological point of view, the word is derived from the Latin word *appendix*, which means an adjoined or annexed thing, and the suffix *-itis*, which means inflammation; therefore, the definition of the concept is "inflammation of the appendix". However, the term *appendicitis* is usually sufficient for those acquainted with this terminology. In a systematized terminology like SNOMED CT®, an identifier can be used for representing this concept by assigning a number or code. In SNOMED CT® the concept *appendicitis* has the Concept ID 74400008 (a unique identifier).

Similarly, the concept *cellulitis of foot* has two superordinate concepts (IS A relationships), namely "disorder of foot" and "cellulitis of leg". It points concurrently to

- a concept in the Inflammatory disorder sub-hierarchy by means of an attribute relationship composed of the attribute ASSOCIATED MORPHOLOGY + the value "cellulitis" chosen among the Inflammatory disorder sub-hierarchy concepts

- a concept in the Body Structure hierarchy by means of an attribute relationship composed of the attribute FINDING SITE + the value "foot structure" chosen among the Body Structure concepts.

This may be illustrated as follows:

- cellulitis of foot
- IS-A disorder of foot
- IS-A cellulitis of leg
- ASSOCIATED MORPHOLOGY cellulitis
- FINDING SITE foot structure.

With the exception of the SNOMED CT® root concept, all concepts are logically defined by their relationships, and it is also possible to generate a narrative format of the definition of a concept from its hierarchical and defining attribute relationships.

4 Translating SNOMED CT®

SNOMED CT® is a terminological resource that can be translated. SNOMED CT® is a clinical terminology increasingly guided by ontological principles. It is not within the scope of these Guidelines to discuss the inconsistencies of the terminology, but it should be mentioned that the core SNOMED CT® terminology (international release) is not perfect and that for this reason, SNOMED CT®'s architecture is undergoing major changes for improvement. These facts call for vigilance on the part of the translation team members who need to review and analyse the relationships of each concept in order to elucidate the meaning of a term within the terminological context.

SNOMED CT® is a comprehensive terminology designed to meet the needs of a broad group of health care professionals in a range of settings. An important aim as described in the User Guide is “to ensure understandability, reproduceability and usability”. Therefore, an effort should be made to provide terms that reflect the underlying concepts and ensure that they are not only understandable, but also psychologically acceptable and clinically relevant to the clinician.

The semantic equivalence of concept representation is an issue of paramount importance. The basic objective of any SNOMED CT® translation is to provide accurate and unambiguous descriptions of SNOMED CT® concepts in the target language. Therefore, a principle of *concept-based translation* must be used. Defining a set of national linguistic guidelines, including syntactical, morphological, and orthographic rules, to support that approach, is also crucial.

4.1 Basic approach

Interdisciplinary collaboration and vigilance regarding form as well as clinical relevance are of foremost importance in order to ensure the usability of the terminology in connection with implementation in electronic health record systems: the linguistic as well as the semantic quality must be assured.

The overall approach for the translation process should be one of close collaboration between specialists within health and/or informatics, and linguists/terminologists. As pointed out by healthcare professionals and terminologists, interdisciplinary collaboration is crucial in terminology work (Infoterm 2005). A translation based solely on linguistic, morphological-syntactical analysis might result in a seemingly correct term which would not adequately represent the concept in question, nor be used by healthcare professionals. On the other hand, compliance with linguistic, systematic, and orthographic principles is necessary in order to avoid confusion and ensure the practical applicability of the terminology.

In practice, this means that a set of basic principles regarding the morpho-syntactical structure of the terms to secure consistency must be followed, but in the case where serious conflicts with daily clinical language occur, the clinical use should prevail.

The following sections address the main problems that translators may meet in an attempt to ensure that the right balance is obtained providing consistent, usable and clinically acceptable terms in the target language terminology.

4.1.1 The principle of concept based translation: a key issue!

The translation of complex terms presented to the translators producing a target language terminology requires a relatively high level of terminology domain insight in order to ensure that any target language word or phrase chosen is an exact representation of the source language concept. The translation team must pay attention to the necessity of understanding the meaning of the source language term, including consideration of the hierarchical position of the concept, and, the relationships of the concept to other concepts.

Ex. no.: Original term	Correct translation [language]	Actual translation [language]
Ex. 1: sore bottom	ømt sædeparti [Danish] = "sore bottom"	øm bund [Danish] = "sore lowest point of [f.ex. a pit]"
Ex. 2: open reduction of volvulus of cecum	réduction d'un volvulus caecal par voie ouverte [French] = <i>reduction of a volvulus of cecum with open access</i>	réduction d'un volvulus caecal à ciel ouvert [French] = "reduction of a volvulus of cecum in the open air"

Figure 7 - Example of literal translations performed without an understanding of the underlying meaning

As seen in the preceding examples, an inadequate understanding of the underlying meaning leads to nonsensical target language translations.

