nehta

Mapping to SNOMED CT-AU

Guidelines and requirements

Version 1.0 – 20110930

Final

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Document management

Document control

Name of document:	Mapping to SNOMED CT-AU: Guidelines and requirements
Document owner:	National Clinical Terminology and Information Service (NCTIS), NEHTA
Document coordinator:	
Author(s):	
Document approver:	

Document authoring and review

Version:	Date	Author	Status and nature of amendments
1.0	20110930	NCTIS	First external release.

Document publication

Publication:	☐ Internal ☑ External
Published version and date:	1.0/20110930
Date of next review and update:	

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1 Introduction

1.1 Purpose

This document describes a mapping methodology that should be followed when mapping local and proprietary coding systems to SNOMED CT-AU.

The document has two key purposes:

1. To provide guidelines for mapping existing coding systems to SNOMED CT-AU through a 'one to one' and 'many to one' mapping method to assist vendors and healthcare providers for the purposes of communication when implementing messaging specifications; and
2. To specify compliance requirements for the conformity assessment of SNOMED CT-AU mapping implementations [NEHTA2011g].

1.2 Intended audience

This document provides guidance for mapping projects undertaken as part of eHealth Sites and Personally Controlled Electronic Health Records (PCEHR) programmes.

The audience of this document is expected to have an understanding of both SNOMED CT-AU and the theories and practices of mapping.

The intended audience includes:

- Health software vendors and vendors of proprietary health terminology products.
- Health jurisdictions and healthcare providers who develop their own maps, or outsource the mapping to vendors.
- Compliance assessors who perform conformity assessment of SNOMED CT-AU mapping implementations.

1.3 Scope

The scope of this document is limited in the following respects:

- This document does not provide guidance for 'one to many' mapping and further guidance should be obtained when attempting this.
- Backwards and bidirectional mapping is outside the scope of this document and further guidance should be obtained when attempting this.
- This document does not provide guidance or information on how to implement mapping files into software applications or messaging feeds.
- This document does not cover the mapping of SNOMED CT-AU to local codesets for the purpose of importing received messages containing SNOMED CT-AU concepts.

1.4 Questions and feedback

Any comments or feedback regarding the guidelines in this document should be sent to the NEHTA National Clinical Terminology Information Service (NCTIS): <terminologies@nehta.gov.au>.

Any comments or feedback regarding the compliance requirements in this document should be sent to the NEHTA Compliance, Conformance and Accreditation (CCA): <cca@nehta.gov.au>.

2 Mapping to SNOMED CT-AU

2.1 SNOMED CT Australian Release (SNOMED CT-AU)

The National Clinical Terminology and Information Service (NCTIS) within NEHTA is responsible for managing developing and distributing SNOMED CT Australian Release (SNOMED CT-AU) in Australia. SNOMED CT-AU includes the content from the International release of SNOMED CT, together with Australian-developed terminology. Documentation to assist with implementation in Australian clinical IT systems is also provided.

SNOMED CT-AU provides local variations and customisations of terms relevant to the Australian healthcare community.

2.2 Licence agreements

All parties who download and use SNOMED CT-AU are required to agree to the SNOMED CT Affiliate Licence Agreement [IHTSDO2009b] and the Australian National Terminology Release Licence Agreement [NEHTA2009a]. When developers integrate SNOMED CT-AU into their products, whether it is a proprietary terminology product or a proprietary software product, the developer needs to comply with all licensee obligations. All developers of maps, therefore, are also required to review and understand these licence terms.

2.3 What is mapping?

Mapping is a process of defining a relationship between concepts in one coding system (‘source’) to concepts in another coding system (‘target’) in accordance with a documented rationale for a given purpose [ISOTC215b]. The mappings are aggregated in a table to form a map between the two systems.

The systems referred to above may be a list of terms, a codeset, vocabulary or terminology. As this document focuses on messaging and local clinical system implementations, mapping to classifications will not be covered in further detail.

Systems vary in their purpose and how they define content (structure, rules, term composition and granularity). This needs to be taken into account when reading and using the map. The terms available within systems may not always be equivalent in the meaning, so the type of map is denoted by a match type. Section 3.3.2 shows the match types recommended when using this guideline. In some cases more than one term may be required to capture the meaning, however due to the purpose of this mapping a one-to-one or many-to-one mapping would be required.

The differences in systems also mean that any map produced should have a clearly defined direction. In the context of this guideline, this would be from your local or proprietary code system to SNOMED CT-AU. If there is a requirement to understand the meaning of the SNOMED CT-AU term in the local or proprietary system and the map between the terms is not equivalent, then an additional mapping in the reverse direction would be required. Backwards and bidirectional mapping is outside the scope of this document.

The reason for mapping in the direction of local codesets to SNOMED CT-AU is to support the transformation of various local and proprietary codesets in existing clinical information systems into a common national terminology for eHealth messaging and system interoperability.

Maps are developed through a mapping process. This process requires a mapping methodology document which identifies the purpose, rules and processes used to develop the map. Section 3 provides the steps for the mapping process.

2.4 'Why map?' and the implications of mapping

Vendors and implementers might consider mapping for a messaging communication scenario as a temporary solution when a native implementation of SNOMED CT-AU into clinical information systems is not yet possible. Such a mapping will not alter data entry by end user clinicians and can be implemented alongside the data entry process (so users can see the item their entry term was mapped to) or in the back-end when the messages are being compiled and sent.

Maps always need a defined purpose and this should be stated in the mapping methodology documentation. Some other reasons for mapping include funding, historical use, and secondary use or reuse of data. In the case of messaging communications, this type of mapping is seen as a mechanism to give vendors time and opportunity to transition to the use of SNOMED CT-AU within their local systems.

Developers and users of maps need to be aware of the implications of using a map and the importance of ensuring sound mapping practices. Maps require a commitment of resources and tools and, if intended for ongoing use, will be costly to maintain. Maintenance is required each time there are changes to either the source or target terms e.g. a new release of SNOMED CT-AU.

Consideration also needs to be given to the potential change or loss of meaning due to the possible differences in meaning between terms within the source and target systems as well as the potential need to map to a term that is broader in meaning where no suitable match is available. These maps would require clinical review prior to implementation to support safe clinical practice. The inclusion of local terms in the message would also be required.

Where the required terms are not available, requests for new content can be made to the NCTIS. Further information is provided in Section 3.9.3 on this process.

2.5 Development of the methodology within these guidelines

The mapping methodology presented in these guidelines has been based on:

- Draft or published standards, guidelines and reports on mapping of health terminologies by standards organisation such as International Health Terminology Standards Development Organisation (IHTSDO), International Organization for Standardization (ISO) and Standards Australia.
- Lessons learnt from projects to map to SNOMED CT-AU in Australia and also international terminology mapping projects.
- The SNOMED CT and SNOMED CT-AU technical specifications, editorial rules and release notes.
- Clinical document specifications.

2.6 Benefits of this methodology

This document has been created to support the development of appropriate maps from local or proprietary code systems to SNOMED CT-AU.

The benefits of the approach in this document include:

- Supports information exchange between healthcare systems.
- Provides a system to ensure a repeatable approach to mapping.
- Provides guidelines on methods and formats.
- Provides guidelines and sets expectations regarding ongoing maintenance.
- Outlines the compliance requirements for clinical safety required by the *SNOMED CT-AU mapping conformity assessment process* [NEHTA2011g].

The quality methodology provided here will produce a map which supports information transfer between healthcare systems which is safe and fit for use.

The methodology also serves the purpose of providing a repeatable quality process to guide production and reproduction of maps to meet the conformity requirements (see Section 4).

A map which supports ongoing use of local code systems and is to be used for sharing or reporting of data using SNOMED CT-AU is not used once, but is used over and over again each time data is shared or reported. The map must be maintained and updated each time either the local/proprietary code system or SNOMED CT-AU is changed. For this reason the processes for creation of the map must be repeatable and the decisions made about resolution of issues must be documented and applied consistently throughout the life of the map.

Sound mapping practices benefit all users of the map, and ensure that the data produced as a result of the map can be consistently and reliably used by the receivers of the information. Specific reasons for investing in sound mapping processes include:

- Maintenance of meaning (and thereby utility and clinical safety) of the information in the source and target systems.
- The ability to re-use and apply ongoing improvement to the map – thereby reducing the cost of map maintenance.

It is essential that once a decision has been made to map a specific type of concept a specific way that this decision is maintained consistently throughout the map.

It is possible that in a future version of any map, decisions made may be changed but such changes must be clearly defined and applied consistently throughout the version of the map. Decisions made must be documented so that those using the information that results from the map can do so knowing what is intended to be included and the meaning implied. Users of the resultant data must be able to identify when meaning of the results of the map have changed.

