Mapping SNOMED CT to ICD-10-CM Technical Specifications

A collaborative project in healthcare information interoperability with the National Library of Medicine and the National Center for Health Statistics

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Amendment History

Version	Date	Editor	Comments
1.0	20110411	James Campbell	Revise plan from ICD-10-CM master
1.01	20110605	James Campbell	Reference procedure review with CMS
1.02	20110621	Kin Wah Fung	General revision. Major revision of exclusions handling and exhaustive mapping of descendants. Added Appendices A and B.
1.03	20110720	James Campbell	Add documentation of LONG and SHORT map record forms
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1.08	20130601	Kin Wah Fung, Julia Xu	Updated for 201306 release
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Contents

1 Document Purpose

This document organizes and presents the use cases and technical procedures for the development of a SNOMED CT to ICD-10-CM map by the National Library of Medicine for the US realm. This document provides prescriptive guidance on the purposes, conduct and outcomes of that project and is the authoritative source for project execution.

2 Business Application/High Level Description

The integration of a clinical terminology such as SNOMED Clinical Terms (SNOMED CT) into computer based patient records systems provides a comprehensive and functional terminology of clinical terms, supporting interoperable transmission of patient-related data between information systems. The cross-maps from SNOMED CT to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (US Clinical Modification) are created to support the reimbursement and administrative reporting needs of the IHTSDO member countries which employ ICD-10-CM.

The business application principles of relevance to the deployment of this map include:
- Rapid and efficient identification of ICD-10-CM classification codes for the reporting on diagnostic data for US healthcare sites
- Re-use of clinical data for additional US statistical purposes
- Rapid submission and response to national reporting requirements
- Saving time and improving efficiency for the coding professional
- Improved accuracy and reproducibility of code mapping from clinical encounters
- Promulgation of widespread comparable epidemiologic and statistical data

This document will reference the data sets, algorithms and intellectual products of the SNOMED CT to ICD-10-CM map as the MAP.

3 Mapping purpose

- To support semi-automatic generation of ICD-10-CM classification codes from clinical data encoded in SNOMED CT. The ICD-10-CM codes can be used for reimbursement or other administrative purposes. Even though reimbursement is expected to be the main use case, the ICD-10-CM codes suggested by the Map are not guaranteed to be reimbursable, and the codes are not optimized to provide the highest level of reimbursement (see Appendix A for a list of frequently asked questions about the MAP)

4 What the MAP is not

- A completely automated ICD-10-CM coding from a SNOMED CT source
- A map that supports management of context beyond that found in the coded record and ICD-10-CM conventions and rules as noted in General approach and Heuristics

5 Audience

This map is intended to provide support within the specified use case, for IHTSDO members, WHO Collaborating Centers and interested countries which are deploying or have deployed SNOMED CT in clinical information systems and have ICD-10-CM employed in systems for purposes of reimbursement, statistical reporting, epidemiology, cancer registries, injury and other registries, quality reporting, safety reporting and research.

6 Applicable use cases supported

MAP with patient context management: Patient Jones is being discharged from the clinic after an encounter for clinical care. The attending physician has maintained an historical diagnosis and health-related problem list coded in SNOMED CT while caring for Jones and updates the problem list at discharge, selecting the problems which were addressed during today's visit. The EHR vendor software employs the MAP, and uses a knowledge-based algorithm to evaluate sequential computable Map Rules. These rules evaluate context (data recorded about the patient e.g. age and gender) and co-morbidities (other problems recorded) in the electronic health record to identify the most appropriate candidate ICD-10-CM code list based on ICD-10-CM exclusion / inclusion guidance and other conventions. MAP Vendor

software which cannot employ these rule-based features can employ the helpful Map Advice to provide a readable and understandable list of step-by-step instructions for the physician to support a choice of one or more ICD-10-CM codes. If necessary, the physician is prompted for additional information needed to decide between alternative codes or refine the output codes. See Appendix B for description of an algorithm to use the MAP interactively.

Alternatively, the MAP can be used by ICD-10-CM coding professional. The MAP can suggest candidate ICD-10-CM codes based on stored clinical problems encoded in SNOMED CT, which will be reviewed by the coding professional prior to submission for reimbursement by the insurance carrier. The Map Advice data further guides them with information regarding additional NCHS rubrics and requirements.

