Mapping to SNOMED CT

Discussion and Guidance on
Mapping Based Solutions Design for Migration or Transformation

STATUS: Informal guidance

This document has not been formally endorsed by the IHTSDO but is made available as a helpful resource for those interested in this topic. Those responsible for writing and reviewing the document have practical experience in and understanding of the subject matter covered. However, it has not been through a formal acceptance process.

Copyright and Acknowledgements

Contents

Version History

Version	Author	Comment
1.0	Andrew Frangleton	Initial pull together of independently created documents. Update of sections written by AF based on feedback
3.2		Update following Copenhagen meeting 10th April 2013
3.3	Denise Downs	diagram and colour coding standardised Activities follow in the correct right order.
4.0/5.0	No published	Re-versioned to synch with collabnet
6.0	Andrew Frangleton and Denise Downs	Review to get consistency and expand content to complete gaps

1 Overview

Organisations planning to implement SNOMED CT based solutions are often faced with data transformation and migration challenges which lead them to consider mapping their existing code system, classification or terminology to SNOMED CT.

The purpose of this document is to provide a high level overview of the issues which should be considered prior to embarking on such an activity, and which will result in the creation of a mapping table, details of how the process of map creation should be managed and how the resulting maps should be used.

There is a range of excellent resource material elsewhere that provides further detail on specific topics related to mapping to SNOMED CT and these documents will be referenced here. It is not the purpose of this document to duplicate that material, but to provide a roadmap of the key issues for those relatively new to the topic.

The requirement to train end user staff in the use of the new coding system to be used after a data migration has occurred is outside the remit of this document but is clearly a requirement.

1.1 Scope

The following table indicates the type of mapping activity addressed within this document; as we are only considering mapping to SNOMED CT the document is specific in its reference to SNOMED CT but the principles may be applicable to other terminologies.

Source	In Scope	Rational
Free text to SNOMED CT	✖	Techniques such as Natural Language Processing or text analysis are a complex area and are therefore out of scope of this document.
Classification to SNOMED CT	✔	Classifications are in common usage and although generally less granular than SNOMED CT are often in practice used as the source of a map. This difference in granularity does cause some issues in the mapping process such as data loss and potential many to many mappings. However, as this is a common scenario, mapping from classifications are considered in this document.
Code System to SNOMED CT	✔	
Terminology to SNOMED CT	✔	
SNOMED CT as the Map Source	✖	The intention of this document is to aid migration to SNOMED CT and therefore map creation where SNOMED CT is the source of the map is not specifically covered.

Source	In Scope	Rational
		This document does not include advice on how to apply a SNOMED CT update although this could be seen as a SNOMED CT to SNOMED CT mapping process where the majority of terms are mapped 1:1 but retired terms, for example, require special processing.
Detail on how an information model is used	✘	This document focuses on the terminology aspect of data migration. Reference is made to the importance of an information model however this is not the core topic of the document.
Maps from Postcoordinated expressions	✘	Post coordinated expressions do not require special treatment as long as they are described adequately.

1.2 Assumptions

Maps are one directional from the map source to the map target.

2 Definitions

Note. These definitions have been provided in relation to the scope of this document. Throughout this document a terminology, classification or bespoke code system is collectively referred to as a code system.

2.1 Automatic Mapping

The use of computer algorithms to create maps between concepts and/or terms in different code systems.

2.2 Human Mapping

The use of human knowledge and skill to author maps. Each map is built singly and individually. The process requires examination of each and every concept in the coding system. Informed judgements or decisions are made about the shared meaning of concepts. Electronic or computational tools are used, but only in support of work process.

2.3 Lexical Map

Maps created where a concept in the source code system uses a lexically identical term to a concept in the target code system. This is a candidate for automatic mapping.

2.4 Map

The relationship between a code, concept or term in one code system so that it is represented by a code(s), concept(s) or term(s) in another code system.

2.5 Mapping

The Process of defining a relationship between each code, concept or term in one code system to a set of code(s), concept(s) or term(s) in another code system, in accordance with a documented rationale, for a given purpose.

Maps or Mapping Table

When mapping from a source code system to a target code system, maps will be required for each code, concept or term; this set of maps is usually held in a mapping table and referred to as the Maps or Mapping table.

2.6 Mapping Source

The code system used as the originating scheme for map production.

2.7 Mapping Target

The code system to which maps are created as part of the mapping process. This document assumes SNOMED CT is the mapping target.

2.8 Migration

The permanent transformation of Electronic Health Record (EHR) data to be represented in another code system using maps, usually in order to migrate to a new system or to upgrade an existing system.

2.9 Re-code

Using Maps to transform or migrate EHR instance data by replacing one code system with another.

2.10 Transformation

The process of converting EHR data to be represented in another code system using maps, usually in order to exchange data between systems. The underlying data in the originating system remains unchanged

3   The Process

The main activities that form the process to be undertaken each time a mapping solution is felt to be appropriate is described by the following diagram; the main flow of activities being indicated in the top row:
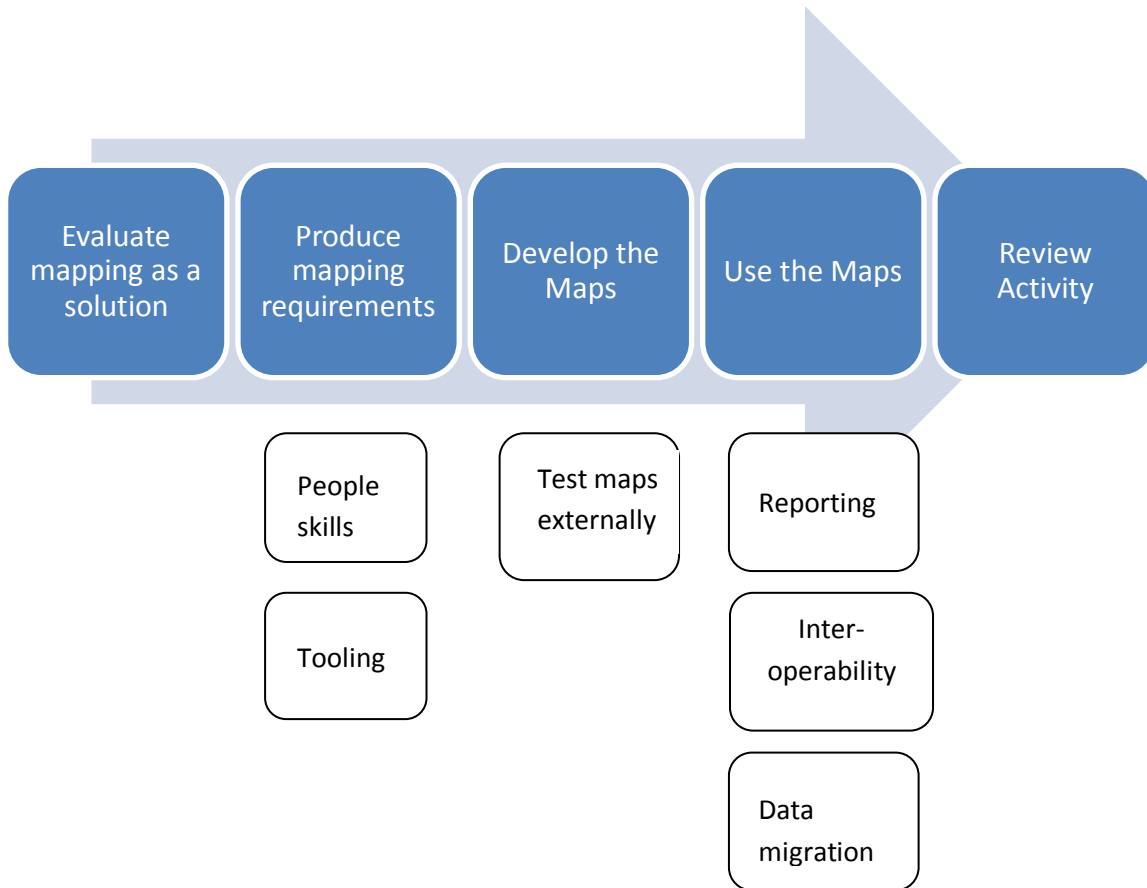
This document acts as a guide to the key aspects to consider in each of these activities.