The map must support automation of translation from the local or proprietary code system to SNOMED CT-AU. For this reason it must have a consistent structure and content to ensure that software can be used to apply the map (to translate from the local/proprietary system to SNOMED CT-AU).

A SNOMED CT-AU map with appropriate documentation can reduce the maintenance costs of that map. The documentation can also be used to induct new staff, and assist those who use the resultant information in understanding where information may have been modified or lost in the process of mapping.

2.7 Conformity assessment

This document contains compliance requirements to be assessed as part of the *SNOMED CT-AU mapping conformity assessment process* [NEHTA2011g]. In order to pass the assessment, a mapping process needs to comply with all the mandatory requirements. The mandatory requirements are stated using the verb **SHALL** in this document while the recommended requirements are stated using the verb **SHOULD**. The compliance requirements are specified in Section 4 of this document.

Table 1: Verbs used to describe compliance requirements

SHALL	This verb **SHALL** when appearing in a compliance requirement indicates a mandatory requirement. Its negative form **SHALL NOT** indicates a prohibition.
SHOULD	The verb **SHOULD** when appearing in a compliance requirement indicates a recommendation. Its negative form **SHOULD NOT** indicates a discouraged option.

3 Mapping methodology

The development and maintenance of a SNOMED CT-AU map requires commitment of resources, use of tools, documentation and consistent and repeatable steps. Each of these requirements is clarified in this section and guidance is provided on how to progress each process to a suitable quality.

The maps developed and the mapping process used to provide translation from local systems to SNOMED CT-AU must meet quality processes to ensure that the data communicated and stored in repositories is clinically accurate.

The SNOMED CT-AU map is a table or computable representation of a concept in a local system (source) and the equivalent representation (or where suitable a supertype) of that same concept in SNOMED CT-AU (target).

The production of map should include documentation of:

- The purpose of the map.
- Examples of scenarios which describe how the map is to be used.
- The map development process.
- Map team members and skills.
- Issues identified and decisions made.
- The format of the build map (the version that includes all results of the mapping process, issues and status).
- The format of the SNOMED CT-AU map (published final map).
- The map maintenance timeframe.

3.1 The mapping process

Part of the documentation in the mapping methodology should include the mapping process. Figure 1 indicates the process considered to be the minimum level of acceptable quality control. The following sections of this document describe this process in detail.

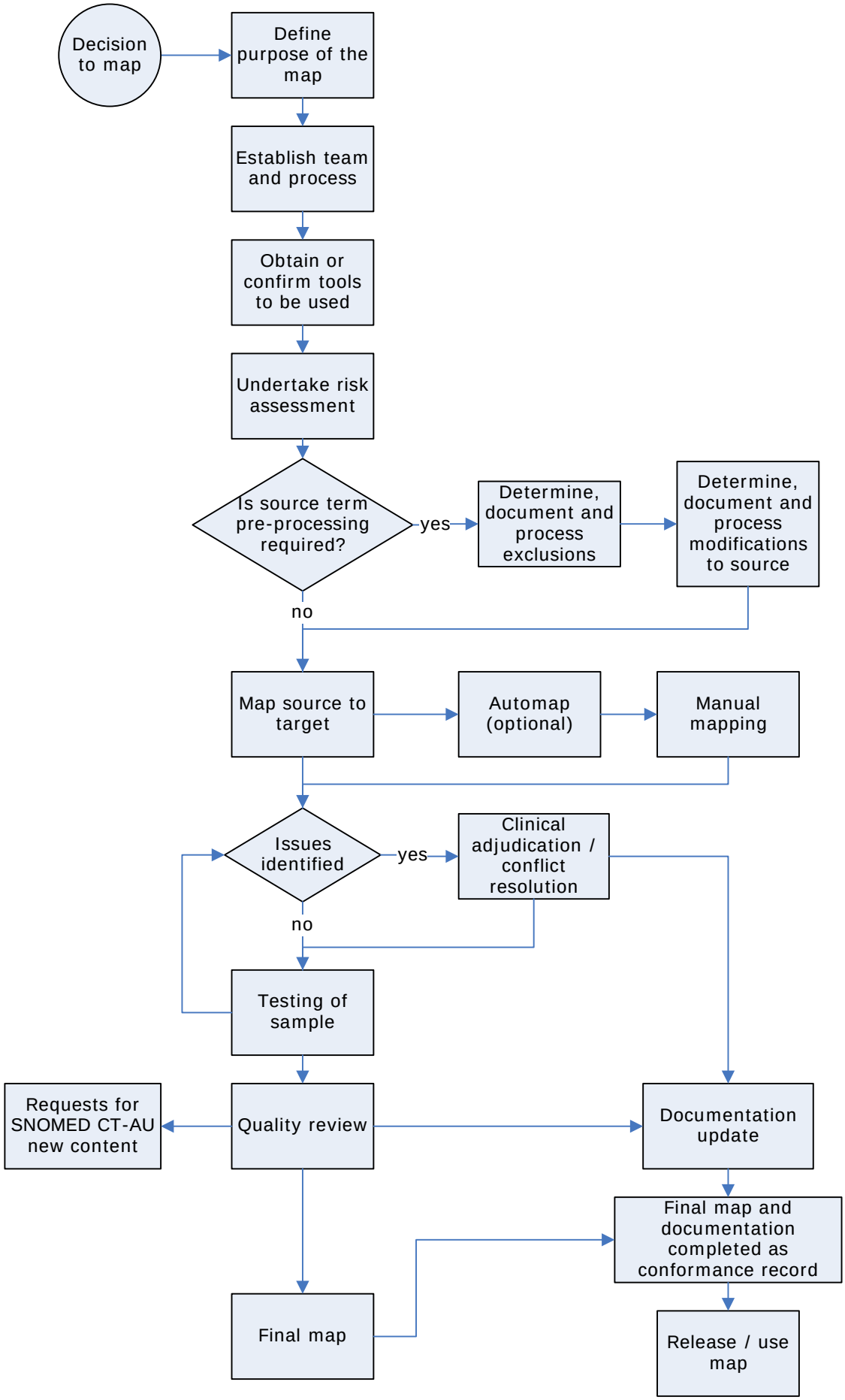

Figure 1: Outline of the mapping process

3.2 Decision to map

Before a map is built or updated, a review of whether to use a map or to convert existing local or proprietary data to SNOMED CT-AU is required. The ongoing costs associated with mapping are significant, and for this reason it is envisaged that mapping will be seen as a mechanism to give vendors time and opportunity to transition to the use of SNOMED CT-AU within their local systems and thereby removing the need to map.

There are effectively three choices to consider:

1. **Use SNOMED CT-AU natively in your system.**

   You may choose to use SNOMED CT-AU within your software product or local implementation. This will require conversion which changes the standard code system used in a software product from a local or proprietary code system to SNOMED CT-AU.

   This option may be the least expensive over time, however it may involve significant work for the software vendor as changes may be required to database structures.

2. **Mapping to SNOMED CT-AU for migration.**

   You may choose to keep your current approach for the moment which requires a SNOMED CT-AU map, with the plan to evaluate and later change to SNOMED CT-AU within your software system.

   The mapping process will assist in defining and understanding the differences between the current local or proprietary code system and SNOMED CT-AU. Requests for new SNOMED CT-AU content (see Section 3.10.3) can be made as required to improve coverage. This will support transition to SNOMED CT-AU in the system, and once migration is complete, the need and expense of map maintenance would be removed.

3. **Develop a map from your system to SNOMED CT-AU.**

   You may choose to keep your current code system and to build and use a SNOMED CT-AU map. You would be required to perform maintenance on the map whenever changes occurred to the local or proprietary code system and with each six monthly release of SNOMED CT-AU.

3.3 Define the purpose of the map

3.3.1 Statement of purpose of the map

A map must have a defined purpose. As maps are built for a particular purpose, this purpose influences decisions made about how to map those concepts which do not have exact comparisons between the local or proprietary code system and SNOMED CT-AU.

For example, a map for clinical purposes would take into account the clinical needs of those who use the result of the map. A map that is to be used to support fiscal reporting would contain rules which apply to building the map and might include some rules that relate to charging conditions or requirements.

In documentation of your methodology you need to clearly indicate the purpose of your map and to provide specific scenarios which describe the use. This forms the basis for further decision-making around the mapping process.

Purpose of local system map to SNOMED CT-AU: The map is being provided to support interoperability and sharing of information in healthcare for continuity of care in a manner that is safe and provides consistent representation of clinical information such as problems/diagnoses.

A map used for this purpose must not change the meaning originally intended by the author of the information due to clinical and safety implications.

3.3.2 Scenarios of intended use

Scenarios should be used to explain the intended use of the map. Each specific business example of where the map could be used or how the map could be used must be described in the scenario.

The scenario applicable to this document is for communication of information through messages that align with NEHTA specifications. This means that there are requirements for the SNOMED CT-AU concepts that are mapped to (i.e. the targets), to be members of reference sets that are specified in the published specifications.