7 Scope and Procedures

This mapping is a tabular, knowledge-based cross-link from SNOMED CT to ICD-10-CM in which the most accurate ICD target code or codes that best classify the SNOMED CT concept within the context of the remainder of the record are linked. The map is a link directed *from* the source SNOMED CT concept *to* the target ICD-10-CM classification.

7.1 Map relationships

The granularity and purpose of ICD-10-CM is different from that of SNOMED CT. SNOMED CT is a comprehensive reference terminology that supports both general and highly specific concepts. Each concept is defined by a set of attribute-value pairs (relationships) which make it distinct from all other concepts. SNOMED CT supports a model of meaning which specifies correct attributes and value sets for each domain of meaning.

ICD-10-CM is a classification of diseases and injuries with granularity of definition that has been chosen to provide utility for purposes of epidemiology, statistical reporting of mortality and morbidity and classification of care for reimbursement purposes. ICD-10-CM was created to classify a clinical concept by defining the classes (or 'buckets' of meaning) which contain the concept within the universe of ICD-10-CM classes.

Only domains of SNOMED CT which overlap in meaning with those of ICD-10-CM will be mapped. Due to differences in granularity, purpose and rubrics, assignment of a map equivalence between the SNOMED source and ICD target concepts is usually not appropriate. Instead, the map will link a SNOMED source concept to the ordered set of ICD-10-CM classes which contain the elements of meaning of the SNOMED concept as conceptualized by ICD-10-CM.

7.2 Source domains and context

All pre-coordinated concepts issued by the IHTSDO within the current international release of SNOMED CT with active status, excluding concepts found in the IHTSDO non-human subset, within the following SNOMED CT domains may be mapped:
- Clinical findings (disorders and findings) SCTID 404684003 and descendants
- Events SCTID 272379006 and descendants
- Situations with explicit context SCTID 243796009 and descendants

7.3 Target domain context and scope

ICD-10-CM is a classification of diseases and findings for purposes of statistical reporting, epidemiology, reimbursement, cancer registries, injury and other registries, quality reporting, safety reporting and research. ICD-10-CM replaces ICD-9-CM volumes 1 and 2 for use in US healthcare settings in 2014.

The scope of ICD-10-CM is primarily designed for the classification of diseases and injuries designated as a formal diagnosis. ICD also classifies signs, symptoms, abnormal findings, complaints, and social circumstances that may appear in a health record. Thus ICD is used to classify data recorded under headings such as 'diagnosis', 'reason for admission', 'conditions treated', and 'reason for consultation'."

Some SNOMED CT concepts within the source domains may be normal findings or other concepts not intended for classification by ICD-10-CM. These are included in the MAP with records designating these concepts as "not classifiable" by ICD-10-CM

7.4 Cardinality

The MAP has cardinality of *one* SNOMED CT source concept to *zero-to-many* ICD-10-CM classification codes. Zero target codes are appropriate only if the source concept is not classifiable or is awaiting editorial review for guidance. In all other cases one or a combination of more than one ICD-10-CM codes will be assigned. Practically speaking, this is usually no more than three. More than one SNOMED CT concept can map to the same ICD-10-CM target.

When there is a need to choose between alternative ICD-10-CM codes, each possible target code is represented as a Map Rule (rule-based map). Related Map Rules are grouped together into one Map Group. Each Map Group will resolve to at most one target ICD-10-CM code at run-time.

8 Authoritative resources

The SNOMED CT mapping is constructed using the SNOMED CT, current version published by the International Health Terminology Standards Development Organisation; and the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Clinical Modification ICD-10-CM, published and maintained by the National Center for Health Statistics. The MAP will be reviewed and updated for each new release of SNOMED CT and ICD-10-CM. In planning for the development of this map, advice was sought from the Center for Medicare and Medicaid Services regarding ICD-10-CM code restrictions for reimbursement in the US. Due to regional variations in care profiles and carrier procedures for authorization of reimbursement, no authoritative resource could be identified to guide target code selection beyond those published by NCHS.