It is recommended that following translation workflow steps illustrated in figure 8 are followed:

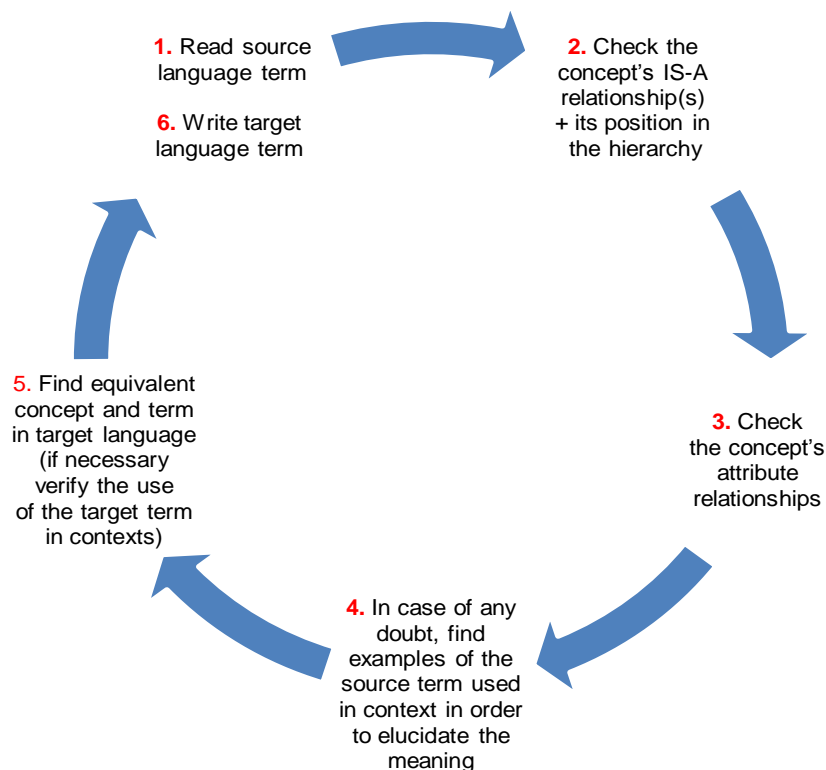


Figure 8 - Suggested process for translation workflow steps

4.2 General linguistic principles

As mentioned above, a national edition of SNOMED CT® may need to take into consideration local linguistic requirements. Therefore, the importance of establishing a set of linguistic guidelines, including syntactical, morphological, and orthographic rules, must be stressed.

The overall principle should be that since the target group of the national edition of SNOMED CT® are professionals, a high level of quality **LSP** (Language for Specific Purpose) terms should prevail. It is recommended that some preliminary, general principles regarding the choice of lexical variant are established before the translation work commences. In the Danish and German languages, for example, it is common to use pure Latin or Greek within the anatomy domain, whereas diagnostic terms, or, terms describing procedures are often **hybrids** (also called **neoclassical compounds**), or, in some cases even national terms. Colloquial expressions (“slang”) should be avoided when translating; if necessary they may be added as synonyms afterwards.

Recommendations or policies established by a national language council, authority or board should, in general, be followed. It may however, be necessary to formulate a number of specific morphological and orthographic rules applicable to the target language terminology. Also, specific practices relating to the constructions of medical terms published in national medical journals should be taken into consideration.

The following sections summarise the main linguistic and terminological issues that must be considered for the target language terminology:

4.2.1 What to do with ambiguities in the source language

In case of ambiguities in the international release, there is a risk, if a word-to-word translation is performed, that the ambiguity is replicated in the target language. Therefore, it is recommended that if the source language description is ambiguous to forward the issue to the IHTSDO via the request submission process, and then the translation is reviewed after a reply is received.

4.2.2 Selecting the best term for the concept

Within the science of terminology, it is generally accepted that certain requirements must be complied with in order to ensure terms of high quality. The translation of SNOMED CT® not only demands interdisciplinary cooperation and reviews, but also calls for defining and respecting specific requirements. The primary requirements and important considerations for a translation of a clinical terminology containing acceptable terms may be summarised as follows (these requirements are particularly important with regard to the fully specified names and the terms intended for clinical use; synonyms tend for example to be more ambiguous):

- **unambiguity**
- **linguistic correctness** (national syntactical and orthographic rules must be complied with)
- **transparency/motivation** (a term should be immediately understandable and self-explanatory, i.e. it should reflect the characteristics of the underlying concept)
- **international recognisability** (terms based on Latin and Greek word elements should be preferred)
- **psychological acceptability** (clinicians' preferences and practice should be taken into account whenever possible)
- **systematicity and consistency** (similar morphological and syntactical solutions should be sought for terms covering semantically similar concepts).