Example:

A GP may be sending a referral to a specialist which includes information about the patient's condition. The NEHTA specification being used would be the *Referral letter structured content specification*, which contains a data element named *Problem/Diagnosis*.

The specifications list the *Problem/Diagnosis reference set* as the applicable value domain, and this means that any mapping undertaken for the purposes of communicating patient conditions must comply to this requirement. Any mapping of GP local codes must be mapped to SNOMED CT-AU concepts that are a member of the *Problem/Diagnosis reference set*.

3.3.3 Audience

Indicate the intended users (decision makers, developers and users) of the data that will result from the map. The audience should be clear from the scenarios.

For the purpose described in this document the intended users are the clinicians involved in providing continuity of care for the patient. Other examples applicable to other scenarios might be:

- Consumers of healthcare to support their care and decision making.
- Government to support accountability and planning.
- Epidemiologists to support public health monitoring and review.
- System implementers.

3.4 Establish the processes and team

3.4.1 Define the scope of the map

Once the purpose and the scenarios have been identified, the next step is to define the scope of the map.

3.4.1.1 The level at which to map

Consider the level at which the data in the local or proprietary code system is set and the purpose of the map.

It is recommended that you consider first the representation from the lowest (or exact equivalence) levels and move to higher (less equivalent) levels only if it is not possible to map appropriately at the lower levels. Any decisions to move to higher levels should be clearly documented.

Example:

A disorder such as 'acute myocardial infarction' from the local system may not have an equivalent concept in SNOMED CT-AU but a parent concept on a higher level, e.g. *Myocardial infarction* may be sufficient for the purpose of mapping.

The above scenario may well be considered to be appropriate for the purpose of communicating patient conditions using NEHTA specifications.

3.4.1.2 The relevant reference set

You will need to consider which existing reference sets meet the requirements for the terms you are planning to map. Information on which reference sets are relevant for use in different parts of eHealth messages can be found within the Structured Content Specifications that are produced by NEHTA. In addition, the *SNOMED CT-AU Reference Set Library* [NEHTA2011h] contains all relevant definitions of reference sets and which specifications they are used with.

Example:

Terms which are disorders such as 'acute myocardial infarction' would map to concepts within the *Problem/Diagnosis reference set*.

3.4.1.3 How much of the code system should be mapped?

In general, maps do not necessarily map every concept in the source (local termset) to the target. A subset may be chosen for inclusion to meet the declared purpose.

Example:

If the purpose of the map is for representation of diagnosis, the content of the map may be limited to the range of clinical findings used in that specific environment.

There will be concepts in the local or proprietary code system which are not appropriate to be mapped and can either be removed from the build table or marked as 'Not to be mapped' if they are kept in that table. For ongoing maintenance purposes it is easier to keep them in the table and mark them as 'Not to be mapped'.

It is necessary to determine what will not be mapped and to document this clearly.

Some of the local terms which should not be mapped might include:

- duplicate entries;
- inactive terms;
- ambiguous terms; and
- terms that do not meet requirements such as reference set membership.

A list of the total number of concepts, and the number of concepts of each exclusion type must be maintained for each version of the map. The following example illustrates this point.

Table 2: Example concept exclusion table

Exclusion	Number of concepts
Total in original table at start	150
Inactive concepts	3
Duplicate entries	2
Number to be removed	5
Remaining total	145

3.4.2 Mapping patterns

Mapping can be considered to happen in the following patterns:

- **One-to-one mapping:** This is where one local term maps to one SNOMED CT-AU concept.
- **Many-to-one mapping:** This is where there is more than one local term that maps to the same SNOMED CT-AU term. Within the mapping file only one instance of the local termset exists, but multiple listings of one SNOMED CT-AU concept appear against different local source terms.
- **One-to-many mapping:** There may be instances where one local termset item contains two distinct representations that cannot be mapped to a single SNOMED CT-AU concept yet it is required to be mapped to more than one target concept. For example if 'Depression/Anxiety' cannot be mapped to a single SNOMED CT-AU concept and if there is no decision made and documented around what to map to in such circumstances (for clinical reasons) there may be a requirement to map it to more than one concept in order to convey the required meaning.

This document provides guidance around mapping structures for mapping one local termset item to one SNOMED CT-AU concept which covers the 'one-to-one' and 'many-to-one' scenarios listed above. Where you have requirements for 'one-to-many' maps we recommend that you approach industry specialists for advice.

3.4.3 Structure of the map

The map is a table which displays the uniquely identified concepts in one code system to be converted to unique SNOMED CT-AU concepts.

The general intent is that a map indicates some correlation between members of a source code system (local termset) and the terminology (SNOMED CT-AU). Three match types are used to describe the correlation between code systems and SNOMED CT-AU:

- **Equivalent:** Indicating the source code and SNOMED CT-AU are semantically equivalent (i.e. mean the same thing).
- **Specialised:** Indicating the source code is more specific than the SNOMED CT-AU concept to which it is mapped. This is a consequence of suitably specific concept being currently unavailable in SNOMED CT-AU. The 'acute myocardial infarction' term being mapped to 'myocardial infarction' is an example that uses the match type of 'specialised'.
- **Not to be mapped:** Indicating that the source term is not suitable or does not meet requirements for mapping.

Mappings are determined through semantic equivalence where the meaning of the concept is the same, though the associated terms from SNOMED CT-AU and the code system may exhibit some lexical discrepancy, where the actual words used in the descriptions to describe each concept varies. Revision of the available SNOMED CT-AU terms may be considered when issues are raised about such differences.

Note: The use of 'Generalised' as a match type is *not* recommended, since adding information that was not specified by the clinician is of a higher clinical safety risk than loss of information. If a term such as 'acute' was added to a patient with 'asthma' without the clinician making this distinction, this could result in a patient receiving treatment that they do not need and may in fact cause harm.

The map format will be dependent on its intended purpose. For example a working draft or 'build map' may need to indicate authors associated with a map. Whereas a distribution format or 'final map' is the published product and intended for direct computer consumption and does not require this information. The final map though, requires history tracking to ensure backward compatibility where different versions are used across different sites that have the same local termset. Human-readable terms may also be provided within final maps to simplify implementation. Fields should be clearly explained in accompanying documentation as per the examples in Table 3 below.

Table 3: Example explanation of a build map structure

Map field	Description
Map ID	Unique identifier of each row entry in the map.
Source ID	The unique identifier (code) of the concept in the local/proprietary system.
Source description	A description from the source code system. Typically this is the display term representing the concept, as a clinician would view it.
SNOMED CT-AU concept ID	The unique code used to represent an individual concept in SNOMED CT-AU.
SNOMED CT-AU description	A suitable description from the terminology. Preferred terms are recommended where the term will be displayed in application interfaces. The unambiguous Fully Specified Name (FSN) is useful during the review and consideration should be given to the collection of both relevant descriptions.
Match type	An indicator of the correlation between the source code and SNOMED CT-AU.
Mapper	Identification of the person who did the match. This field can be used to go to the mapper for further explanation of any documented issues, or where errors are identified later in verification processes
Status	Indicates whether the term is mapped (completed and agreed), referred for clinical adjudication, not to be mapped, or other status values that are helpful to the mapping process being used by the organisation. For example items where clinical guidance is needed, or where it was not possible to find a match in SNOMED CT-AU. This should also indicate if a concept is considered to have completed mapping, i.e. has no outstanding issues associated with it.

The technical format of any map should also be clearly identified. For example build maps may be circulated as Microsoft Excel files, whereas final maps should be provided in a cross-platform format that is easily machine readable, most likely a delimited text file. UTF-8 character encoding must also be used to support special characters that are likely to be present in healthcare terms.

3.4.3.1 Build map example

As noted in the previous section a build map must clearly indicate both the codes and terms used in the source and target systems, as well as map status and details about the individual who performed the map as well as any editorial comments.

The following table illustrates an example of the content of a build map.

Table 4: Sample Build map structure

Map ID	Source ID	Source description	Target ID (concept ID)	Target description	Match type	Mapper	Status	Comments
1	C0287	Acute MI	57054005	Acute myocardial infarction	Equivalent	AG	Mapped	
2	D0025	Left fractured NOF	5913000	Fracture of neck of femur	Specialised	FR	Mapped	
3	D0021	Right fractured NOF	5913000	Fracture of neck of femur	Specialised	MS	Mapped	
3	Z0104	Ref – AIHW Chronic Dx				TC	Do not map	Internal flagging Code

3.4.3.2 Final map example

The requirements of the file format for implementation are dependent on the intended use, potential consequences, and capabilities of the system into which it is to be implemented. If the scope of the implementation is only to provide SNOMED CT-AU codes in parallel to an existing code system, the system only needs access to active mappings and the appropriate preferred terms. If the system does not use either an internal or external terminology service, the required information should be distributed in a single file.