9 Map Data Sets

Release data structures for the MAP will be compliant with SNOMED CT Release Format 2 (RF2) datasets as defined in the IHTSDO document: *SNOMED CT Release Format 2.0: Data Structures Specification*. MAP data structures and definitions important to MAP deliverables defined below include:

- **Reference Set (RefSet)**: an IHTSDO data structure supporting the publication and dissemination of SNOMED CT and associated data sets, including maps. The organization and structure of RefSets are documented in the publication: *SNOMED CT: Release Format 2.0 Reference Set Specifications*
- **Map Record:** a single RefSet MAP data record including linked metadata which assembles knowledge-based data required to validate the link between a single SNOMED CT concept and at most one ICD-10-CM classification code. The Map Record includes a link to the source SNOMED CT concept identifier, a Map Group numeral, a Map Priority numeral, a Map Category status concept, a Map Rule, Map Advice, and link to at most one Map target ICD-10-CM classification code.
- **Map Group:** an integer assigned to each set of map records which are coordinated to specify <u>one</u> target ICD-10-CM code for the map, or the null map if the source concept does not require an additional ICD-10-CM code for proper classification. Each Map

Group collates and orders the rules which are sequentially evaluated to yield at most a single target code. The first Map Group designates the set of records used to specify the first (primary) target code. The second Map Group identifies the set of records for the second target code. These are repeated as required to specify a complete set of mapping target codes.

- **Map Priority:** an integer which designates the sequence of run-time map record processing within each Map Group. Each record may include a rule which is designed to be processed in order to provide knowledge-based mapping. Only the first Map Record meeting the run-time criteria is taken for the target code within the Map Group records.
- **Map Category:** a SNOMED CT foundation metadata concept identifier (see *SNOMED CT: Release Format 2.0 Reference Set Specifications, page 23)* which indicates the process state for run-time use including the editorial status of the Map record:

  - The map source concept is <u>properly classified</u> (447637006 |Map source concept is properly classified|) within the target ICD-10-CM classification for this map record, no additional data is necessary for selection of this target code of the map(Exemplars: One to one: #1-7)
  - The map source <u>cannot be classified</u> (447638001 |Map source concept cannot be classified with available data|) and cannot be assigned a target without additional data. This map category is used when:
    - The source SNOMED CT concept is outside the scope of ICD-10-CM – this includes normal findings, suspected/unconfirmed conditions, negative findings and grouper concepts which themselves do not convey clinical information (Exemplars:Not Classifiable: #1-3)
    - No default ICD-10-CM code is available for the SNOMED CT concept. Some essential qualifier is missing for ICD-10-CM coding (Exemplars:Gender: #3-5)
    - When used in the second or higher map group, this flag is to signify that when a map rule is satisfied, no additional ICD-10-CM code is needed. (See Exemplars: Low level concepts:#4. The map for Iron deficiency anemia requires only one ICD-10-CM code, but one of its descendants requires an additional target code. So map group 2 is created for that descendant, and the default rule for map group 2 points to a NULL target, with map category of 'Not classifiable')
  - The map is <u>context dependent</u> (447639009 |Map of source concept is context dependent|) and requires additional patient information for accurate mapping as specified in the Map Rule (Exemplars:Gender:#3-5)

Three additional Map Categories identify editorial process states but are published as a single Map Record for the source concept for completeness, auditability and transparency of the MAP:

- The source concept is ambiguous (447640006 |Source SNOMED concept is ambiguous|) in its SNOMED CT definition; ambiguity is undergoing resolution before map classification can be concluded. See definition of ambiguity in 11.1.1.
- Guidance from NCHS is ambiguous (447635003 |Mapping guidance from NCHS is ambiguous|) relative to the map target; awaiting clarification from NCHS
- Retired from map scope (447642003 |Source concept has been retired from map scope|); although within the defined scope of the map, the map editors retracted this source concept from mapping

- **Map Rule:** A machine processable truth statement created to evaluate to "true" or "false" at run-time, which determines whether the Map Record should be validated as the correct link to the associated Map target for the Map group being evaluated.