3.1 Evaluate mapping as a solution
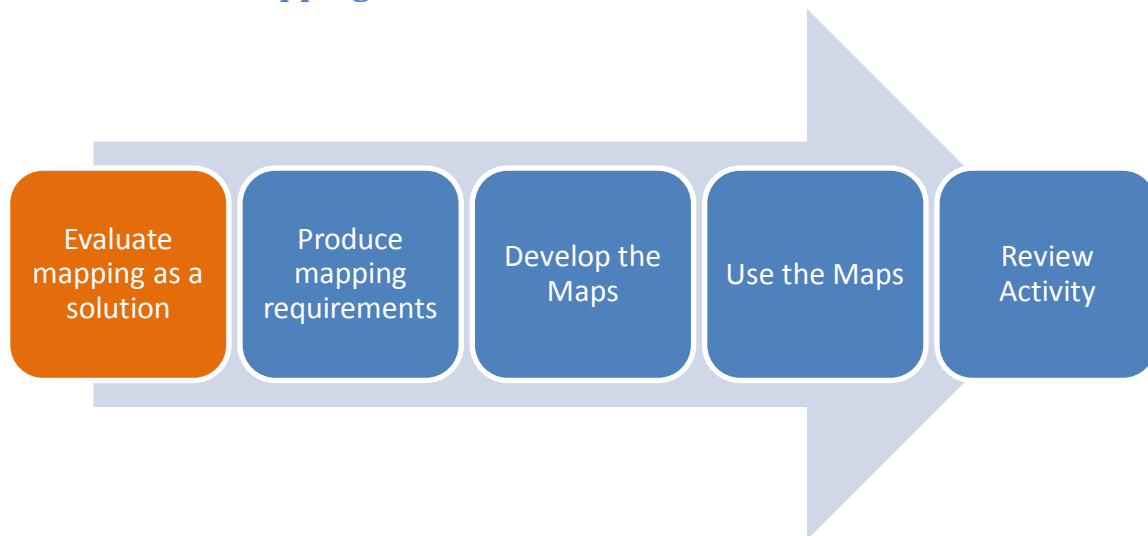
3.1.1 Description:

Before embarking on the creation of a map there are a number of high level questions which should be considered. The approach should be not to focus on creating a map table, but rather on understanding the instance data itself which needs to be transformed or migrated, and the requirements for use of that data. This helps to ensure that any maps which are created will be fit for purpose.

Key issues to consider are:

- Are the business requirements well understood?
  - How will the data to be migrated or transformed through the maps be used?
  - How does this future use compare to current use of the data? And if very different, is this future use likely to be met by the current data and thus worth mapping?
 - Is this a data transformation exercise or is it intended to permanently migrate coded element of the EHR to SNOMED CT? If this is a data migration exercise, is it a once-off effort at the time of implementing a new system? Or will there be a continuing need for data migration? There are benefits in reprocessing migrated data as improvements may be made to the maps resulting in a higher data quality in the new system. The merits of this should be considered, and hence during the migration process what needs to be recorded to enable such a re-mapping.
  - Will users continue to use their existing coding systems? In which case there will be a need to maintain the maps to ensure consistency as either the coding system or SNOMED CT changes over time.
  - Will it be necessary to create a reverse mapping table .What are the issues in creating and using a reverse map (if the granularity between the source and target code is very different, information can be lost that could have safety risks)?
  - Is it necessary or useful to restrict SNOMED CT to a specified RefSet?
- To what extent can the source data contribute value to the target data?
  - Is the source data complete? Consistently coded? Independent of free text? If from a classification is it specific enough?

- o Does the source data have an information model which needs to be taken into account? Will aspects of the model be replaced by coding in the future or vice versa?
  - o What is the data quality? If poor, is it really worth the effort?
- What are the options?
  - o Depending on the business requirements, mapping may not be required. It may be sufficient to store the data in some simplified format such as free text.
- What requirements are there after mapping of the original data?
  - o The text needs to be available for clinical inspection?
  - o The original code needs to be retained to support historical reporting or a possible re-map?

If, after considering the above, mapping seems to be the best option, further consideration should be given to the feasibility and cost of the mapping exercise. In particular:

- What is the scope of the mapping exercise?
  - o Magnitude and scope of content
  - o Frequency – is this a one-off exercise or recurring, either occasionally or real-time?
  - o Clinical safety – extent of validation required? Is validation of the map sufficient or will there be a need to support some user validation of the transform/migration process through, for example, testing and/or statistical analysis?
  - o Completeness – is migration of all data essential?
- Can the map target be restricted through an existing Refset, national or otherwise, in order to improve consistency in mapping, and thus improve semantic interoperability.
- What is the cost of creating, quality assuring and maintaining the maps?
- Are appropriate resources available to create and verify the maps?
- What is the cost of the actual data migration: if once-off; or the services required for on-going data transformation if recurring?
- Have the risks been analysed and appropriately mitigated.

3.2 Produce Mapping Requirements
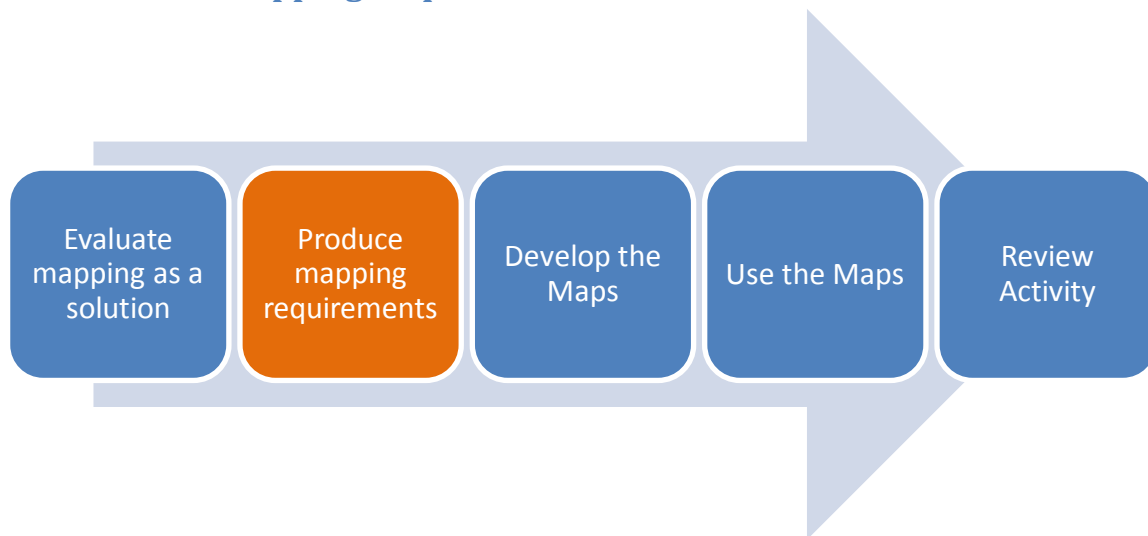
3.2.1 Description:

Having evaluated the options and concluded that a mapping solution is the preferred way to proceed; more detailed plans need to be made. The core objectives of the mapping should have been defined in the initial phase and these will drive the decisions on how to perform the mapping and what tooling will be required.

The first stage is to fully understand both the map source and the map target (SNOMED CT).