Table 5: Sample final map structure derived from the Build map example above

Map ID	Date	Status	Source ID	Source Description	Target ID (Concept ID)	Target Description	Match type
1	01022009	Active	C0287	Acute MI	57054005	Acute myocardial infarction	Equivalent
2	0102209	Active	D0025	Left fractured NOF	5913000	Fracture of neck of femur	Specialised
3	30092010	Active	D0021	Right fractured NOF	5913000	Fracture of neck of femur	Specialised

The structure shown in the above table includes appropriate preferred terms from each system. Such detail may be excluded only if it is readily available during implementation.

Thorough configuration management is required in producing a final map. As well as the final map itself being versioned, the full details of the source and target systems (OID, version, name) must be clearly documented. To satisfy the requirements of traceability, processes must be in place to facilitate a full audit of the map including when every change was made and against which versions of the source and target code systems the map was performed.

3.4.4 Personnel

Mapping requires a multidisciplinary group of people to administer the development of the map, undertake the actual mapping, verify content, determine the action where there is discrepancy, test, and document and release the map.

It is the responsibility of the owner of the map to ensure that an appropriately skilled team is used to develop and maintain their map. This responsibility is true for internally or externally developed maps. The qualifications of team members and the skills they represent should be recorded in the documentation of the mapping process.

Skills required include:

Clinical Expertise and understanding of the discipline and the way in which the concepts in the result of the map will be used in clinical practice. In order to provide appropriate advice these individuals should have actual clinical practice experience. Their role is to provide decisions on the clinical safety and appropriateness of the results of each individual map.

Source Expertise and understanding of the source content and structure in order to ensure that the meaning of the source is clearly understood.

Target Expertise and understanding of the target content and structure in order to ensure that the meaning of the target is clearly understood.

Technical Expertise and understanding of the computer systems from which the source data originates, the system in which the target data will be used and the automated process to transform the data from the source to the target.

Administrative Management of the process and project, ensuring repeatability, quality, risk management (minimisation of patient risk) and consistency. (See Section 3.6 for risk management details.)

The IHTSDO has identified the broad groups of personnel required and the competencies they require [IHTSDO2009a]. Table 6 is based upon this work and provides a short description of these requirements to assist in building or selecting appropriate staff or organisations to undertake map building and maintenance.

It is suggested that mapping personnel should have the following competencies:

- Understand and be able to apply the structure, content and relationships for the local/proprietary code system and SNOMED CT-AU.
- Understand and explain the purpose of the map.
- Be able to apply the basic concepts of the SNOMED CT-AU concept model and description logic (the logic and relationships used to define concepts within SNOMED CT-AU). This is necessary to be able to determine if two concepts are actually equal or not.
- Understand the way in which the computer system will use the map.
- Understand the processes associated with new releases of SNOMED CT-AU.

Though teams may be small, each of the roles indicated below need to be accounted for. In a small team the mapping manager and specialist may be the same individual.

Table 6: Mapping personnel roles and competencies

Role	Responsibilities	Competencies
Mapping Manager	Responsible for the conduct and documentation of the process, ensuring that decisions are logical, appropriate staff allocated to all tasks and appropriate processes employed.	In addition to general skills required in project management and being an experienced mapper, this person must be able to: • Design and apply change management principles and version control. • Design and apply mapping quality assurance processes. • Design and apply verification and testing processes suited to the purpose and content of the map. • Assess the risks and strengths of mapping verses conversion to SNOMED CT-AU.
Mapping Specialist	Responsible for actually mapping content from one system to another.	In addition to general terminology skills: • Use understanding of the SNOMED CT-AU concept model and description logic applicable to the terminology to identify the level of match between the source and the target code. • Use tools designed to assist and support the mapping process. • Apply the mapping process. • Develop and apply quality assurance measures to map content and production. • Consistently apply the rules established for the map.
Clinical Map Advisor	Responsible for clinical guidance where the meaning of either source or target is unclear.	In addition to clinical skills: • Apply the SNOMED CT-AU concept model description logic used in the terminology to determine meaning consistently. • Consistently apply the rules established for the map.

Role	Responsibilities	Competencies
Technical Advisor	Responsible for the technical utility and release of the map for technical use.	In addition to IT/IS skills: • Design and apply mapping structure and rule automation. • Design and build file structures to support the building and release of the map. • Document release processes for use of the map in software.

3.5 Tools

Tools include both computer tools to support building the map, software to browse SNOMED CT-AU in order to manually map concepts, and to investigate alternative map results where there are issues or alternatives.

Mapping tools used should be evaluated against the following requirements and assessed to establish if they are appropriate to use in mapping to SNOMED CT-AU.

- The tool should include SNOMED CT-AU.
- Appropriate filters to limit the map to a specific hierarchy should be available. For example, a map of diagnostic concepts might be restricted to the concepts of the clinical finding part of the hierarchy.
- The tools should map against the FSN, but be able to search against Preferred Terms and Synonyms in order to identify the relevant FSN.
- The tool should have the ability to limit mapping to concepts with a status of 'Active'.
- The tools used should be able to provide details of the concept and relationships to other concepts in SNOMED CT-AU. This includes navigating up and down the hierarchies to see other options, and the attributes of the SNOMED CT-AU concept to allow the mapping specialist to confirm the meaning of the SNOMED CT-AU concept where there is doubt about the term from which it is being mapped.
- Automapped items need to be identified as such for further validation.
- It should be able to record comments and resolutions.
- It should have the ability to produce a computable version of a SNOMED CT-AU map.
- It should be able to be limited to a specific SNOMED CT-AU reference set.
- It should display/record the version of the local or proprietary code system and the release of SNOMED CT-AU.

3.5.1 Automatic mapping

Automatic mapping is the process where software automatically compares the descriptions of the local code system to those used in SNOMED CT-AU. Where the terms are the same, the build of the map can be automatic, including the concept identifiers and descriptions from the local/proprietary code system as well as the concept ID and description from SNOMED CT-AU. This process can significantly reduce the effort required to map, and also has the potential to improve the accuracy of the map.

Though a tool may have been used in the past it is necessary to confirm that the tool is current and relevant to the task on each occasion it is used to build a map.

Automatic mapping is undertaken to reduce the amount of manual mapping required. It is therefore conducted before manual mapping. Pre-processing of the source data should also be undertaken before automatic mapping is done.

Consideration should be given to how accurate the automatic mapping process will be.

The following example quality assurance processes may help to improve automatic mapping results:

- Establish a threshold to consider an item to be a match (must match one and only one entry in SNOMED CT-AU).
- Establish filters to consider map results only from a hierarchy or reference set of SNOMED CT-AU.

As the automated mapping function may not be guaranteed to be 100% accurate, each automatically-mapped source term should be manually validated against the result from SNOMED CT-AU. A record should be kept of any automatic mapping errors to assist in improvement of the process in future.

After the automap function is run, the remainder of the file is manually mapped.

3.5.2 Manual mapping

Manual mapping requires the use of a browser to manually search SNOMED CT-AU to find the local code system concept in SNOMED CT-AU. The result is then manually recorded in the build table (often a spreadsheet). This method is very time-consuming and prone to error due to copying and pasting from the browser into the build table. The use of a mapping tool, which integrates a terminology browser together with a mechanism for recording the mapping results, can increase the efficiency and accuracy of the mapping process.

A mapping tool may allow automap and manual map functionality and allow the production of a consolidated output.

After each stage of the process, including automatic mapping processes, it is advisable to check that the number of items in the build table is the same.

3.6 Risk management approach

The mapping of terminologies has obvious patient safety implications. Where local or proprietary terms are incorrectly or in some cases imprecisely mapped to SNOMED CT-AU concepts, or the maps are incorrectly used:

- The clinical system may display clinical information inappropriately or in a manner that is unclear or misleading in the context in which it is presented.
- Misleading or inaccurate information may appear in a patient's clinical record, which may lead to decisions which cause harm to the patient.

Example:

Different systems may use slightly different variations in the terms used to describe a concept. The variations between clinical systems and how they represent and register data can cause confusion with clinicians.

SNOMED CT-AU: Borderline glaucoma

Local codeset term: Glaucoma suspect

These concepts do not have exactly the same meaning. If the map is to be used for non-direct care reporting purposes this would not represent a risk to the patient, but if used in clinical care could lead to inappropriate assumptions by the receiving clinician.

To minimise patient safety risks associated with the usage of SNOMED CT-AU maps, a risk management approach or plan for patient safety risks should be clearly defined prior to commencing the mapping activity and should be followed throughout the entire mapping process through to validation, production release and ongoing maintenance. The developer may use any risk management methodology that is relevant to the context of their organisation. However at a minimum, the developer should:

- Clearly identify all patient safety risks that may arise from using the developed maps in clinical settings.
- Perform and document risk assessment including definition of the likelihoods and these impacts.
- Formulate, document and implement risk mitigation measures.
- Undertake and document the risk management activities not only during the mapping process but also for ongoing maintenance of maps.