Formatting of the Map Rule is specified in Augmented Bacchus Naur Form (ABNF) in Appendix C but generally is one of three forms:

- **IFA SCTID| FULLY SPECIFIED NAME | [= VALUE]**: a Map Rule which evaluates for the existence of one or more SNOMED CT concept instances or an observable and value found concurrently in the patient record. The concept is designated by the SNOMED CT ID for a clinical finding or observable entity and the SNOMED fully specified name. In the case of rules for age of onset of the disorder (observable), it may include a range of allowable "VALUES". If such an instance is found in the patient record at the time of rule evaluation, the rule is assumed to evaluate as "true" and the associated Map Target is selected for that Map Group. Otherwise the rule evaluates as "false" and the run-time evaluation proceeds to the next Map record within the Map group. The Map Advice for the record will include a readable statement relating the rule and map target.
- **TRUE:** applied when a Map Rule is not relevant for evaluation of the Map Record and the Map Record should always be accepted as valid.
- **OTHERWISE TRUE:** employed as the rule in the final Map Priority record when a series of rules must be evaluated to determine the valid Map Target. This is the case when none of the rules are satisfied or when there is no additional patient context information available. A default target code may or may not be specified with this value for Map Rule depending whether the Map Category is properly classified (447637006 |Map source concept is properly classified (foundation metadata concept)|) or non-classifiable (447638001 |Map source concept cannot be classified with available data (foundation metadata concept)|).

- **Map Advice:** human-readable textual advice that a software vendor may employ to inform the clinician user or the classification expert during an interactive mapping session, or to trigger prompts for additional user input e.g. laterality specification. The Map Advice has two components:

  a) a statement of the Map Rule in readable terms for the clinical user and
  b) supplementary metadata guidance intended to clarify the map for the coding professional. Metadata advice supported in the MAP includes:

- DESCENDANTS NOT EXHAUSTIVELY MAPPED
- EPISODE OF CARE INFORMATION NEEDED
- CONSIDER ADDITIONAL CODE TO IDENTIFY SPECIFIC CONDITION OR DISEASE
- CONSIDER LATERALITY SPECIFICATION
- CONSIDER TRIMESTER SPECIFICATION
- CONSIDER WHICH FETUS IS AFFECTED BY THE MATERNAL CONDITION
- POSSIBLE REQUIREMENT FOR AN EXTERNAL CAUSE CODE
- POSSIBLE REQUIREMENT FOR CAUSATIVE DISEASE CODE
- THIS IS A MANIFESTATION CODE FOR USE IN A SECONDARY POSITION
- THIS IS AN EXTERNAL CAUSE CODE FOR USE IN A SECONDARY POSITION
- THIS IS AN INFECTIOUS AGENT CODE FOR USE IN A SECONDARY POSITION
- ADDITIONAL CODES MAY BE REQUIRED TO IDENTIFY PLACE OF OCCURRENCE AND ACTIVITY
- USE AS PRIMARY CODE ONLY IF SITE OF BURN UNSPECIFIED, OTHERWISE USE AS A SUPPLEMENTARY CODE WITH CATEGORIES T20-T25 (Burns)
- USE AS PRIMARY CODE ONLY IF SITE OF CORROSION UNSPECIFIED, OTHERWISE USE AS A SUPPLEMENTARY CODE WITH CATEGORIES T20-T25 (Burns)
- MAPPED WITH NCHS GUIDANCE
- MAPPED WITH IHTSDO GUIDANCE
- NCHS ADVISES TO ASSUME CLOSED FRACTURE
- MAP IS CONTEXT DEPENDENT FOR GENDER
- MAP SOURCE CONCEPT CANNOT BE CLASSIFIED WITH AVAILABLE DATA
- SOURCE SNOMED CONCEPT IS INCOMPLETELY MODELED
- CONSIDER STAGE OF GLAUCOMA SPECIFICATION
- CONSIDER TOPHUS SPECIFICATION
- CONSIDER TIME OF COMA SCALE SPECIFICATION

10 Mapping Assumptions

Assumptions that are central to the construction of the MAP include:

10.1 Exclusion of implied context

The SNOMED CT concept or statement taken from the health care record will be evaluated for meaning within the guidelines of the *SNOMED Clinical Terms User Guide*. No assumed context or modifying semantics will be inferred beyond the definition asserted by the fully specified name and the SNOMED CT defining relationships, excluding qualifiers. Identification of inconsistency between the fully specified name and the synonyms, or between the fully specified name and the defining relationships will constitute a case for ambiguity. This will cause a map record to be flagged for editorial review by the IHTSDO editorial staff. An understanding of the meaning (semantics) of the SNOMED CT concept is a necessary first step to an understandable, reproducible and useful map.