Unfortunately, these requirements will often be in conflict. Psychological acceptability tends to be an obstacle to compliance with several of the principles:

Commonly used and accepted **eponyms** such as *Apgar score* or *Down syndrome* are at odds with the wish for transparency, and the wide-spread clinical preference for eponyms is also in conflict with international recognisability. Furthermore, the random habits or practices of using noun+noun or adjective+noun constructions or prepositional phrases challenge systematicity and consistency (such as *tibia adamantinoma* versus *tibial torsion* or *fracture of tibia*).

For these reasons, not all SNOMED CT® terms – neither source language nor target language terms - can be expected to meet all the requirements. In fact, changing a term because it does not meet one requirement may result in inconsistency with respect to another requirement.

Therefore, the group responsible for establishing rules and principle decisions for the translation of SNOMED CT® into a specific target language, will have a difficult task trying to comply with the

principle of making general, as well as individual decisions, which are justifiable not only from a terminological and linguistic, but also from a psychological and clinical point of view.

Question to be considered: Is it possible to define a set of rules for the target language terminology to prioritize the term requirements?

4.2.3 Concept equivalence problems

4.2.3.1 National or cultural variations

Social or cultural differences complicate translation and particular attention should be paid to the issue of concept equivalence, or lack thereof. Due to the historical evolution of SNOMED CT®, parts of the source language terminology are based on British or American administrative structures or clinical practices which may not necessarily be globally acceptable. This is currently seen in several of the sub-hierarchies of hierarchies within the international release such as *Social context*, *Regime/therapy*, *Environment or geographical location*, *Substance* and *Pharmaceutical/biological product* hierarchies. In connection with drug and vaccine concepts, there may be important equivalence difficulties regarding the way to represent drug dose form etc. At the same time, the local regulations may dictate which drugs should be included in the national edition. Therefore, *Pharmaceutical/biological product* is an example of a hierarchy that needs a complete revision involving local pharmacologists in order to be adapted to the local needs, preferably to establish a national extension.

Although it would normally be possible to obtain a reasonably understandable national term for each concept, the local usability of such culture-dependent concepts remains an issue. Therefore, it may be necessary to elaborate new sub-hierarchies within a national edition that address those needs. In summary, it is recommended that, before starting the translation process, those sub hierarchies containing concepts that are not internationally valid are identified. The decision as to how to deal with these concepts should be taken locally.

4.2.3.2 False Friends

Even concepts which are seemingly equivalent may not prove to be so. Certain words are similar in both the source and target languages, but have followed different evolutionary paths through the years and subsequently acquired different meanings. This phenomenon is commonly referred to as “false friends”. Following, are a few examples:

The English term *typhus* and the Danish term *tyfus* would seem to reflect the same concept. However, the correct translations would be *typhus* in English = *plettyfus* in Danish and *typhoid fever* in English = *tyfus* in Danish. Similarly, one might think that the English term *assertive* should be *asertivo* in Spanish, however, in English it means energetic/resolved, but in Spanish it is a quality of assertion in the sense of affirmation.

Similar problems arise when a term covers a broader concept in one language than in the other. This is the case with the English words *substance* and *drug* which are constituent parts of a number of terms: translating *substance* into *substans* in Danish would be acceptable in some cases, in others it would be nonsense. As for *drug*, which is a **holonym** with a broad semantic coverage in English, there is not a similar word or concept, in Danish - the solution is to find the **meronym** in Danish which may best represent the concept for each individual case.

Question to be considered: Are the translators, reviewers and other team members sufficiently aware of the issue of equivalence, i.e. the importance of applying a concept-based and not a term-based or word-based translation?

4.2.4 Translation techniques and syntactical issues

Within a functionalist translation approach, various techniques may be applied as described by Molina et al (Molina et al. 2000). To some extent, techniques like borrowing or literal translation may be recommended as long as concept equivalence is ensured: the resulting target language terms will often be internationally recognizable and psychologically acceptable to clinicians, and they make it possible to conform to the structure of SNOMED CT®. However, several more genuinely functionalist techniques may often be preferable, for instance transposition, amplification/description, and established equivalents.