Risk scoring and classification should form a part of risk assessment so that the level of effort in addressing each risk can be prioritised. It also provides consistency in ongoing risk management. The table below includes an example of a risk scoring and classification framework for patient safety risks. This is an example only and the developer should use a risk scoring scheme that is most relevant to their mapping process.

Table 7: Example of a risk scoring scheme for patient safety risks[1]

Risk scoring Risk score is obtained by multiplying the likelihood score by the consequence score.			**Likelihood score**				
			1	**2**	**3**	**4**	**5**
			Rare	**Unlikely**	**Possible**	**Likely**	**Almost certain**
Consequence / impact score	**5**	**Catastrophic**	5	10	15	20	25
	4	**Major**	4	8	12	16	20
	3	**Moderate**	3	6	9	12	15
	2	**Minor**	2	4	6	8	10
	1	**Negligible**	1	2	3	4	5

Extreme risk	15 to 25
High risk	8 to 12
Moderate risk	4 to 6
Low risk	1 to 3

3.7 Pre-processing source terms

Variations are likely to exist in the way that a concept is described between the local termset (or proprietary code system) and SNOMED CT-AU. In order to support automated mapping processes, the more similar the structure and representation of data between the descriptions in each system the more likely matching is to be accurate.

Pre-processing modifies the local system description so that it will match the format used in SNOMED CT-AU, and provided that the mapping tool is able to be restricted to the appropriate part of the hierarchy, increased success in automapping can be achieved.

Pre-processing must not change the meaning of the term in any way, but may be required to change the way that the text that describes the term is represented in order to support automated comparison.

For this reason there are advantages to 'pre-processing' the local system code data for mapping. All changes made to the local system code descriptions must be recorded. This not only supports compliance and risk assessment but also maintenance of the map content as the process can be repeated when either the local code system or SNOMED CT-AU are changed.

Pre-processing may be undertaken in the build map, which as a result would not affect the descriptions used in the local system, or the local system can be modified to make it more consistent with SNOMED CT-AU, which will improve the potential for automapping into the future.

[1] From [BMG2010].

Pre-processing may be required to cater for the following example differences between the termsets and SNOMED CT-AU:

- The use of dashes, slashes and other symbols in the source terms.
- The use of numerical symbols in the source terms.
- Abbreviations in the source terms.

3.7.1 Pre-processing rule guidance

Making definitive recommendations about what pre-processing shall or should be done is impossible and most existing termsets which need to be mapped will have to be dealt with on an individual basis, accounting for their distinctive characteristics.

There are however, a range of areas that can be considered. These will not apply to all termsets, nor will all the recommendations be valid or necessary for mapping each of them. These recommendations and/or methods need to be considered alongside the context and purpose of the mapping as well as the features of local systems.

Some characteristics of local termsets might carry implicit meaning and this should be understood and accounted for in selecting SNOMED CT-AU target concepts.

The following recommendations and examples are provided to outline what needs to be considered when undertaking pre-processing and are not intended to be an exhaustive list.

3.7.1.1 What do dashes mean?

The use of dashes is common. What these dashes actually stand for (represent or mean) may vary within a single termset as they may or may not have been used consistently throughout.

The meaning implied by dashes will vary between different termsets.

Table 8: Example mapping of terms with dashes

Local term description	Possible meaning of dash	Possible pre-processed local term description	Possible mapping target from SNOMED CT-AU
Fracture – femur	‘of’	Fracture of femur	71620000 Fracture of femur
Concussion – LOC	‘with’	Concussion with loss of consciousness	62564004 Concussion with loss of consciousness
Back pain – chronic	‘course’	Chronic back pain	134407002 Chronic back pain
Calcinosis – acne	‘following’	Calcinosis following acne	402493009 Calcinosis following acne

Recommendation: Do not assume that the use of dashes within a termset means the same thing for every term within that termset. If there is evidence of ‘mixed’ use of dashes to convey different meanings, then data cleaning/normalisation may have to be performed manually with associated review processes.

3.7.1.2 What do slashes mean?

Slashes within term names are also common in local termsets. Again, the use of a slash can have a variety of meanings, and the original meanings will make a difference to how accurately and completely maps are constructed to SNOMED CT target concepts.

Table 9: Example mapping of terms with slashes

Local term description	Possible meaning of slash	Possible pre-processed local term description	Possible mapping target from SNOMED CT-AU
Laceration – head/neck	'and'	Laceration of head and neck	283358007 Laceration of head and neck (disorder)
L3/4	'between'	Between L3 and L4	244532004 Joint between bodies of L3 and L4 (body structure)
6/52	'fraction of'	Six weeks	224916004 weeks/year
Depression/Anxiety	'or'	Depression or anxiety	3548907 Depressive disorder (disorder) 197480006 Anxiety disorder

Recommendation: Ascertain whether slashes are used within terms in your existing termset in a consistent way. If slashes denote a variety of meanings or are intended to (variously) convey combinations, choices, groupings, then pre-processing or manual data cleaning techniques may be worthwhile and might facilitate more accurate and comprehensive automapping approaches.

3.7.1.3 Other symbols

Many existing termsets were built by clinical practitioners, and the termset content has 'inherited' a great many of the representations that clinicians routinely used in their traditional hand-writing/paper-based medical documentation practices. Noted below are some of the terms common in existing systems which contain a variety of symbols. Also noted is that while these symbols may be broadly understood by human readers, they are difficult to parse and compute and do not necessarily convey the same meaning to each human reader, nor each computer system.

Table 10: Example interpretations of various symbols*

Symbol	Possible meaning
#	fracture, break, broken
@	at, for each
+	onset, acute, mild, low
++	onset, moderate, medium
+++	severe, extreme pain, high
?	possible, suspected, probably, differential, investigate further
~	approximately, about, not sure, estimated
↑	increasing
↓	decreasing
>	greater than
<	less than
,	and, also, as well as, included together

*Note: This list is neither exhaustive nor definitive.

Recommendation: Determine the extent of use of symbols within the existing termset descriptions before commencing mapping efforts. If symbols are used consistently in the termset and (for example) every occurrence of '#' does indeed mean 'fracture', then programming or scripting techniques (or find and replace methods) can transform the symbols into words. This might increase the likelihood of accurate and comprehensive maps production.

3.7.1.4 Numbers

Numbers within local termset descriptions are another area requiring consideration. Are the numbers represented numerically or are they described using text? Numbers are used to quantify, as well as to describe items such as:

- age;
- time;
- temporal aspects of disorders; and
- anatomical features.

Where numbers are concerned it is important to understand how SNOMED CT-AU approaches numbers. Generally, the rule is that SNOMED CT-AU does *not* handle numbers. As its name suggests, SNOMED CT-AU is a terminology, so we can expect that it (mostly) deals with words. However, we do know that a lot of medicine is quantitative and not merely descriptive. SNOMED CT-AU does have some number-based terms and concepts, though as a rule these numbers cannot be utilised for any sort of arithmetic or mathematical functions.

From a pre-processing point of view it might be helpful to transform numerals to words if automap tools are unable to use indexing tables to search for numerical/word equivalence.

Table 11: Example mapping of terms with numbers

Local termset description	Possible pre-processed local term description	Possible mapping target from SNOMED CT-AU
4th nerve palsy	Fourth nerve palsy	20610004 Fourth nerve palsy (disorder)
2nd O burn	Second degree burn	403191005 Second degree burn (disorder)
3 point gait	Three-point gait	88471006 Three-point gait (finding)

Given how SNOMED CT-AU deals with numbers, there are areas where pre-processing would not provide any value and below are two examples that could require manual mapping.

Table 12: Example terms with numbers requiring manual mapping

Local termset description	Possible mapping target from SNOMED CT-AU
95% disabled	82303003 Disability evaluation, disability 95% (finding)
Birth weight >2.5kg	310539009 Baby birth weight above 2.5kg (finding)

Recommendation: Be aware of existing termset content and determine whether numerical representations are consistent or not with regard to age ranges, percentages etc. Given the variations in the way that SNOMED CT-AU expresses numerical concepts, it may not be beneficial to pre-process your terms to support automapping techniques. However, initial review and some guidance will help humans to manually map in a more consistent fashion if they understand the way in which the existing local termset content is represented, and what they can expect to find (or not) in the SNOMED CT-AU target content.

3.7.1.5 Abbreviations

Abbreviations are common in local termsets, as they are commonly used by clinicians. SNOMED CT-AU does contain some abbreviations within synonyms, and automapping tools may be able to make matches based on this. The SNOMED CT-AU policy regarding abbreviations is to include the abbreviation, followed by the full description of that abbreviation. This policy exists because there are multiple meanings for some abbreviations.