10.2 Reference terminologies and classifications

The organization, structure and conventions of the classification ICD-10-CM is different than SNOMED CT and meaning (semantics) within the classification is specified by the order and relationship of the chapters, section and categories. The position of a classification code within the axis, the title of the code and the associated conventions and guidance provided from the authoritative source further contribute to the specification of meaning of a classification code. Finally, since ICD-10-CM is a classification, the semantic space of a particular classification code depends upon the definition of sibling codes and others within the same category. Since ICD-10-CM is designed for statistical, epidemiological and reimbursement purposes, one ICD-10-CM classification code may include many SNOMED CT concepts within its semantic space.

SNOMED CT is a reference terminology that expresses the semantics of concepts within its domain by means of a controlled vocabulary and use of an extensive set of defining relationships. The relationships are employed in concept definition within a constrained and defined model of meaning applicable to each SNOMED semantic root. Understanding the meaning of a SNOMED CT concept requires evaluation of the vocabulary as well as the defining relationships.

10.3 Full semantic (concept) mapping

The goal of the mapping process is to identify the meaning of a SNOMED CT concept, determine the best location of that concept in the ICD-10-CM semantic space as identified by one or more ICD-10-CM classification codes, and to create a link between the SNOMED CT concept identifier and the correct ICD-10-CM code(s). Since SNOMED CT is a reference terminology, this process cannot proceed reproducibly using only naming (terms or descriptions) conventions. A full understanding of both SNOMED CT and ICD-10-CM semantics, as specified in Section 11 Mapping Heuristics, is required for success.

As an example, the SNOMED CT concept 235991007 |Peritoneal eosinophilia (disorder)|, may be identified as a type of blood disorder by some lexical (terming) coding tools and mapped to D72.89 "Other specified disorders of white cells" in ICD-10-CM. However the concept 235991007 |Peritoneal eosinophila (disorder)| has defining relationships 213293008 |is a (attribute)| = 213293008 |Aseptic peritonitis (disorder)| with 116676008 |associated morphology (attribute)| = 23583003 |Inflammation (morphologic abnormality)| and 363698007 |finding site (attribute)| = 15425007 |Peritoneum structure|. From these relationships, the mapper should correctly identify that the SNOMED CT concept is an inflammatory gastrointestinal disorder, and appropriately map the concept to the ICD-10-CM semantic space K65.8 "Other peritonitis".

11 Mapping Heuristics

11.1 Evaluation of source meaning

The Mapping Specialist will initiate the mapping process by evaluating the source SNOMED CT concept employing the Context-free assumption: SNOMED CT concepts to be mapped from the source domains will be presumed to "speak for themselves". The concept definition as asserted in the fully specified name and the concept's defining relationships (excluding qualifiers) will be presumed to encompass all information available for definition of the concept and interpreted as explained in the *SNOMED Clinical Terms User Guide*. This information alone will be employed by the map specialist in assessing the source meaning and researching target code(s) for the MAP. If the meaning of the SNOMED CT concept is judged to be ambiguous by the mapper, the concept will be managed as follows:

11.1.1 Definition of ambiguity

Cases for concern or question of ambiguity in the SNOMED CT source concept definition will include:
1. Discrepancy between the Fully Specified Name (FSN) and associated defining relationships; and

2. Discordance between the SNOMED CT definition and the term synonyms. Discrepancies will be assessed relative to standard medical references and compared to guidance and definitions provided in the ICD-10-CM authoritative source.

Case #1 constitutes fundamental ambiguity in the meaning of the SNOMED CT concept and cannot be mapped pending clarification. These concepts will be assigned a map record with MAP CATEGORY of ambiguous (447640006 |Source SNOMED concept is ambiguous|). The editorial notes field will be populated with any information on the map accrued by the mappers during their research. The concept will be referred to an arbitration committee of SNOMED CT editors and the map lead. Once the ambiguity is resolved, the map will be completed and MAP CATEGORY will be updated with the appropriate assignment.