Useful references to consult regarding translation methodology and solutions used in connection with the Spanish translation are described by Reynoso et al (Reynoso et al. 2000) and the Danish translation by Høy (Høy 2006).

Examples of different translation techniques are represented in the tables below:

Translation technique	English term	Morpho-syntactical composition of English term	Danish term	Morpho-syntactical composition of translated term	English literal translation of Danish term
Borrowing	cardiac output	adjective+noun	cardiac output	adjective + noun	-
calque or literal translation	closed fracture of metacarpal bone	verbal adjective + noun + preposition + adjective + noun	lukket fraktur af metakarpalknogle	verbal adjective + noun + preposition + adjective-noun-compound	“closed fracture of metacarpal bone”
transposition (change of grammatical category)	disability affecting daily living	noun + gerund + adjective + noun	funktionsnedsættelse der påvirker daglig livsførelse	noun-noun-compound + relative sentence	“function impairment which influences daily living”
amplification/description	battered wife	verbal adjective + noun	hustru der har været udsat for vold i hjemmet	noun + relative sentence	“wife who has been exposed to violence at home”
established equivalent	Y-graft	prefix letter + noun	bukseprotese	noun-noun-compound	“trouser graft”

Translation technique	English term	Morpho-syntactical composition of English term	Swedish term	Morpho-syntactical composition of translated term	English literal translation of Swedish term
Borrowing	blue baby	adjective+noun	blue baby	adjective+noun	-
calque or literal translation	closed fracture of two ribs	verbal adjective + noun + preposition + adjective + noun	sluten fraktur på två revben	verbal adjective + noun + preposition + numeral adjective + noun	“closed fracture of two ribs”
transposition (change of grammatical category)	cystocele affecting pregnancy	noun + gerund + noun	cystocele som påverkar graviditeten	noun + relative clause	“cystocele which influences pregnancy”
amplification/description	heavy-for-dates	Adjective + preposition + noun	tung i förhållande till graviditetstiden	adjective + preposition + noun + preposition + noun-noun-compound	“heavy in relation to duration of pregnancy”

Figure 9 - Examples of translation techniques with description of the morpho-syntactical structure of the source language and the target language terms

In some languages, the use of **gerunds** is not as common as it is in English. Therefore, according to the target language, the syntactical structure of many SNOMED CT® terms will have to be altered, so that the English gerund is replaced with a relative phrase as seen in the first two examples or a prepositional phrase as in the third example:

- English conditions affecting ... = Spanish *enfermedades que afectan...*
- English disease presenting primarily with ... = Danish *sygdom der primært manifesterer sig ved...*
- English ...affecting pregnancy = Danish ... *med indvirkning på graviditet* ("with effect on pregnancy").

Prepositional phrases as well as **adjectival constructions** or **juxtapositions** of similar semantic functions may be found in SNOMED CT® preferred terms – like *intrinsic vein of kidney* versus *subclavian artery* and *knee joint*. There may not be any fixed rules in the target language regarding the choice of construction type, and a principle decision pertaining to all or specific hierarchies or specific type(s) of concepts may also not be evident. The solution could simply be to follow clinical habits and/or to follow the source language construction:

- English skin abscess = Spanish *absceso cutáneo* (“cutaneous abscess”)
- English ligament of finger = Danish *fingerligament* (“finger ligament”)

- English: *abscess of the skin* = Spanish *absceso de la piel*.

Conjugated verbs should be used with caution and completely avoided in the Procedure hierarchy, since the past tense will invoke a temporal context for the procedure and indicate that the procedure was done. Thus, *salivary gland abscess drained* should be *drainage of salivary gland* and *cancer diagnosis discussed with patient* should be *discussion with patient regarding cancer diagnosis*. Conjugated verbs would be used in hierarchies like Clinical finding or Situation to express an occurrence as opposed to an action. In these hierarchies, the use of present or past tense may sometimes be necessary to express the meaning of the concept: *patient has gone abroad (finding)* or *looks ill (finding)* or *patient refused laboratory test (situation)*.

Questions regarding **word order** will often be solved by referring to ordinary, prevalent orthographic rules in the target language. It should be noted, though, that contrary to the general rule that English adjectives should be prefixed, SNOMED CT® presents a number of cases where the adjective is suffixed. This is the case with quite a lot of the concepts representing results of some tests or examinations: *pulse regular* instead of *regular pulse*. If the various results/findings are to be listed in a “drop down box” within a software application, it will be easier to overview the possibilities if all terms start with the same word (in this case the Observable entity + the value, a combination that converts the concept into a Finding).

Question to be considered: Is it possible to establish a set of rules regarding the morpho-syntactical construction of expressions in the target language in general, or in certain (sub-) hierarchies?