For the map source, analysis must take place regarding how the terms have been used in the existing system such as the scope of terms actually used, contextual information provided by the information model, term life cycle and update frequency. In analysing the map source it may be possible to identify some cleansing processes that can be applied to the current content to improve the likely outcome of the data quality after the mapping transformation or migration stage.

The owners of the patient records in the originating EHR system should be consulted on the use of their data and the proposed migration / transformation approach. Aspects such as essential reports and the possible impact on these should be considered, especially where future use of SNOMED CT may result in a change in coding practice. A testing strategy should be developed and a method created to allow data owners to check the data after the migration / transformation.

Once the code system and how it has been used is fully understood, a document should be created which defines the rules which should be applied when creating maps to SNOMED CT. The rules should account for scenarios such as:

- Inexact mappings – how are maps *from* or *to* terms of differing granularity managed? Examples
    - o 'Diabetes' to 'diabetes mellitus Type II'
    - o Warfarin sodium to warfarin.
- Are maps needed to the SNOMED CT Descriptions or Concepts or both?
- Maps to post coordinated expressions
- Maps to synonyms (same concept different term – requirement to preserve original text)
- No suitable target term available (e.g. do you preserve original text and alert for manual intervention)

- Meta data requirements to identify how maps should be used in transformation or migration, for example if "History of" was dealt with in the information model but will in the future be maintained with the SNOMED CT context model
- Identification of reference set requirements
- Identification of auto mapped items
- What information to store as part of the mapping process

The mapping rules to be undertaken when creating maps may be able to be implemented by automatic mapping or may require the skills of a human. In practice a combination of automatic and human mapping is usually the most efficient and effective method.

Automatic mapping is often useful where there are exact lexical matches or similar patterns or techniques where a certain or candidate map can be derived. For example: the concept of 'diabetes mellitus' exists in both the map source and the map target. It is also often the case that a semi-automated process is useful where potential map targets are identified but a human must make the final choice or investigate alternative targets manually.

If automatic mapping is identified as part of the solution an algorithm specification should be created.

Depending on the intended use for the maps, verification and/or validation will be required. This could be through a second manual check, or it could be managed through parallel independent manual mapping with a review of differences. If maps are for clinical use then a level of verification/validation is essential.

If the mapping table is to be used more than once, process and controls must be identified for re-verification of maps when either the source code system or SNOMED CT Changes. This may lead to removal of maps, identification of new maps and refinement of existing maps. Consideration should be given as to what action, if any, is expected on existing data that has already been mapped where the maps are changed.

In order to be able to understand the evolution of the maps, an audit trail of the map creation and maintenance activity should be maintained.

4   People Skills
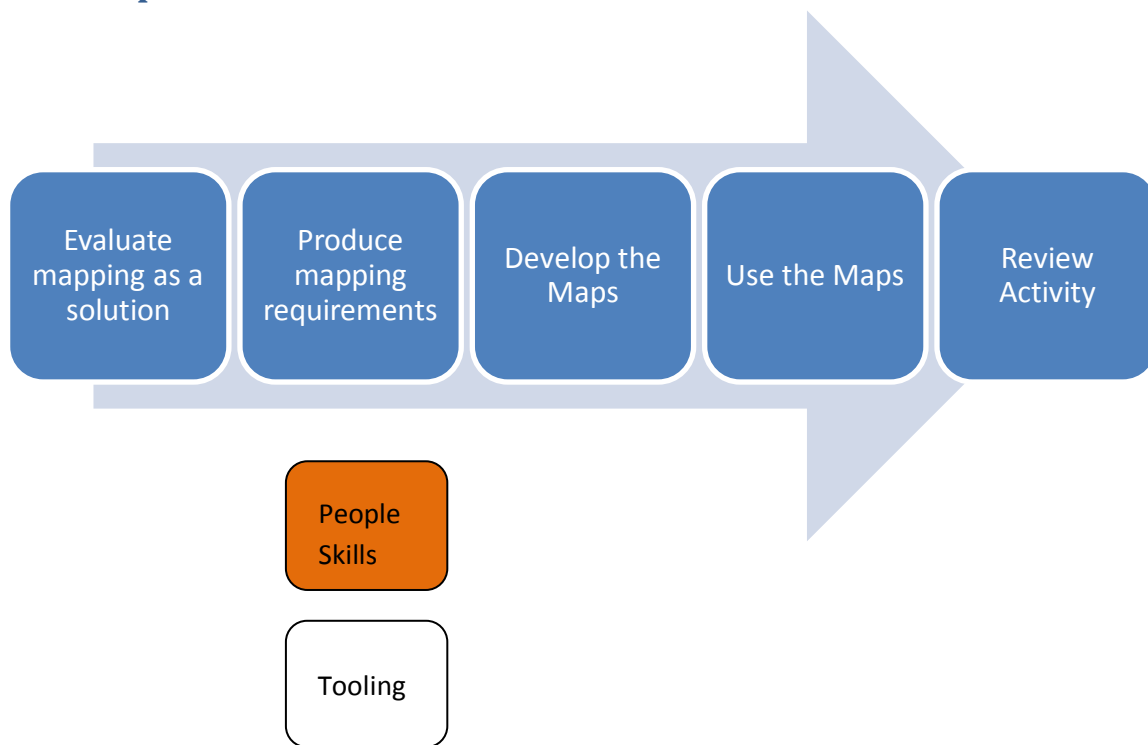
4.1   Description:

Human resource requirements are somewhat dependent on the model used for mapping and the type/ complexity of the map being developed. As there are a variety of roles the following table identifies some candidates for consideration. It is possible and likely that the skills will overlap.

Mapping resources Roles	Responsibilities	Skills/Competencies
Mapping sponsor	Responsible for commissioning and determining the business case to be met by the map. Provide high level oversight, direction and financial resources for the mapping project.	Competence in communication Competence in developing and/or assessing business case merits
Mapping manager	• Establish and manage the mapping project • Establish and execute communication plan • Determine education needs of the mapping team, for example in relation to coding systems • Establish handover from mapping project to business owner	Competence in managing teams, managing workflow, and managing communication. Desirable but not necessary is that the mapping manager understands the domain in which the mapping occurs
Mapping Team Leader	• Determine mapping process • Acquire mapping tool(s) • Coordinate mapping specialist work • Manage communication within the	• Knowledge of source and target terminologies • Understand and explain the purpose of the map

Mapping resources Roles	Responsibilities	Skills/Competencies
	mapping team and with external stakeholders as applicable • Manage mapping issues and facilitate resolution of mapping decisions	• Understand the way in which the computer system and people will use the map • Issue and risk management • Communication
Mapping Specialist	• Determine the mapping requirements • Develop and verify maps • Perform mapping within mapping framework to resolve mapping issues • Provide support to users of the maps • Develop & execute maintenance and sustainability plan	• Knowledge of the source and target terminologies • Understand and explain the purpose of the map • Understand the way in which the computer system and people will use the map • Understand and be able to apply the structure, content and relationships for the source and target terminology. • Be able to apply the basic concepts of the SNOMED CT model and description logic. • Understand the processes to maintain and publish the map.
Clinical specialist/mapping advisory group	• Provide in depth knowledge of the clinical practice and understanding of the terms • Assist in the development of editorial mapping rules and the resolution of issues • Have clinical domain knowledge and decision making ability • Clinical validation/verification of maps and thus mapping process	• Knowledge of the clinical practice where the terms will be used • Understanding of the source and target terminologies • Understanding of the purpose of the map