Case #2 represents a confusing issue for the mapper using only lexical tools to review SNOMED CT and ICD-10-CM. However the SNOMED CT definition is not truly ambiguous and the map for this concept will be completed as described herein. The SNOMED CT term which is the source of the confusion will be flagged by the mapping team in the editor notes for editorial review by the arbitration committee with the expectation that the confusing term will be marked for demotion as a non-synonymous lexical tag.
Examples of confusing and ambiguous mapping source concepts include:

- Case 2: Discrepancy in synonyms: SNOMED CT concept "Epidermoid cyst of skin (disorder)" 419603000 has synonyms 2580186011 "Sebaceous cyst" and 2580183015 "Epidermal cyst". The ICD-10-CM reference has separate classifications for "Epidermal cyst" L72.0 and "Trichilemmal cyst (sebaceous cyst)" L72.1. The mapper will map 419603000 to ICD-10-CM target classification L72.0 and flag the SNOMED CT synonym term 2580186011 "Sebaceous cyst" as confusing for editorial review.
- Case 2: Discrepancy in synonyms: SNOMED CT concept "Hemorrhagic duodenitis" 95531001 has a synonym 512170014 "Multiple duodenal erosions" and definition as a hemorrhagic inflammation of duodenum. The synonym implies ulceration and not hemorrhage and should likely be defined and classified as a type of duodenal ulcer. "Hemorrhagic duodenitis" 95531001 maps to ICD-10-CM classification "Duodenitis with bleeding" K29.81. Discrepancy with concept definition will cause the mapper to report the term 512170014 "Multiple duodenal erosions" as confusing.
- Case 2: Discrepancy in synonyms: SNOMED CT concept "Intestinal obstruction" 81060008 has a synonym 134480018 "Ileus". The concept itself is defined as obstruction of an intestinal structure, yet the synonym implies "paralytic or adynamic ileus" which is a subtype of the source concept having a different ICD-10-CM classification. This discrepancy will lead the map specialist to create an

editor's note identifying the ambiguity created by the term yet proceed with creation of the map since the source concept is clearly defined.

The context-free assumption will require agreement regarding procedures for the map when certain elements of context are asserted in either the SNOMED CT source or the ICD-10-CM target reference. These context issues, along with mappings to multiple target codes, are detailed in the following. In all discussions, source always refers to the SNOMED CT concept and target refers to the ICD-10-CM classification.

11.2 Choosing Initial Target Codes

Once the map specialist has reviewed and understands the SNOMED CT source concept to be mapped, she will employ the ICD-10-CM alphabetic index of diseases and nature of injury to research and select candidate ICD target codes for the map. She will usually use the Fully Specified Name from the SNOMED source concept to search the best textual references in the alphabetic reference that capture the meaning of the SNOMED CT concept. The alpha reference is organized hierarchically when multiple term modifiers may be considered as specifications of the primary term, and the map specialist will search through the specifications looking for the terms of interest.

This review may identify matching ICD terms, or may require searching through related cross references. Two types of cross-reference in the alphabetic listing need to be considered before assignment of a tentative target code(s). These are: *'-see…',* and *'-see also…'.*

'-see…' is an explicit direction to look elsewhere in the index and no codes are found alongside this reference. The map specialist will review the directed descriptions in searching for target candidates.

Nodule(s), nodular
- actinomycotic - see Actinomycosis

'-see also…' instructs the user to look elsewhere if the detail they are looking for cannot be determined from the reference.

Anaplasia cervix (see also Dysplasia, cervix) N87.9

When a code is given alongside the term showing the '-*see also…*' note, which appears in parentheses as in the above example, it **may** or **may not** be necessary to look under the alternative term. When no code is given, the instruction does not appear in parentheses as it is **essential** for the user to look under the alternative lead term. In this example with reference to the term "Angiofibroma", the mapper <u>must</u> also evaluate the alpha references for the specific condition for relevant target classifications:

> **Angiofibroma —see also Neoplasm, benign, by site**

The map specialist will create preliminary map records employing the candidate target records resulting from these searches. If specializations are noted in targets selected from the alphabetic index and there exist sub-headings for the term selected, these will be considered for exclusion rules as documented in section 11.10 below. For source concepts that represent examples of poisonings caused by drugs or chemicals, the map specialist will use the index ICD-10-CM Table of Drugs and Chemicals to research the default maps and essential modifiers. An example of this is provided in section 11.6 below.