4.2.5 Choice of lexical variants

Depending on the language and the semantic area in question, a medical term could be either a purely Latin-Greek term, a so-called hybrid (i.e. terms based on Greek and Latin morphemes but morphologically and syntactically adapted to the national language), or a purely national term. Examples taken from the SNOMED CT® international release include:

- purely Latin/Greek terms: *diabetes mellitus*, *pes valgus*
- hybrids (nationalized Latin/Greek terms): *common hepatic artery* (Latin/Greek: *arteria hepatica communis*), *arteriosclerotic retinopathy* (Latin/Greek: *retinopathia arteriosclerotica*)
- national terms: *stomach ache*, *placing a patient on a bedpan*, *bad taste in mouth*.

Questions to be considered: Are there any general rules regarding the choice of lexical variant and the construction of hybrids to be used in the target language terminology, and, are there any semantic areas where practice dictates the use of a certain lexical variant?

4.3 Specific linguistic principles

In the following sections, a number of particular questions and issues are discussed. The relevance and importance may vary, depending on the target language.

4.3.1 Organism names (bacteria, viruses, plants, animals, etc.)

The Organism hierarchy makes extensive use of international taxonomic names. The reference is "Taxonomy resources" of the NCBI homepage <http://www.ncbi.nlm.nih.gov/Taxonomy/>. Unless it is

clearly in conflict with national language policy, names of organisms should be retained as universal (international) scientific terms and should adhere to the accepted orthography, especially with respect to the application of upper and lower case letter conventions in the individual words. Examples: *Chlamydia pneumoniae*, *Spirochaete dentium*, *Dependovirus*.

Note: In SNOMED CT®, erroneous, exclusive use of the lower case is occasionally found!

Aside from the taxonomic names, the Organism hierarchy includes a large number of “umbrella terms/headings”, called **grouper concepts**, where the common name is used in English such as *infectious agent* or *arthropod-borne organism*. Common names may also be found in other hierarchies. When a common name is used in English, it is recommended that a common name is also used in the target language.

Question to be considered: Should the international taxonomic names be used in the target language not only in the Organism hierarchy, but also in other hierarchies – or, should the common name of a given organism be used as preferred term in certain hierarchies, or, contexts?

4.3.2 Chemical and biochemical designations, ingredients in medications, enzyme and hormone names

A term which refers to a chemical substance contained in a medication may be regarded in two ways: it can either be the name of a particular ingredient in a medication (e.g. *morphine*, *glycogen*), or it can be a generic designation for the actual chemical substance. Ingredients are found in the SNOMED CT® *Pharmaceutical/biological product* hierarchy, and chemical substances under their generic designation in the *Substance* hierarchy. It may be common in the target language to apply different orthographic principles for products respectively substances.

Question to be considered: Are there any rules or habits that should be taken into consideration regarding the orthography of chemicals and biochemical agents, ingredients, enzymes, or hormones?

4.3.3 Foreign (loan) words and foreign abbreviations

The national translation guidelines should include directions regarding another language policy issue: the extent to which foreign words are acceptable in the target language. The English *cardiac output*, *Rift Valley fever*, *spindle cell*, *bias* or French *tabatière*, *en plaques*, *grand mal* are examples of terms and expressions that are accepted as such in some other languages. Whatever the solutions chosen, those foreign words that are accepted should comply with the orthographic rules of the original language; i.e. the accents in French words like *péan*, *tabatière* and *débridement* should be included.

Some (sub) hierarchies like *Staging and Scales* may contain a large number of concepts which are always represented by terms in English, and for which there is no official translation in the target language. In these cases, the source language term should be preferred.

Acronyms and initials – foreign as well as national ones – also give rise to questions: *AIDS* (*acquired immunodeficiency syndrome*) is an example of an abbreviation that is accepted as such in Danish and German, whereas the French and the Spanish use *SIDA*, the abbreviation of the national editions of the term. The number of abbreviations admitted in the terminology should be kept at a strict minimum:

only well known and widely used abbreviations should be allowed as part of the national SNOMED CT® terms.

A decision as to how to deal with specific SNOMED CT® abbreviations like NOS (not otherwise specified) or O/E (on examination) must also be taken. Since using the source language abbreviations may not make any sense in the target language, it may be necessary to decipher their meaning and translate into fully stated phrases (refer to the IHTSDO list of abbreviations in the User Guide).

Questions to be considered: What is accepted practice regarding the admittance of foreign expressions and abbreviations in the target language terminology? To what extent is the clinical use compatible with the general linguistic rules in the target language?