5   Tooling
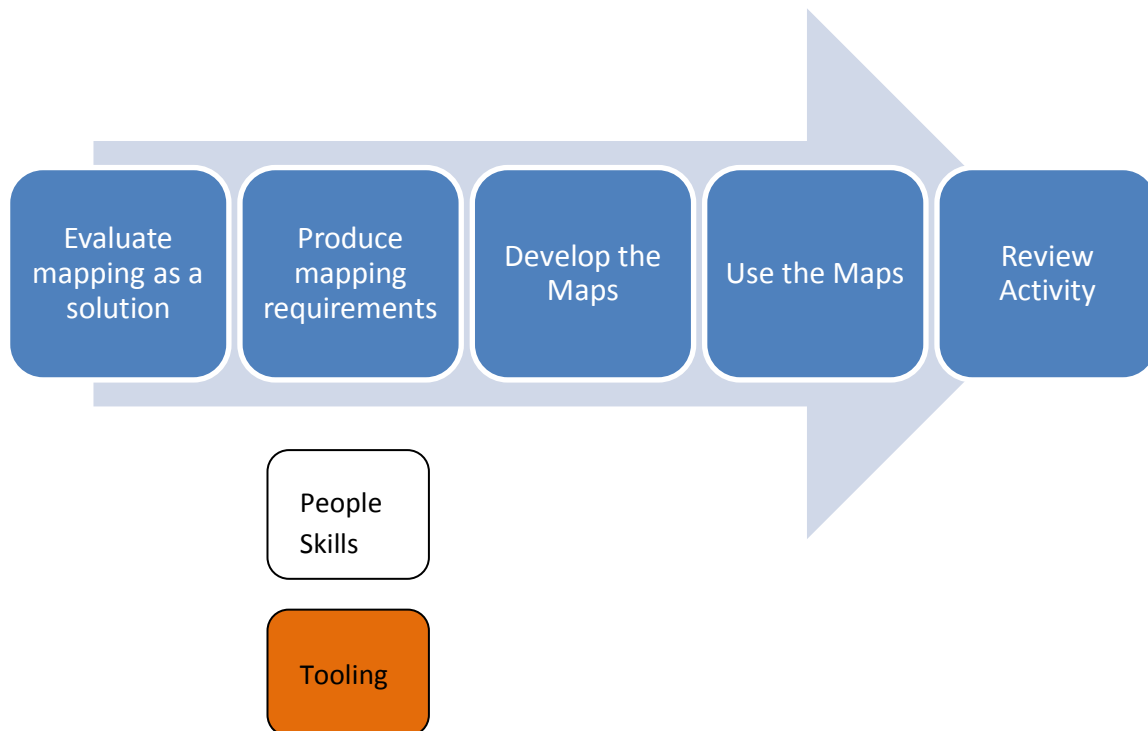
5.1   Description:

Once all requirements have been defined, appropriate software tools to support the creation of the maps must be decided upon. The tools required depend upon a number of factors such as the number of the maps being maintained and the complexity of the requirement surrounding the mapping process.

There are three main alternatives which should be considered:

- Simple multipurpose tools such as Excel,
- Dedicated map maintenance applications,
- Custom built applications.

The following table outlines some of the requirements that the chosen tooling might need to support. In a custom tool or a tool designed for maintaining maps, many of these features will probably be available, or can be built if a custom application is chosen.

Simple, multipurpose tools may not easily support all the features described. This correctly indicates that there are some limitations in their use. Likely criteria for success with multipurpose tools are when:

- The purpose of the maps is not for clinical use.
- The mapping is a one off process – there are no requirements to update either the map source or map target in the future. In reality this is quite an unlikely scenario.
- There is only a single person creating and managing the maps
- The map source is a small terminology

- The map source is structurally simple
- Only a small subset of SNOMED CT is required as the map target

	Possible Tool Requirements
Map Source	
Initial setup	Ability to import the set of source terms and identifiers plus any required relationship, status or attribute information into the mapping environment
	Access to context of use in the originating EHR system
Updates	Ability to import future updates to the source terminology and the identification of changes which may require map review
Map Target (SNOMED CT)	
Initial setup	Import of an initial version of SNOMED CT so that it can be used as a map target
Updates	Ability to import future versions of SNOMED CT and to process the change management aspects of updates
Filtering of content	Support for filtering of SNOMED CT content based upon user requirements E.g. to filter on the top level SNOMED CT concepts
Reference set? support	Support for SNOMED CT Reference Sets to provide Refset filtering
Multilingual support	Support for SNOMED CT Reference Sets to provide alternative language variants
Synonym support	Support for alternative descriptions and abbreviations including use of the SNOMED CT Word Equivalents Table
Extension support	Ability to include SNOMED CT content extensions
Algorithmic Mapping	
Algorithms to support creation of maps	Ability to create maps through the use of a computer driven algorithm
Map identification	Ability to identify maps created automatically versus through human authoring
Map support	
One to many mappings	Allow one source term to map to multiple target terms if required or prohibit if not
Many to one mapping	Allow many source terms to map to one target term if required or prohibit if not
Failed map identification	Allow the flagging of source terms to explicitly identify where a map cannot be created
Map removal	Support such that after publication a map may be deprecated
Annotations	Provide the ability to comment on a given map
Metadata	Allow the setting of attribute values against a given map.
Post coordination	Provide support for creating post coordinated SNOMED CT concepts
Finding Map Targets	
Browse capability	Ability to browse through SNOMED CT components

Search capability	Ability to search for a SNOMED CT concept or description
Map Suggestion	Ability to suggest candidate target map terms to the user
Reporting	
Metric analysis	Provision of standard reports to show current status of the maps
Custom report	Additional reports as may be required
Workflow Management	
Task list support	Functionality to allow allocation of terms to be mapped / reviewed
Parallel independent mapping	Ability to allow map to be created independently and then analysed for differences
Support for independent map validation	Ability to enforce validation of a map by the non-originating author
Audit	Provision of an audit trail for all mapping work including who, when and what
Export / Access to Maps	
SNOMED CT Release Format 2	Creation of SNOMED CT standard Cross Map Reference sets
Custom	Export capability of the maps to a preferred format
API	Provision of service through which the maps can be accessed
Graphical Representations	
Diagramming support	Provision of graphical tools to allow browsing of Map Source and Map Target and the maps between them.
Environment	
Multi user	Support for multiple, simultaneous users
User identification	Support for user sign on and audit
Remote access	Ability to access the tooling through the internet
Ease of use	Different solutions may require a different level of technical ability / knowledge of the mapping process

6 Develop the Maps
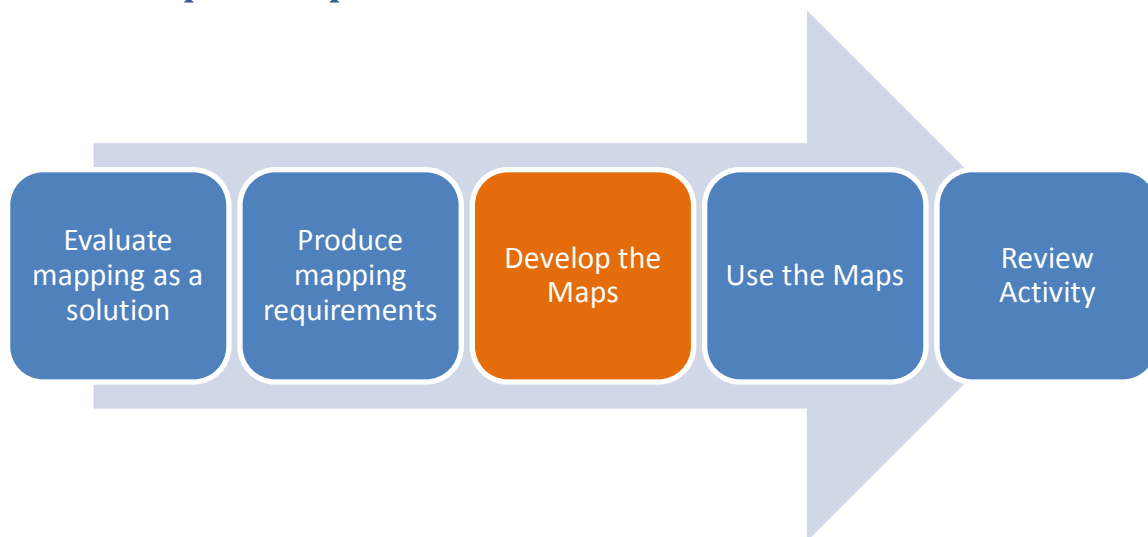
6.1 Description:

The process of mapping needs to be done in a controlled manner. Checks and balances should be used at each stage to ensure that the process is technically accurate and any maps created should be checked either using a map verification process or by parallel independent mapping. Once maps are created and published a cycle of testing should be performed to validate that the results obtained through the use of the maps to transform or migrate data within the EHR meets the defined requirements.