The map specialist will proceed from this source concept analysis to research the tabular guidance for the candidate targets and evaluate for issues of context which will alter the map records as explained in the following sections 11.3 through 11.11.

11.2.1 Laterality

ICD-10-CM employs specializations of the International version of ICD-10 for coding of laterality within certain classification categories. For example,

> **H60.9 : Unspecified otitis externa**
>   **H60.90 : Unspecified otitis externa, unspecified ear**
>   **H60.91 : Unspecified otitis externa, right ear**
>   **H60.92 : Unspecified otitis externa, left ear**
>   **H60.93 : Unspecified otitis externa, bilateral**

When the SNOMED CT source concept employs a specification of laterality (rare within the core international release) then the appropriate ICD-10-CM specialization will be chosen as the target code. As is more often true, if the source code does not specify laterality, then the unspecified target will be chosen –**H60.90** in this case. The Map Advice CONSIDER LATERALITY SPECIFICATION will be added to the map record. (Exemplars: Laterality)

11.2.2 Episode of Care

Classification categories such as **M80 Osteoporosis with current pathologic fracture** have guidance that 7th digit specialization for episode of care must be specified when choosing an ICD-10-CM target code. Category guidance includes a statement such as:

The appropriate 7th character is to be added to each code from category M80:
A initial encounter for fracture
D subsequent encounter for fracture with routine healing
G subsequent encounter for fracture with delayed healing
K subsequent encounter for fracture with nonunion
P subsequent encounter for fracture with malunion
S sequela

When the SNOMED CT source code specifies a relationship to the episode of care, then the appropriate ICD-10-CM 7th digit specialization will be chosen for the target classification. When as often true, the SNOMED CT source does not specify such information, then a "wildcard" place-keeper of "?" will be included in the 7th digit of the target code created. For example, "203445009 | Osteoporosis of disuse with pathological fracture (disorder) |" maps to "M80.80X? Other osteoporosis with current pathologic fracture, unspecified site, episode of care unspecified". The Map Advice EPISODE OF CARE INFORMATION NEEDED will be added to the map record indicating that additional episode of care information is required for full specification of the map target. (Exemplars: Episode)

11.3 Context: Gender

If the source concept asserts a gender restriction, a target will be selected including the restriction. If no targets with restriction apply, a more general target will be chosen. The Map Category will indicate that the source is properly classified (447637006 |Map source concept is properly classified (foundation metadata concept)|) in ICD-10-CM, the Map Rule will default to TRUE and Map Advice will be NULL.

- Female infertility 6738008 maps to N97.9 Female infertility unspecified
- Male infertility 2904007 maps to N46.9 Male infertility

If the source concept does not assert gender yet only gender restricted target codes are found within ICD-10-CM, the map will be considered CONTEXT DEPENDENT. The mapping specialist will create up to three map records for this source concept, including rules for mapping to female and male record context as appropriate to the ICD-10-CM structures, and a default record providing Map Advice for the user should rule evaluation fail to specify an ICD-10-CM target code. Map rules for gender context will be of the form "IFA {248152002 Female (finding) OR 248153007 Male (finding)}".

- "Unexplained infertility (finding)" 237145004 map will be mapped within a single Map Group employing sequential rules for female and male gender patients. The Map Target for each record will link to the appropriate classification code for that gender context; females map to N97.9 "Female infertility", unspecified, and males map to N46 "Male infertility". The Map Advice for each will indicate that the record is context dependent (|Map of source concept is context dependent|), the Map Rule will be "IFA 248152002 Female (finding)" or "IFA 248153007 Male (finding)" and the Map Advice will reproduce the rule as a readable advice to the user. A final default Map Record will also be created should rule processing for gender not be supported by vendor software. This will include a Map Category indicating the Map is not classifiable (447638001 |Map source concept cannot be classified with available data|), requiring patient data. The record will provide Map Advice information for the MAP user: "MAP IS CONTEXT DEPENDENT FOR GENDER" and have a NULL Map Target. (Exemplars:Gender:#3)
- "Malignant neoplasm of genital structure" 430556008 has a similar mapping. In this case the map for females is C57.9 Malignant neoplasm, female genital organ, unspecified. The mapping for males is C63.9 Malignant neoplasm, male genital organ, unspecified (Exemplars:Gender:#4).
- "Herniated urinary bladder (disorder)" 410070006 Has a similar map structure. (Exemplars:Gender:#5)

The gender rule is usually the last rule in a group, just before the OTHERWISE TRUE rule.