4.3.4 Eponyms

Eponyms present a serious problem in the medical LSP: although many of them are internationally renowned, some may be used in restricted geographical areas only and, even worse: none of them live up to any of the important term requirements of unambiguity, linguistic correctness or transparency. However, they have their place in the medical LSP and some of them may have to be accepted in order to make the terminology psychologically acceptable from a clinical point of view.

Question to be considered: Are the translators sufficiently aware of the necessity of checking if a given eponym in the source language is used in the target language and adequately reflects the same concept?

4.3.5 Determinate versus naked form

In most terms and expressions in SNOMED CT®, nouns are presented in their naked form. However, sometimes the determinative is used in connection with concepts of which there is only one-of-a-kind. This is the case particularly with *Body structure* concepts like *the stomach*, *the liver*, *the heart*, etc.

It should be noted, though, that the use of determinate respectively naked form in the source language is not always consistent. This is an issue that is currently being discussed by the SNOMED CT® modellers and in the future, the determinate form will be abandoned where possible. For example, one may find disorder terms like *Yellow atrophy of the liver* and *Cirrhosis of liver*, as well as procedure terms like *Fasciotomy of deep posterior compartment of the leg* and *Fasciotomy four compartments of leg*.

Questions to be considered: Are there any general rules regarding the use of determinate/naked form that should be taken into account in the target language terminology – or, particular conventions that should prevail in the translated terms?

4.3.6 Plural versus singular

In general, neither fully specified names nor preferred terms should be represented in the plural, unless the concept necessarily involved multiples such as for example *multiple acquired kidney cysts*.

There is still a number of SNOMED CT® fully specified terms as well as preferred terms that are actually given in the plural form – especially in terms that represent grouper concepts like *procedures relating to eating and drinking*, but these are in the process of being changed.

Question to be considered: Is the use of plural absolutely necessary in order to convey the meaning of the concept? (Until further notice, it is recommended to comply with the source language conventions for plurality or singularity.)

4.3.7 Lower case *versus* upper case letters

In general, all terms should use lower case letters. This is in concordance with the ISO Terminology Standard 704, where a lower case letter in the first word of the term is recommended, unless it is an eponym, a universal scientific term (see section 4.3.1), or a proper name. The general rules of the target language regarding lower versus upper case letters, should also be followed (e.g. nouns in the German language).

Eponyms, chemical substances, abbreviations, and others, though, may call for the use of upper case letters. Examples: *Behçets syndrome*; *Candida albicans antigen assay*; *pH profile measurement*; *ECG finding*; *blood group A*. If the case of the initial letter in a source or target language description is significant, i.e. if the term must start with a capital letter respectively a lower case letter, this will be reflected in the SNOMED CT® source and target language description tables, by use of an “Initial capital status” flag. In connection with the translation, it is important that this flag be activated in such cases.

Question to be considered: Are there specific reasons that a particular concept should start with, or, comprise upper or lower case letters?

4.3.8 Punctuation, typographical signs, symbols, and digits

Commas and **dashes** are used extensively in SNOMED CT® in cases where it has been deemed useful to add supplementary information to a term, such as:

- *well child visit, newborn*
- *vaginal abnormality – baby delivered with postpartum complication.*

Commas are also used in English to shorten down SNOMED terms and/or to construct terms where the most important feature is presented at the head of the phrase. Thus,

- *sprained thumb, metacarpophalangeal joint, ulnar collateral ligament* actually means *sprain of ulnar collateral ligament of metacarpophalangeal joint of thumb*, and
- *fracture, closed, comminuted, with displacement* actually means *closed comminuted fracture with displacement*.

Forward slashes are used to indicate "or": *T2b (IIB): Fallopian tube/ovarian tumor with extension to other pelvic structures*.

Parentheses and **colons** are also quite common in SNOMED CT®. They are often used to add semantic information about the concept, as in:

- *mass concentration (property)*, or
- *entire eye region (surface region)*, or,
- to shorten down the terms like in *FH: cardiac disorder* which actually means *family history of cardiac disorder*.

Depending on the tools used to assist the translation, **tags** can also be an issue, since they might be used to indicate for example superscript or subscript: *alpha⁺ thalassemia* or *beta⁺ thalassemia, normal Hb A₂, type 2*.

In these two examples, it is recommended that instead of using the **Greek letters**, α (alpha) and β (beta) the characters are written out in full. This is similar to the use of **numbers with digits or letters** and **Arabic digits** *versus* **Roman digits**, therefore a decision should also be taken for these.

Other signs and symbols, like for example > and <, % or = may also be subject to decisions of principle.