Table 13: Example interpretations of abbreviated terms

Abbreviation	Possible SNOMED CT-AU target concepts
PVD	399957001 PVD – Peripheral vascular disease 76267008 PVD – Pulmonary valve disease 236078003 PVD – Post-vagotomy diarrhoea
IC	10743008 IC – Irritable colon 63491006 IC – Intermittent claudication 197834003 IC – Interstitial cystitis 227708009 IC – Ice cream
PAC	225359006 PAC – Pressure area care 284470004 PAC – Premature atrial contraction
CHL	44057004 CHL – Conductive hearing loss 276353004 CHL – Crown heel length

It is important to note that there are many more abbreviations in use than are covered in SNOMED CT-AU, and thus some pre-processing to expand out these abbreviations may be required again after the initial automap is performed.

3.7.1.6 Overall pre-processing of textual representations

Note that there will be human effort required either in pre-processing or in (later) manual mapping. Vendors and custodians are advised to determine which approach is most beneficial to their efforts, given the characteristics of their existing term set.

You will have noticed that many of the examples given above in relation to possible local termsets reveals that some terms have more than one feature which would need to be addressed.

Table 14: Example terms with multiple features to be considered during mapping

Multiple features	Example
a dash and slash	Laceration – head/neck
a number and a slash	6/52
a symbol and a number	Birth weight >2.5kg

This will mean that there may be several review iterations or run-throughs of the existing termset, each time addressing each of these characteristics in turn, and applying ‘transforms’ to increase the likelihood of finding equivalent meanings in SNOMED CT-AU via automapping or manual mapping techniques.

It should be noted that even if mappers decide to manually map by human review and selection techniques they will be assisted in their task if there is consistency in the existing local (source) termset. If there is no consistency in the form of words, they will be less able to make consistent judgments about meaning.

Note: **None** of the above examples are exhaustive. Existing local termsets cannot be expected to be uniform and may well display other characteristics not addressed here.

Resources which should be considered when understanding pre-processing source terms for mapping to SNOMED CT-AU include:

- *SNOMED CT user guide* [IHTSDO2011b]
- *SNOMED CT editorial guide* [IHTSDO2011a]
- *The Australian Dictionary of Clinical Abbreviations, Acronyms and Symbols* [HIMAA2004]

3.7.2 Document pre-processing process

Where pre-processing is undertaken the methods used to modify concept descriptions must be documented in order to be included in risk assessment, and to ensure that the process can be accurately duplicated the next time the map is updated.

3.7.3 Carry out the pre-processing process

When all pre-processing rules have been established each of the rules should be automatically processed in order to change the descriptions of the local code system descriptions.

Precautions should be taken to ensure that any automated changes made to the data do not have unexpected consequences. For example, the addition of a space before ‘mg’ should not result in a space in a word which includes the letters ‘mg’.

3.8 Building the map

Building the map includes multiple processes: the use of automated tools may be included along with manual mapping, or the map may be built completely manually. Whichever process is used, the build must include quality processes for issue resolution. Mappings should be to SNOMED CT-AU concept IDs. For review purposes the FSN should be used, as this is the unique and unambiguous description for each concept.

3.8.1 Performing automated mapping

If an automated mapping tool is being used and data has been pre-processed, the build table source terms will be processed using the tool with appropriate filters specified to identify a single match in SNOMED CT-AU. A record must be kept of the tool used (including the version of the tool), filters used and the number of matches achieved through the automatic mapping process. Any verification of the mapping process employed must also be indicated.

3.8.2 Performing manual mapping

Even the best automated mapping process is likely to leave some concepts that require manual mapping.

Each term should be mapped and checked by a mapping specialist. The mapping specialist completes or confirms automated mapping results for each individual entry in the source table, building individual entries in the map for each concept and inserting relevant values.

The mapper may use terminology browsers to find the equivalent term in SNOMED CT-AU and should record the concept identifier, the description, the map type (level of equality between the terms) and any potential issues with the map that should be discussed. The status of the map should be updated to indicate whether the original concept has been mapped, awaiting clinical adjudication or a decision made not to map the concept. The range and progression through different map statuses should be clearly documented as a map life cycle.

3.8.3 Documentation of issues

Issues may arise where it might not be clear whether the concepts match or not, or where clinical clarification is required. In this case the person undertaking the manual mapping or checking must clearly document the issue. A record of all issues and how they are resolved should be maintained.

Example:

Local system description:	Nut allergy
SNOMED CT-AU:	Food allergy peanuts
Issue:	A nut allergy in SNOMED CT-AU specifically refers to 'tree nuts' whereas a peanut allergy is considered a 'legume' allergy. Clarification is required as the exact intent of this term in the clinical information system; otherwise the less specific concept must be used.

3.9 Validation

There are different methods that can be used to validate the accuracy of the map content.

3.9.1 Dual mapping

Dual mapping might be considered to be the 'gold standard' approach for mapping. This process involves every concept being independently mapped by more than one mapper and their results compared. Only when each mapper produces the same target term from SNOMED CT-AU is the map considered to be correct. All other terms require issue defining and conflict resolution. Dual mapping should be employed where assurance of a high-quality map is required.

Generally it is sufficient to involve two mappers in the process, however if the resourcing allows additional simultaneous mappings, adjudication of mapping discrepancies may be more efficient. The use of this process provides a validation mechanism reducing inadvertent manual or computer-based errors from getting through to the final map. This is the process recommended by the IHTSDO for production of a high-quality map.

Each mapper conducts their own individual mapping of each concept from the local or proprietary system. If each mapper selects the same solution the solution is deemed to be correct. If the solutions differ they must be clinically adjudicated to determine appropriate action. If this approach is taken a sample to validate is not required (except for where automapping is used).

3.9.2 Sampling validation

This method involves selecting a sample set from the whole map and validating each sample map entry. To ensure unbiased validation, validation is performed by personnel who are not involved in developing the maps. If the sample set is considered valid for the pre-defined purpose of the map, then the whole map is assumed to be valid.

The sample size, the sampling approach and acceptable error rate should be carefully determined in advance, based on the risk profile and the purpose of the map relevant to each mapping project. One recommended example of a sampling approach is grouped random selection. The map source terms are divided into logical groups of choice, for example by frequency of use or by clinical domains. Then the map entries associated with the source terms from each group are randomly selected to create the sample set ensuring that the entries from all groups are represented in the sample set. Afterwards, each entry from the sample set is validated. Depending on the quality of the sample set, a review of the mapping process may be needed.

The sampling validation method does not necessarily validate the whole map as there may be incorrect maps that are not in the sample set. Therefore it may only be a suitable method for ongoing maintenance of the maps with mature automated mapping processes.

3.9.3 Conflict resolution

A suitable conflict resolution strategy is required to resolve all issues identified by any part of the validation process described above. This process requires clinical input and is usually led by the mapping manager in order to ensure consistent application of mapping decisions developed during the mapping process. The objective is to reach a sound terminological and safe clinical decision on the appropriate map from the source to the target for each relevant concept.

All decisions must be documented and this document should be generic where possible.

Suitably experienced and qualified clinical expertise is required to provide clinical governance and to resolve issues identified when mapping. The conflict resolution process requires clinical adjudication on the appropriate action.

Actions might include:

- Advice on the match type, for example:
  - deciding that concepts describing a clinical meaning with different wording can be considered to be the same; or
  - deciding that a concept should not be mapped as doing so would represent a clinical safety issue (i.e. map type: not to be mapped).
- Advice that is general and should be applied whenever a given situation occurs anywhere in the mapping process. Decisions such as these should always generate a documented record of the agreed way to handle the situation. For example it might be agreed that the terms ‘level’ and ‘measurement’ will be considered to be synonyms in all cases.

This process supports the development of a reproducible methodology that uses patient safety as the primary guide to decisions made.

3.10 Quality review

The quality review process is undertaken to identify improvements that could be made to the mapping process for future use and to determine whether the map is fit for clinical use. It can also be used to identify improvements that could be made to the content of SNOMED CT-AU.

3.10.1 Quality review overview

The quality review process should be undertaken by all involved in development of the map and a selection of stakeholders or users of the map. The process should include:

- Review of the clinical audit process to ensure consistency of advice provided and rules developed or applied to ensure that clinical risk has been appropriately assessed and minimised.
- Review of validation results to ensure appropriate accuracy of the map.
- Identification of concepts relevant for inclusion in SNOMED CT-AU and submission of request for change/addition (see Section 3.9.3).
- Review of documentation to ensure completeness and clarity as well as appropriateness of instructions.
- Review of the release process to identify issues or improvements.
- Documentation of lessons learnt in the process through review of results and discussion with those involved in the development of the map and the process.