6.2 Data preparation

The initial stage involves preparing the map source and the map target in the chosen mapping tool. This stage requires that the Code Systems and any required supporting data such as relationships, alternate descriptions and subsets of the code systems/SNOMED CT are loaded into the mapping tool.

Prior to loading any content, cleansing on the map source should take place to ensure that terms that are not required for mapping are excluded or marked as such. This may be due to such considerations as terms that are not in use, known to be ambiguous or are for a legacy use only

Once the data is loaded checks should be carried out to ensure that the integrity of the data is complete and that the metrics of the original data are equivalent to the metrics of the loaded data, for example to check that all the terms are present, to check all the relationships are valid.

6.3 Algorithmic Mapping

Once the source and target datasets are loaded the next optional stage is to load any pre-existing maps, or to create maps based on algorithms which were defined in the requirements phase. The risk in creating any maps algorithmically must be assessed and the need for a review of these maps must be evaluated. It is often necessary to create two types of algorithmic maps, those needing review and those that are secure and thus can be automatically verified. For example lexical maps where terms match exactly may not require review whereas more complex mapping algorithms might require a level of sampled inspection.

6.4   Human Mapping

Having loaded the data and set any algorithmic maps the next step is to undertake the manual mapping process on any unmapped items. There needs to be an editorial policy in place that acts as a guide to those undertaking the manual mapping. Mapping should be carried out according to the defined editorial policy. During the mapping process, editorial policy may need to be refined due to findings that only manifest themselves during the work itself. Any changes to the mapping policy should be documented and communicated to the team. If new rules require a review of previously created maps these should be revisited. Editorial policy may, for example, define when to map to a SNOMED CT procedure, regime/therapy or observation depending on circumstances in the source data.

The next stages of the process can be performed iteratively on batches of terms rather than waiting for one step to be fully complete. There are advantages to this approach as it ensures that lessons learnt can be quickly applied with less revisiting of original work.

6.4.1   Map Verification Approach

Once source terms for which a map can be found are mapped to SNOMED CT the review process can be started. The purpose of the review is for someone other than the originator of the map to perform a check and to verify or reject the chosen map. Any challenges to the existing map should be identified, and then discussed within the mapping team, with a final map being agreed through discussion. This may result in changes to the editorial policy and any implications of this such as the need to re-map must be undertaken.

6.4.2   Parallel Independent Mapping Approach

If parallel independent mapping is the chosen method then two independent mapping work streams are initiated. After both mapping work streams are complete on a set of identical terms, a comparison must be made of the independently generated maps and any differences must be resolved. The differences will need to be discussed in the mapping team and a consensus on a solution decided. This may result in changes to the editorial policy and any implications of this such as the need to re-map must be undertaken.

All maps created, amended or verified should be audited to ensure that there is a way to detect what maps were created by whom and when.

At this stage it has been 'verified' that the maps are correct, but in isolation and not in the context of the original use. A process of validation should be undertaken, which uses a sampling approach, to ensure that when applied to the actual data the maps are acceptable to the data owners. This Validation should be done in conjunction with the data owners who are the key stakeholders.

6.5   Publication

On completion of all verification and validation processes or difference analysis, the maps are ready to be published. This will usually mean exporting the maps from the mapping tool. This should be carried out as defined in the requirements with additional checks being made to ensure that the extracted data is a true reflection of the maps held in the tool.

6.6 Life cycle management

If the mapping is not a one off process, then there will be multiple data load, mapping and publishing cycles. Subsequent data loads require an additional step to ensure that any differences in either the map source or map target are accounted for with respect to existing maps, and any user reported errors or issues are addressed. To achieve this, a re-verification phase is necessary after a new map source or target is loaded. Changes in the map source or target should be determined, for example description or term status changes should be identified, and if any changes affect existing maps then these maps should be marked as requiring re-mapping or reviewing. Changes to maps need to be documented and subject to audit. An audit of changes needs to be kept and circulated with or as part of the maps. SNOMEDT CT Release Format 2 (RF2) maps provide for the appropriate audit trail within the format specification.

On each release of the data it is also important to ensure that there is an opportunity for the data owners to validate the results of the use of the maps when data stored in the originating terminology is migrated or transformed. This can only be done within the EHR system presenting the EHR data in terms of the target terminology.

7 Use the Maps
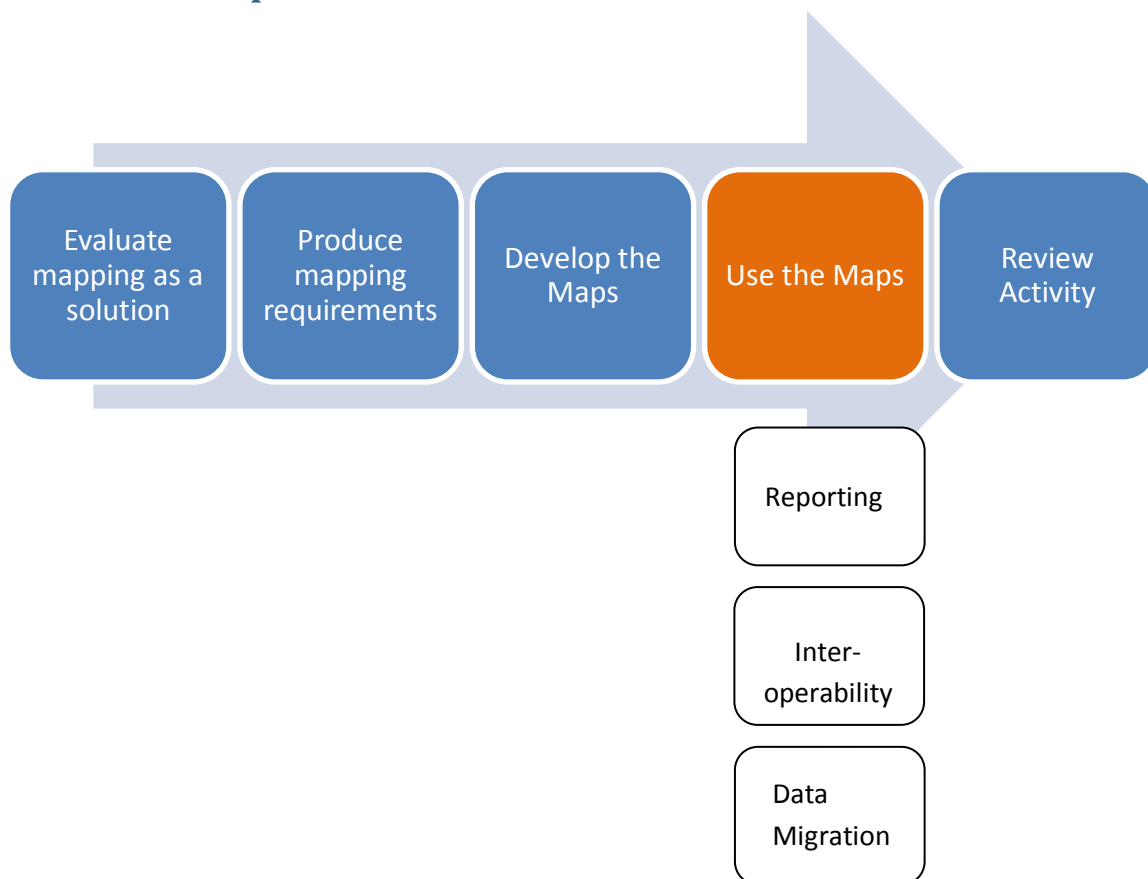
7.1 Description:

Having created the maps to SNOMED CT, this section will look at the various aspects to consider when using the maps to migrate or transform EHR instance data. This serves as a general check list, however the actual specific use case needs to influence the final requirements of how this is undertaken. The main uses cases identified are:

- identifying records to include in reports;
- Transforming the originating EHR instance data to meet the messaging specification for sending data to another system
- Migrating existing EHR instance data either because a system is being upgraded to use SNOMED CT or to introduce a new system that uses SNOMED CT

The fundamental principles where any EHR instance data is subject to re-coding are:

- The original clinical term as entered by the clinician may need to accompany the re-coded item, both the text and the actual code.
- Metadata should be used to determine if a map can be made automatically and not require subsequent clinical review in the context of a specific EHR instance record. In this case the clinician should be warned of any problems and be allowed to confirm or revise any suggested re-coded terms.
- Any re-code confirmed or amended by a clinician for a specific record should take precedent over any system instigated change and the item should not become a candidate for future system instigated change (e.g. due to subsequent re-coding based on updated maps);
- Instance data re-coded by using the map should be amended if subsequent changes to the maps are undertaken; this might not be possible in the use case of interoperability because

the data has already been released and there may not be a mechanism to advice the remote system of the change. An audit trail should be kept at some level of this activity.

Note. *The data, reports and design elements of an information system are all affected by a re-code activity and should be appropriately addressed; this section addresses data transformation only.*

In addition to the fundamental principles there are other best practice principles which should be adhered to:

7.2 Consider all design elements of the system

Data migration may be undertaken to move the data into a new system or to adopt an existing system to SNOMED CT. When undertaking adoption within an existing system, in addition to the data in the EHR, the design elements such as form templates and reports also need to be considered. The maps may be used to migrate these design elements to SNOMED CT; it may be necessary to undertake an additional level of clinical assurance on these components.

7.3 Maintain an audit trail for transformation or migration

An audit trail of the versions of maps used within the system and the dates of their currency of use should be maintained. It should be possible to identify by some appropriate means:

- o the date a re-code was undertaken
- o the mapping table used to re-code including its version and release date.

It is possible to record the date and time and version of transformation at different levels:

- System level
- Database/Table level
- Record level
- Field level
- Code level (expression level if post coordination is employed)

There are some risks associated with managing metadata at a level higher than code level, and these risks need to be evaluated and thus managed.

7.4 Manage future amendments to the mapping table

A system may need to ensure it is able to reprocess instance data that has already been re-coded. This may be required where a change to a map has been made due to a previous error in the mapping table or where due to changes in SNOMED CT a better candidate is now available

7.5 Visibility of original text of re-coded items

A system may need to indicate where an entry has been re-coded automatically and allow the user, by some appropriate means, to inspect the original clinical term entered and if necessary amend the current entry.

7.6 Supporting Clinical Safety

A system may need to provide a means for those responsible for clinical safety and/or data quality/ data governance, to undertake a random inspection of the re-coding activity undertaken.

7.7 Use the Maps: Reporting
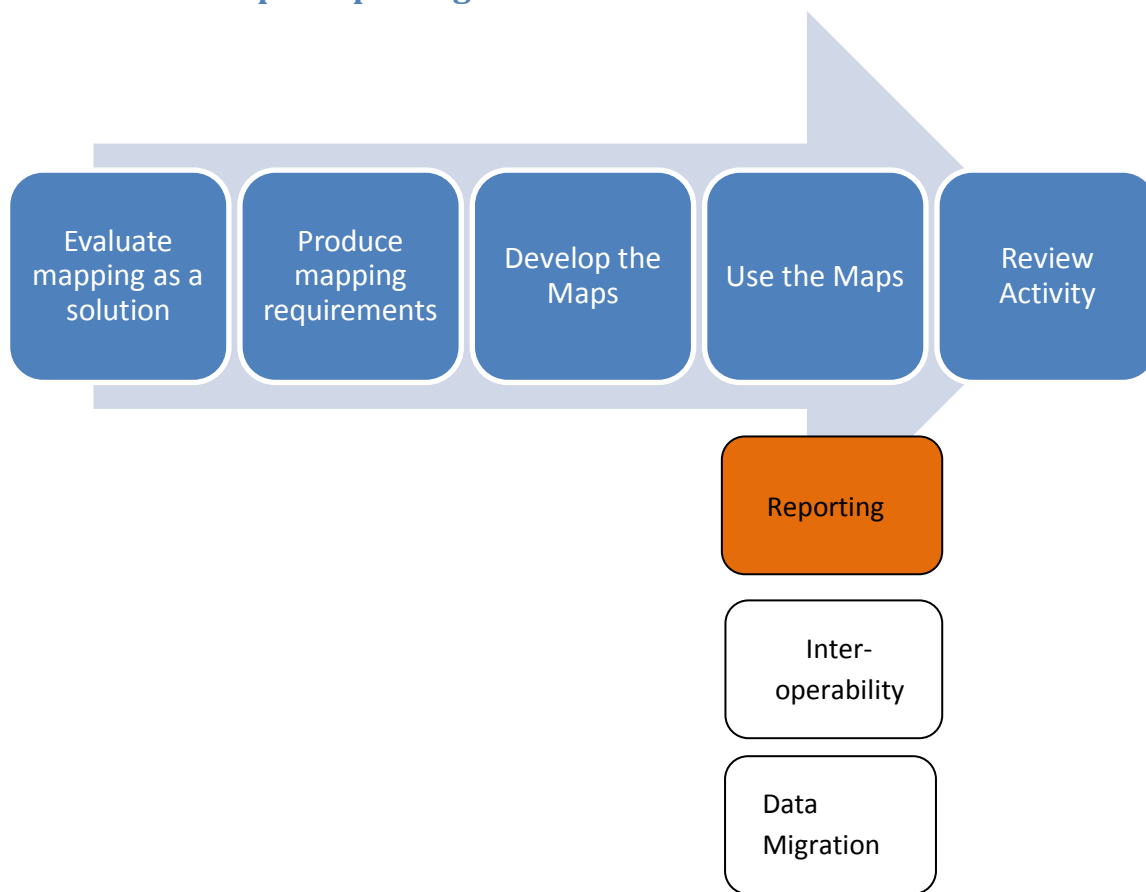
7.7.1 Description:

In addition to the general guidance on the 'Use of Maps', the following should be taken into account in relation to reporting:

Any system being updated to adopt SNOMED CT will have design components that will require updating. For example, existing queries in reports that extract or analyse data using the previous coding system will need to be altered to be based on SNOMED CT. As systems can have significant numbers of queries, an automatic migration of these to SNOMED CT using the maps can be undertaken. There are some considerations to be taken into account before undertaking these which are detailed below.

The updated system will almost certainly require changes to the data entry components too in order for the user to efficiently and accurately code records against SNOMED CT. Although the detail of how to implement these changes is out of scope of this document, consideration should be given to the fact that changes to the user interface will almost certainly change the pattern of coding by users. This is due to the likely difference in the terms present in SNOMED CT compared to the originating code system, and/or changes to the interface which can affect the terms which a user chooses.