Questions to be considered: To what extent should we insist on idiomatic, descriptive and coherent terms in the target language in order to avoid specific typographic signs and symbols, and, what are the national language conventions/policies regarding Greek letters and digits?

4.3.9 Abbreviations and measurement units

The issues regarding foreign abbreviations and acronyms have been previously described (see section on “Foreign (loan) words and foreign abbreviations”).

It is likely that in both the LSP (Language for Specific Purposes) and the LGP (Language for General Purposes) of the target language, there are a number of common local **acronyms** that might be acceptable, but, in general, one should be very cautious and admit only widely used, very common ones.

For **measurement units**, it is recommended to comply with the guidelines of The International System of Units (SI = *Système international d'unités*), for example: *m* for *meter*, *s* for *second*, and *Pa* for *pascal*.

Question to be considered: Are there a number of commonly used abbreviated forms and acronyms that would be acceptable in the target language terminology?

4.3.10 Hyphens

Depending on the target language, hyphens may require additional attention. It may be common, or, useful in the target language, to insert a hyphen in hybrids and combining forms, compounds containing an eponym or a foreign word and particularly long compounds, such as *cardio-fascio-cutaneous syndrome*, *Legionella(-)infection*, or *pathological-anatomical analysis*. Also, hyphens may be used in connection with words containing abbreviations or signs or letters like *DNA(-)molecule*, *C(-)vitamin*, *T2(-)fracture* or in connection with certain prefixes like *non(-)infectious*.

Question to be considered: Are the rules regarding the use of hyphens in the target language sufficiently clear and/or should specific guidelines be established?

4.3.11 Other issues

Dependent on the target language, there may be a number of other issues that may be objects of decisions of principle. Examples could be gender and articles, conjunctions, prepositions, ligatured letters (also called diphthongs), the way to represent numbers, fractions, and digits (Arabic or Roman, or, numeral adjectives).

Questions to be considered: What are the national rules and habits in connection with various specific questions like the ones mentioned in this paragraph?

5 Sources of information

This chapter mainly deals with recommendations regarding sources in the target language. However, a few remarks regarding source language references that may help translators decipher the content of concepts, may be useful. Recommended sources in English could be: pubmed, Terminologia Anatomica with English and Latin terms, selected internet sites, preferably those established by official, recognized authorities, associations, or institutions, English/American medical dictionaries; and possibly local bilingual glossaries set up by recognized individuals or associations.

A number of valid and approved sources of reference information should be available to the translators and other specialists involved in the translation process. Whenever possible, selected internal working documents, textbooks, reference books, etc. in electronic form should be directly accessible to everyone to search for information about a specific concept through text examples, definitions, or explanations containing a particular word or phrase.

Suggestions of a number of useful sources of information are listed below. It is useful to prioritize the list of sources and to verify the validity of the sources.

5.1 References made available in electronic form

Ready access to already approved, translated terms

- It should be possible for the translators and others involved in the translation process to refer to terms previously approved that contain similar constructions and/or word combinations.

National corpora

Internal working documents such as:

- National guidelines for translation
- Overview of principle decisions made by the Editorial Board or similar responsible body
- Lists of examples of translated terms and/or corrected terms representing specific semantic or morpho-syntactical problems

Textbooks covering the regulated clinical practice domains and areas

Reference files or books such as:

- National versions of medical dictionaries or lexicons
- National version of chemistry nomenclature
- National version of Nomina Anatomica, Terminologia Anatomica or other
- National version of the International Classification of Diseases (ICD)
- National versions of other classifications

Medical articles

- Electronic versions of articles of renowned national medical journals.

Notes: These may be valuable references as to the use of specific terms and of abbreviations of foreign as well as local origin. Attention should be paid to the fact, though, that the expressions chosen in these journals may not always be linguistically correct or consistent when it comes to foreign expressions!

- Clinical guidelines and quality assessment papers.

5.2 Recommended internet references

A list of valid internet references that contain useful information should also be set up. The links to various authoritative taxonomies or nomenclatures are listed below. Some of them may be available in the target language:

- <http://www.ncbi.nlm.nih.gov/Taxonomy/taxonomyhome.html/> for Kingdom animalia: names of bacteria, viruses, animals, plants, etc.
- <http://www.genenames.org/> for a list of human genes established by the Gene Nomenclature Committee under the auspices of The Human Genome organisation (HUGO)
- <http://iupac.org/> is the reference for the International Union of Pure and Applied Chemistry (IUPAC) with approved names of laboratory substances and procedures)
- <http://enzyme.expasy.org/>for information relative to the nomenclature of enzymes primarily based on the recommendations of the Nomenclature Committee of the International Union of Biochemistry and Molecular Biology (IUBMB)
- The International System of Units (SI = Système international d'unités) contained in the ISO 31 standard from the International Organisation from Standardisation may be ordered directly from ISO; parts of it may also be found at various homepages (search for "International System of Units")
- National standards of names of drugs and medicinal substances – possibly available at the homepage of the national Medicines Agency
- National general syntax and orthography rules – possibly available at the homepage of a national language council or board
- List of approved medical abbreviations – possibly available at the homepage of a national medical journal.