3.10.2 Process improvement

Consideration should be given to the methodology and tools used and changes made to reflect lessons learnt, so that the next production of the map will be an improvement upon this iteration.

Such changes and the rationales behind them should be documented.

3.10.3 Request submission

If the developer finds any material error or change or correction needed in SNOMED CT-AU, or would like to recommend an improvement, they are encouraged to submit a request to NEHTA. NEHTA is committed to refinement and improvement of SNOMED CT-AU content. Where a non-equivalent map is produced, the request submission process should be used where equivalent mappings would offer improvement.

The SNOMED CT-AU request submission templates, available on the secure NCTIS website[2], should be used for completing all required information as indicated. The *Guidelines for submitting requests* [NEHTA2010d] contains helpful information on how to use these templates. On completion, the email request with all supporting documentation should be sent to NEHTA at <terminologies@nehta.gov.au>.

[2] <https://nehta.org.au/aht/index.php?option=com_content&task=view&id=35&Itemid=55>.

3.11 Documentation

Documentation of the mapping methodology and decisions made can be used not only to reproduce the mapping process when either the local or proprietary code system or SNOMED CT-AU are changed, but also as an evidence of the mapping process undertaken and rules applied for compliance assessment. Documentation should include:

- Clear statement of the source (local or proprietary code system) including version and the target (release version of SNOMED CT-AU).
- Purpose of the map.
- Scenarios of the map uses.
- Intended users of the map.
- The SNOMED CT-AU reference sets, to which the local or proprietary code system is mapped, including clinically appropriate reasons for this.
- Pre-processing undertaken including specification of terms not included in the map, and processes used to modify the source terms prior to mapping. (Include details of changes made and the reasons for the change.)
- Personnel – personnel involved in the mapping process and their qualifications identifying the role played by the individual as well as the skills offered by them. Any evidence of competency should be included in the documentation.
- Tools used – indication of tools used and the capabilities and limitations of these tools.
- The mapping process used.
- The issues resolution process and any common approaches incorporated, or rules to be applied to the map or the map development process, and the conflict resolution process.
- The validation process (including sampling methods).
- The risk management process.
- The risk profile of patient safety risk associated with using this map.

3.12 Release

3.12.1 Produce final SNOMED CT-AU map

In order to produce the final map, the build map is used as the basis and is retained as documentation of the mapping process.

Individual map entries which are not mapped (not of sufficient accuracy to be included in the map) are excluded.

Those fields used to manage the building of the map are removed. This includes fields such as mapper, issues and status.

Where the final map is intended for direct input into a specific information system, the format shall be as required by the system, so as to avoid additional transformation and the associated risks.

This results in the final SNOMED CT-AU map. The version of the map shall be recorded.

3.12.2 Release documentation

Documentation should be provided to accompany the release of the map. This shall include details of the structure and format of the map to assist those using the map. Details of map purpose, scope etc., and decisions made when developing the map should also be included as these may impact the way that the map is used.

Version control on the documentation and the map should be consistent.

3.12.3 Release of the SNOMED CT-AU map

Prior to release, the developer should undertake the *SNOMED CT-AU conformity assessment process* [NEHTA2011g] to ensure that the maps have been developed in line with NEHTA guidelines and requirements.

The map should be released on a specified date and this date should be clearly indicated on all documentation.

3.13 Maintenance

The map should be reviewed when either the source or SNOMED CT-AU is updated. Assessment of the update of either the source or SNOMED CT-AU might conclude that mapped concepts have not changed, in which case the map need not be rebuilt. It is necessary to assess clinical risk related to changes in the source or SNOMED CT-AU. Rebuilding should be undertaken when mapped concepts in either the source or SNOMED CT-AU change.

Rebuilding should follow the same process as the original build (recognising improvements identified during the quality review process). Where changes in process might impact map concepts other than those that have changed, i.e. existing mapped concepts – consideration should be given to rebuilding all individual concept maps which might require change.

The update process should result in an updated map, associated documentation, final map and associated release documentation.

4 Compliance requirements

This section defines the compliance requirements to be assessed as part of *SNOMED CT-AU mapping conformity assessment process* [NEHTA2011g]. These compliance requirements are derived from the mapping methodology discussed in Section 3 of this document.

4.1 Purpose of the maps

Req No 011460 **Priority** Mandatory

Purpose of mapping

The purpose of mapping **SHALL** be clearly defined and documented.

Additional information Refer to Section 3.3.

Req No 011461 **Priority** Mandatory

Scenarios of intended use of the maps

Specific scenarios describing the intended use of the maps **SHALL** be clearly defined and documented.

Additional information Refer to Section 3.3.

Req No 011462 **Priority** Mandatory

Relevance of the scenarios

The scenarios of intended use of the maps **SHALL** be consistent with the defined purpose of mapping.

Additional information Refer to Section 3.3.

Req No 011463 **Priority** Mandatory

Intended users of the maps

Intended users of the maps **SHALL** be clearly identified based on the scenarios of intended use of the maps.

Additional information Refer to Section 3.3.

4.2 Scope of the maps

Req No 011464 **Priority** Mandatory

SNOMED CT-AU concept hierarchies

The SNOMED CT-AU concept hierarchies that have been chosen to be mapped to **SHALL** provide the precision and the context required for the scenarios of intended use of the maps.

Additional information Refer to Section 3.4.

Req No 011465 **Priority** Mandatory

SNOMED CT-AU reference set(s)

Where the scope and the context of an existing SNOMED CT-AU reference set support the defined purpose of mapping, that existing reference set **SHALL** be chosen as the reference set from which to select the map targets.

Additional information Refer to Section 3.4.

Req No 011466 **Priority** Mandatory

Source concepts

The decisions as which source concepts to include or exclude in the mapping **SHALL** be based on the specific scenarios of intended use.

Additional information Refer to Section 3.4.

Req No 011467 **Priority** Mandatory

Documentation on the scope of the maps

The decisions on which source and target concepts to include or exclude in mapping **SHALL** be documented with relevant justifications.

Additional information Refer to Section 3.4.

4.3 Personnel

Req No 011468 **Priority** Mandatory

Knowledge and experience

The personnel, who perform the manual mapping or create the auto-mapping rules or validate the maps, **SHALL** possess knowledge of the map source and the map target, and clinical experience as a healthcare professional relevant to the scenarios of intended use of the maps.

Additional information Refer to Section 3.4.

Req No 011469 **Priority** Mandatory

Mapping manager

A mapping manager **SHALL** be assigned to oversee the overall mapping process.

Additional information Refer to Section 3.4.

Req No 011485 **Priority** Recommended

Mapping team

The mapping team **SHOULD** consist of the following defined roles:

- Mapping specialist;
- Clinical map advisor; and
- Technical advisor.

Additional information Refer to Section 3.4.

4.4 Software tools

Req No 011486 **Priority** Recommended

Evaluation of software tools

The developer **SHOULD** evaluate the capabilities of available software tools based on the purpose and the scope of mapping, before determining which software tool(s) to use.

Additional information Refer to Section 3.5.

Req No 011470 **Priority** Mandatory

Software tools used

The capabilities and limitations of the software tools used in mapping **SHALL** be fully documented and made available to the mapping personnel.

Additional information Refer to Section 3.5.

Req No 011471 **Priority** Mandatory

Use of the tools in the mapping process

An explanation of how the software tools have been used throughout the mapping process **SHALL** be documented.

Additional information Refer to Section 3.5.

4.5 Risk management

Req No 011472 **Priority** Recommended

Risk management

A risk management approach for patient safety risks associated with implementing and using the developed maps within clinical information systems **SHOULD** be clearly defined and undertaken throughout the mapping process.

Additional information Refer to Section 3.6.

4.6 Pre-processing the map source

Req No 011473 **Priority** Mandatory

Documentation on pre-processing

When pre-processing the concepts in the local or proprietary coding system, the following information **SHALL** be recorded:

- what changes are made; and
- reasons for the changes made.

Additional information Refer to Section 3.7.

Req No 011474 **Priority** Mandatory

Meanings of the source concepts after pre-processing

When pre-processing the source concepts, the changes made **SHALL NOT** alter the meaning of the source concepts.

Additional information Refer to Section 3.7.

4.7 Matching the source to the target

Req No 011475 **Priority** Mandatory

Automapping

Any matching rules or patterns, used by the software tool to automatically map the source to the target, **SHALL** be clinically appropriate for the intended use of the maps.

Additional information Refer to Section 3.8.

Req No 011487 **Priority** Mandatory

Mapping to concept ID

The source terms shall be mapped to SNOMED CT-AU concept IDs only and **SHALL NOT** be mapped to SNOMED CT-AU description IDs.

Additional information Refer to Section 3.8.

Req No 011477 **Priority** Mandatory

Acceptable matches

Only the following types of match between the map source and the map target **SHALL** be released for implementation in clinical systems:

- Equivalent – the source concept and the target concept are semantically matched.
- Specialised – the source concept is more specific than the target concept.