These changes in coding patterns and use of migrated queries will have a subsequent impact on any reports and data analysis performed. The effect may not be present immediately after the data migration, but will increase over time as records are maintained in the new environment. Consideration should therefore be given to the following scenarios:

- **Original Report no longer required**. It may be that the date items that can be input into a recording template are changed significantly so any reporting from this is no longer applicable. In this case a new report will be required to be produced.
- **Original report required, for example for historical comparisons**. Where a report could be enhanced through the adoption of SNOMED CT there may still also be a requirement to maintain an existing version of a report or analytic process that remains as faithful as possible to the original but based in SNOMED CT instead of the originating coding system. The maps can be used to transform the query but this may require analysis of the scope of terms and relationships between terms in the source code system in order to determine an equivalent extract in SNOMED CT.
- **Errors identified in original report**. In migrating the query, the review process may discover errors in the original report specification, for example it may be discovered through analysis based upon SNOMED CT due the existence of a better relationship model, that some terms have been omitted in the original query. Decisions need to be made on how to deal with this if historical comparisons are required; one option may be to re-run corrected queries on the historical data.

7.8 Use the Maps: Interoperability
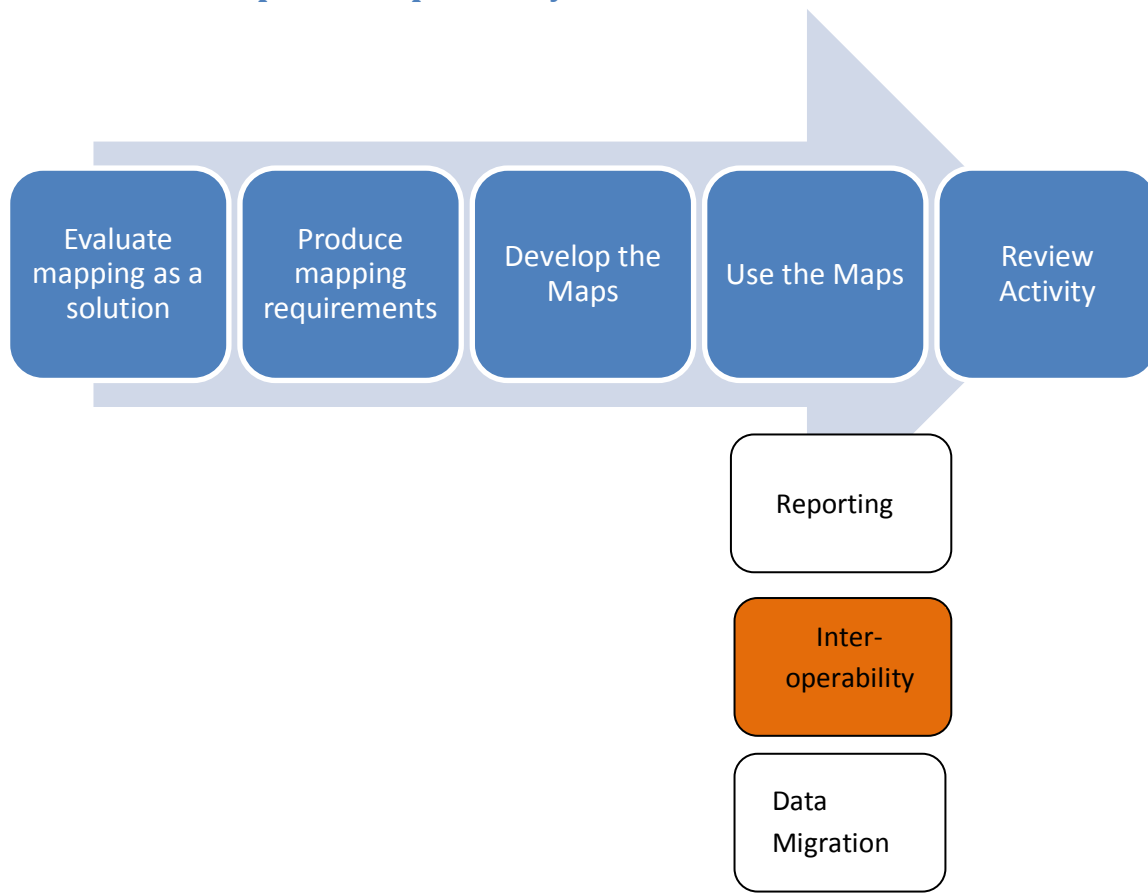
7.8.1 Description:

In addition to the general guidance on the 'Use of Maps', the following should be taken into account in relation to interoperability:

Where the maps are used for transforming instance data prior to use in a messaging system (used to support interoperability) care should be taken to ensure that the maps have been appropriately assured for the given purpose of record exchange.

In a constrained scenario, where maps have been prepared for a given use case, the maps should not be used inappropriately as the rules governing the map creation were created to address a particular scenario.

In an unconstrained scenario, content is sent without specific knowledge of the receiving system and its intended use. Maps should only be used in this way if that was the intention when they were created.

When transforming instance data the latest maps available should be used unless otherwise specified. An audit should be kept of which maps are used so that given a particular timestamp, the actual map in use can be determined retrospectively if required.

The sending system should construct the message to be sent in the source coding system, and then use the mapping tables to translate the source coding to SNOMED CT. Ideally the sending system should send the source codes and terms as well as the SNOMED CT codes as part of a 'translation set'; this enables any receiving system to use the original codes if that coincides with its own source

coding and also allows the user to see the original term text. Any unmapped items need to be represented appropriately (the original code and text can still be sent) and the receiving system will need to decide what action to take; for example the text from the source could be prefixed with 'degraded to text:' so the clinician is able to inspect the original data recorded and at the same time know that the item is not coded.