6 Translation process and post-translation issues

Recommendations regarding the various steps of the translation process may be found in the document entitled “**Guidelines for Management of Translation of SNOMED CT®**”. This section summarizes the most important steps.

6.1 Translation

There should always be at least two persons involved in the initial translation – a translator and a “proof-reader” (to verify the initial translation). It is crucial that translators have high level linguistic skills as well as a good insight in health care. The role of the translators is to:

- translate source language terms into target language terms
- proof-read the translated terms before passing them on for further review
- raise questions so that principle decisions are made by the Editorial Board (or similar group), whenever they deem necessary.

6.2 Review

Apart from proof-reading, a proper review should be carried out by health and social care professionals. They act as quality assessors and their role is to:

- confirm that the translated terms reflect the underlying concepts
- verify that the terms comply with the linguistic guidelines and the general rules of the target language
- approve the terms that live up to the requirements
- return unacceptable terms to the translators for correction
- raise questions of principle for decisions by the Editorial Board whenever they deem necessary
- consult with the Editorial board about “questions of doubt”.

6.3 Editing

The Editorial Board should be composed of an interdisciplinary team comprised of professionals with educational and empirical backgrounds within areas such as medicine and nursing, linguistics and terminology, information science or technology, paramedical specialties, which have a sound knowledge and understanding of the English language. The role of the Editorial Board is to:

- define and maintain the guidelines to which all those involved in the translation process must adhere
- determine the validity of textbooks and references made available to translators and reviewers
- ensure that all participants are continuously advised of decisions made
- act as an advisory body for translators and reviewers

- create and evolve the principle decisions that will inevitably be required during the course of the translation
- deal with particularly complicated translations and questions raised by translators, reviewers and others
- following revision of "terms of doubt", approve the terms that meet the requirements
- collect and register errors and related queries regarding SNOMED CT® content in the international release, to be submitted to the IHTSDO.

6.4 Progress monitoring and follow-up

A project manager and/or co-ordinator should be appointed to carry out continuous assessment of the progress of the translation, general project administration and surveillance. The roles regarding monitoring and follow-up are described in the document entitled "Guidelines for Management of Translation of SNOMED CT®"

6.5 Post-translation issues

Clinical validation of the translated terms plays an important role in the establishment of a SNOMED CT® terminology in the target language. Some terms reflect very complicated or rarely used concepts, and there is a risk that in spite of best efforts, the translators as well as the reviewers may have misunderstood the source language term. There is also a risk that a particular term, however correct, is not psychologically acceptable to the clinicians who may have a habit of using a certain word or phrase for a particular concept. Validation should be carried out by health and social care providers to ensure that the translation is useful in clinical and social care settings.

Apart from validation of the translated terms a policy regarding maintenance of the target language terminology and of feedback to the IHTSDO is needed. It may be that some of the national terms and concepts that are added in the target language extension would be translated into English in order to be included in the SNOMED CT® International release.

7 Supporting documents

Documents consulted for the development of these guidelines:

- IHTSDO Guidelines for Management of Translation of SNOMED CT®, 2012, 2008
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8 Appendix A: Translation Quality Assessment

This Appendix provides a brief extract of information found in the IHTSDO document “A methodology and toolkit for the assessment of SNOMED CT® Translation Quality” regarding quality metrics that translation projects should incorporate into their project and quality plans.

As outlined in section 3.6 of the document, the following four (4) **structure** and **process**-related quality characteristics and associated quality metrics that have a **SMART** rating of **GREEN**, are deemed suitable for IHTSDO use and mature enough for immediate use, and, translation projects should consider them **mandatory** for use:

Component	Quality Characteristic	SMART Rating
Structure	Participants knowledge of terminology and terminology translation processes (also includes translators and reviewers competencies)	GREEN
Structure	Content of style guides and reference materials in the target language	GREEN
Process	Ongoing communication, co-operation and translation project process adjustments between the TPO and the TSP	GREEN
Process	Translation reviews (two-level, or, two-stage review process necessary).	GREEN