Additional information Refer to Section 3.8.

4.8 Issues and conflicts resolution

Req No 011478 **Priority** Mandatory

Issue resolution

Issues encountered and how they are resolved during the mapping process **SHALL** be recorded.

Additional information Refer to Section 3.10.

Req No 011479 **Priority** Mandatory

Conflict resolution

Conflict resolution process followed during the mapping process and related decisions made **SHALL** be recorded.

Additional information Refer to Section 3.9.

4.9 Validation of the maps

Req No 011480 **Priority** Mandatory

Validation

The developed maps **SHALL** be validated using a validation approach relevant to:

- the purpose of mapping; and
- the risk profile of patient safety risks associated with using the developed maps.

Additional information Refer to Section 3.9.

Req No 011476 **Priority** Mandatory

Validating the automapped terms

The automatically created maps, where the source and the target term descriptions are lexically different, **SHALL** be manually validated.

Additional information Refer to Section 3.8.

Req No 011488 **Priority** Mandatory

Manual validation

The automatically created maps, where the source and the target term descriptions lexically match, **SHALL** be validated using an appropriate sampling validation method as a minimum.

Additional information Refer to Section 3.8.

4.10 Release to the implementers of clinical information systems

Req No 011481 **Priority** Mandatory

Release data

As a minimum, the data released to the clinical information system implementers **SHALL** contain:

- unique identifier of the map;
- status;
- unique identifier of the source concept;
- source concept description;
- SNOMED CT-AU concept ID;
- SNOMED CT-AU Preferred Term; and
- match type.

Additional information Refer to Section 3.12. This requirement also supports composition and transmission of clinical documents that have been defined by NEHTA [NEHTA2011a], [NEHTA2011b] and [NEHTA2011d].

Req No 011482 **Priority** Mandatory

Release documentation

The release documentation **SHALL** contain:

- The purpose of the maps (how the map should/should not be used).
- The format of the release data (including metadata for each field).
- Details of any rules or processes to be applied by the clinical information systems.
- Details of the source and the target coding systems:
  - Name of the source coding system.
  - HL7 registered Object Identifier (OID) of the source coding system (http://www.hl7.org/oid/index.cfm).
  - Version or release date of the source coding system.
  - 'SNOMED CT-AU' as the name of the target coding system.
  - '2.16.840.1.113883.6.96' as the OID of the target coding system.
  - The release of SNOMED CT-AU (e.g. 20110531).
- The release date or the date from which the release is to be applied.
- The processes used to develop the map (indicating inclusions and exclusions).

Additional information Refer to Section 3.12.

Req No 011483 **Priority** Mandatory

Release documentation update

The release documentation shall be updated and **SHALL** accompany every release of the map data released.

Additional information Refer to Section 3.12.

4.11 Maintenance

Req No 011484 **Priority** Recommended

Regular maintenance

The developer **SHOULD** review and update their maps with each release of the map source or the map target.

Additional information Refer to Section 3.13.

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Appendix A: Glossary

Term	Definition	Notes and Explanations
AMT	Australian Medicines Terminology	
Assessment	Determining if specified requirements relating to a product, process, system, person or body are fulfilled.	
Automapping	A computational mapping task, undertaken using an algorithm.	Separate files of concept content from different coding systems are compared using an algorithm to determine whether there are concepts which match each other; that is, whether each coding system has content in common [NEHTA2005]
Build map	A build map or 'working draft' contains all required maps and information required to manage the map such as who performed the map, what status the map is at any point during development.	
CCA	NEHTA Compliance, Conformance and Accreditation business unit	
Clinical vocabulary	The language used by the clinical profession and industry [ISOTC215b].	
Competency	A person's ability to undertake a role or perform a task including related dimensions of ability such as underpinning knowledge [IHTSDO2009c].	
Compliance	The adherence to the requirements of laws, industry and organisational standards and codes, principles of good governance and accepted community and ethical standards.	
Concept	Related conditions and situations that provide a useful understanding and meaning of a subject.	Commonly described as a 'thing' – anything which can be described, imagined, whether real or fictional, present, past or future [ISOTC215b].

Term	Definition	Notes and Explanations
Conformity	Conformity is a term that encompasses both conformance and compliance. When applied to software systems, the term 'conformity' may be replaced with the term 'conformance', in accordance with common practice in the information technology industry. When applied to management and business processes, the term 'conformity' may be replaced with the term 'compliance'.	
Conformity assessment	Demonstration that an object of assessment fulfils specified requirements.	
Cross map	See: Map.	
Cross map target	See: Map target.	
Data aggregation	A process by which information is collected, manipulated and expressed in summary form.	Data aggregation is primarily performed for reporting purposes, policy development, health service management, research, statistical analysis and population health studies [ISO18308].
Developer	An organisation that creates an implementation of NEHTA eHealth specification. A developer may be an organisation that develops a software product, or a provider of eHealth services. Health jurisdictions, healthcare providers and systems integrators may also be developers of eHealth systems.	
DOHA	Department of Health and Ageing	

Term	Definition	Notes and Explanations
Equivalence	Like in significance or import; corresponding or identical in effect and function.	Synonym: • Semantic equivalence In controlled terminology: Two concepts are (semantically) equivalent if their domain of meanings overlap and their semantic definitions are interpreted as identical. That is, the total scope of meaning of each concept is the same and each concept is defined as the same thing [ISOTC215b].
Final map	The final map or published product is the file that it implemented for use and should contain history tracking to ensure backward compatibility where different versions of the same map are used across different sites/sectors.	
FSN	Fully specified name	
Human mapping	The use of human knowledge and skill to build maps between concepts and/or terms in different coding systems.	Each map is built singly and individually. The process requires examination of each and every concept and coding system. Informed judgements or decisions are made about the shared meaning of concepts. Some electronic or computational tools are used, but only in support of work process: these are not helpful in determining any equivalence of meaning. [NEHTA2005]
IHTSDO	International Health Terminology Standards Development Organisation	
ISO	International Standards Organisation	

Term	Definition	Notes and Explanations
Lexical match	Where two concepts are represented using the same word(s).	The source concept matches the target concept exactly; word for word, singular to singular, plural to plural. It must be noted that just because the source and target systems have matching words, does not mean that the meaning is exactly the same. For example: 'high blood pressure' can mean a single instance of a high reading for an individual (which could have been after strenuous exercise), while high blood pressure can also be an ongoing condition. One meaning is far more clinically significant than the other.
Map	An index from one term to another, sometimes using rules that allow translation from one representation to another indicating degree of equivalence.	Synonyms: • Individual map • Cross map
Map source	A terminology, coding scheme or classification used as the starting point for map production (in the context of mapping).	Synonym: • Source
Map target	A terminology, coding scheme or classification to which some or all of the concepts in another terminology, coding system or classification (the map source) are mapped.	Synonyms: • Target (in a map) • Target Scheme.
Mapping	The process of defining a relationship between concepts in one coding system (Source) to concepts in another coding system (Target) in accordance with a documented rationale, for a given purpose.	Quality mapping will be useable, reproducible and understandable [ISOTC215b].
Mapping specialist	An individual who is competent to determine whether a map concept within a source terminology has a link to a concept in the map target.	
NCTIS	National Clinical Terminology Information Service	

Term	Definition	Notes and Explanations
NEHTA	National E-Health Transition Authority	
PCEHR	Personally Controlled Electronic Health Record	
Reference set	A group of components (e.g. concepts, descriptions or relationships) that share a specified common characteristic or common type of characteristic.	Synonym: • Subset A reference set is a subset of the superset or complete terminology or classification. [ISOTC215b]
Scenario	The story based description of a situation or business instance that defines requirements, roles and processes for a given map. (Modified from [ISOTC215b]).	Synonym: • Use case It is preferred though that the term 'use case' be reserved for the IT-based representation of use cases and use case modelling.
Semantic match	Where two concepts represent the same meaning, even if the words used to describe them are different. [ISOTC215b]	Semantic matching uses knowledge of meaning of the SNOMED CT concept and target ICD-10 code(s) to develop the map. For example, semantic matching may use knowledge of synonyms, knowledge of part or whole relationships, knowledge of class/subclass (parent/child, sub-type/super-type) relationships, and knowledge of the user's own information and realm of context to increase both recall and precision of matching choices. [IHTSDO2009c]
SNOMED CT	Systematized Nomenclature of Medicine-Clinical Terms	This is considered to be the most comprehensive, multilingual clinical healthcare terminology in the world. SNOMED CT intellectual property rights were transferred to the SNOMED SDO® in the formal creation of the IHTSDO. [IHTSDO2009c]
SNOMED CT-AU	SNOMED CT Australian Extension	This includes the content from the International release of SNOMED CT together with Australian-developed terminology and associated documentation.