7.9 Use the Maps: Data Migration
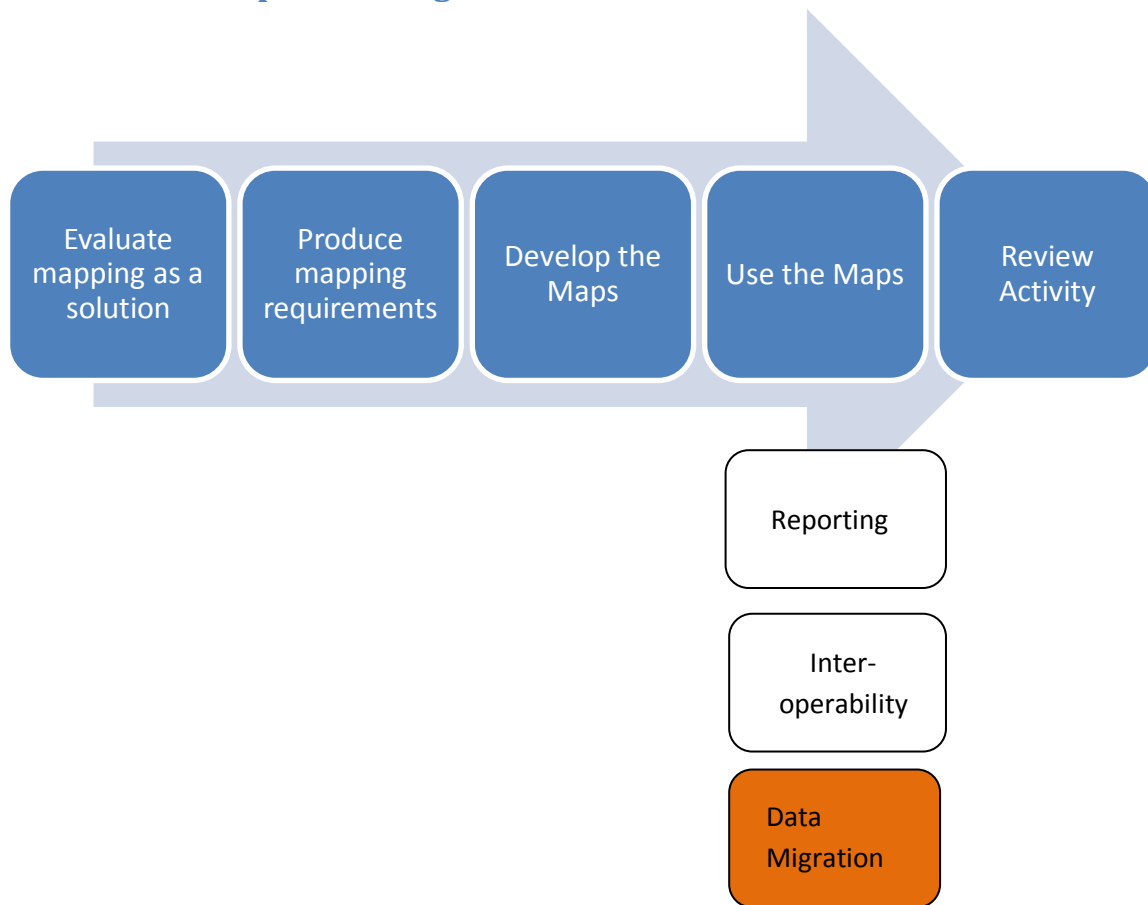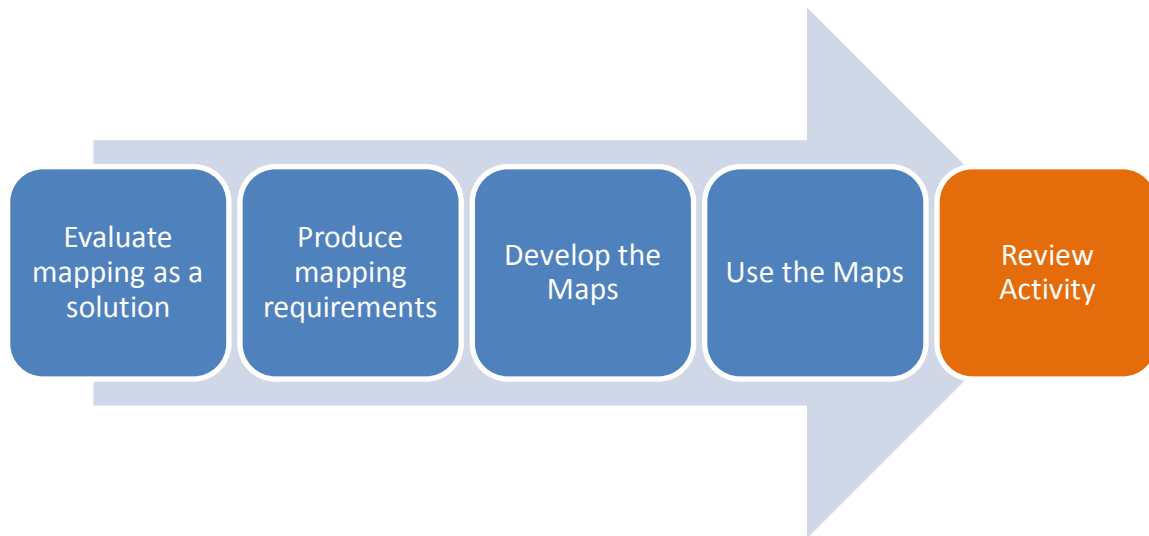

7.9.1 Description:

In addition to the general guidance on the 'Use of Maps', the following should be taken into account in relation to data migration. It is assumed that the maps have been clinically validated for the purpose of data migration of EHRs.

The fundamental principles of a data migration re-code are:

- The original clinical term as selected by the clinician is retained in perpetuity with relevant metadata that identifies the terminology scheme in use at that time;
- Any re-code confirmed/amended by a clinician for a specific record takes precedent over any system instigated change and the item should not become a candidate for future system instigated change (e.g. due to subsequent re-coding based on updated maps);
- A re-code should be amended if changes to the maps used in the re-code are required;

As part of the data migration, you should consider whether all entries in all records should be re-coded, or whether a partial re-code of the full record store will be undertaken. For example, in a patient record system, all records relating to details of vaccinations may be re-coded, but forms detailing blood pressures taken more than 2 years ago may not. Aspects to be taken into consideration in deciding which approach to take (full re-code or partial) is: the timestamp of the data record, the type of data within the particular record entry, the type of data record (eg. an assessment form, a patient visit record) and the queries supported by the system. New queries within the system will be written in SNOMED CT and thus any re-code needs to ensure that historical records are retrieved if relevant.

8   Review Activity

8.1   Description:

As with any process, a post-activity review stage is recommended. This should ensure that:

- Appropriate lessons are learnt and documented and thus can be referred to in any future mapping activity.

- Issues that can be addressed within the current mapping are appropriately managed. For example, where the maps are being used for transformation then lessons learnt should be fed back into the process to improve the quality of the transformed data. The same is true in a data migration scenario where maps are reapplied subsequent to the initial migration.

As a framework for identifying issues, particular attention should be paid to:

- Confidence and satisfaction of the end users with the re-coded clinical data
- Adequacy of training, communication and preparation of end users for the use of SNOMED CT
- Clinical Assurance and the appropriateness of criteria used in that assurance
- Evidence provided by the system, such as clinician over-ride of automated maps, that gives an indication of acceptability of the mapping, migration and transformation process.
- Fitness for purpose of reports and data analytics
- Resources available for the mapping activity including adequacy of people skills and experience
- Usability and quality of the tools used to support production of the maps
- Robustness of the mapping process and subsequent use of the maps for transforming and/or migrating data
- Issues arising from testing and whether these should have been better accommodated in requirements

9 Document References

Note that some publications in this section may require membership and a login in order to access:

- IHTSDO
    - SNOMED CT Starter Guide
    - SNOMED CT Technical Implementation guide
    - SNOMED CT to ICD-10 mapping
    - IHTSDO Implementation and Innovation Committee Project – 'requirements for maps to SNOMED CT' within IHTSDO collabnet space
- ISO Publications
- AHIMA
    - AHIMA Library
    - On-line Research Journal
- PubMed Central Canada

References to known documents that are in the public domain and provide more detail on any aspect of mapping are provided here:

- NHS- Technical Report 12/01: Data Migration Technical Report 12/01 (PDF, 444.3kB).

- GP Systems of Choice Data Migration specification: http://www.connectingforhealth.nhs.uk/systemsandservices/gpsupport/gpsoc/news/downloads/npfit-pc-pmg.pdf
- From Read to SNOMED: Migration of data and Queries http://www.primis.nhs.uk/attachments/507_Rogers-Data-Query-Migration.pdf
- HL7 Terminology: Migration to SNOMED CT http://www.hl7.org/documentcenter/public_temp_1584B76A-1C23-BA17-0CC5F018587EC703/wg/vocab/presentations/HL7%20Terminology%20-%20Migration%20to%20SNOMED%20CT%20January%202012%20v2.pdf

Documents within the IHTSDO collaborative space (not login may be required to access some or all of these document):

- Migrating GP Systems into SNOMED CT https://csfe.aceworkspace.net/sf/go/doc9097?nav=1
- Data Cleaning Process https://csfe.aceworkspace.net/sf/go/doc6832?nav=1
- Implementation Focused Principles of Mapping between Code Systems https://csfe.aceworkspace.net/sf/go/doc6826?nav=1
- NEHTA Mapping to SNOMED CT Guidelines and Requirements https://csfe.aceworkspace.net/sf/go/doc6829?nav=1
- Options for staging a technical migration of existing systems in primary care to SNOMED CT https://csfe.aceworkspace.net/sf/go/doc6831?nav=1