11.4 Context: Patient age at onset

If the source concept asserts an age or phase of life for onset of the disorder, a target will be selected first including the restriction or, if none is available, then a more general classification target (Map Category="Properly classified", Map Rule =TRUE, Map Advice=NULL) that is inclusive of the source concept. No Map Rule restrictions for age will be applied in cases where there is a properly classified ICD-10-CM Map target.

If the authoritative sources include specifications for employment of age, those will be used. Otherwise, these definitions for common phases of life will be employed when SNOMED CT or ICD-10-CM employ these descriptive terms and the age of onset restrictions in parentheses will be applied to the map rule:
- "Neonatal": birth to 28 days of life (age < 29.0 days)
- "Perinatal": 22 weeks of gestation to 7 days of life (age < 8.0 days)
- "Childhood": less than 18 years of age (age < 18.0 years)
- "Adult": 18 years of age and older (18.0 years =< age)
- "Infant (infancy)": birth to less than 1 year of age (age < 1.0 year)
- "Juvenile": 1 year of age to less than 18 years of age (1.0 years =< age < 18.0 years)
- "Adolescence": 12 years of age to less than 18 years of age (12.0 years =< age < 18.0 years)
- "Pre-senile": less than 65 years of age (age < 65.0 years)
- "Senile": 65 years of age and older (65.0 years =< age)

Employing the map tooling, lower boundaries of age will be asserted with the operator 'greater than or equal to'. Upper boundaries of age will be asserted with the operator 'less than' as identified in the definitions above.

If the source concept does not assert age or time of life and only age-restricted targets are available, the map will be considered CONTEXT DEPENDENT and the mapping specialist will assemble two or more Map Records including Map Rules to properly classify to each ICD-10-CM target classification. The map Rule will be constructed with reference to the SNOMED CT observable for "Age at onset of clinical finding".

- "Sleep apnea" 73430006 will be identified as dependent upon age context. Guidance from NCHS indicates that mapping will be to P28.3 for age of onset from birth to 28 days of life. Later in life the correct map is G47.30

(Exemplars:Age:#2) There are three additional exclusion rules relevant to this source concept.

- "Failure to gain weight" 36440009 will be identified as dependent upon age context. NCHS guidance indicates that the correct map is P92.6 from birth to 28 days, R62.51 for children and R62.7 after 18 years of age. (Exemplars:Age:# 4)

NOTES AND EXCEPTIONS:
- Juvenile onset and adult onset diabetes will be considered archaic terminology and always treated as type 1 and type 2 diabetes respectively. Guidance from NCHS directs that diabetes unspecified will be mapped as type 2 diabetes. Furthermore, should the source concept state the use of insulin as treatment, NCHS requires a second map group with target Z79.3 for use of insulin as treatment.

The age rule is usually the last rule in a group, just before the OTHERWISE TRUE rule. In cases where there is both an age and gender rule, the age rule should be above the gender rule.

11.5 Context: Acquired versus congenital

A source concept which identifies origination as a congenital or acquired condition will be mapped to a target of consistent or more general classification should one exist (Map Category="Properly classified", Map Rule=NULL). If a source concept is general and only specific targets exist, ICD-10-CM authoritative source will be searched for guidance of a default map record, either "Congenital" or "Acquired". When such advice is provided, this context will be employed to create the appropriate Map Record and Map Category will be (447637006 |Map source concept is properly classified|) Properly Classified, Map Rule=NULL, Map Advice = "MAPPED WITH NCHS GUIDANCE". When the source concept is general and no guidance is provided, the map specialist will create map records employing Map Rules relevant for all appropriate targets.

- "Congenital deformity of hip(disorder)" 2749000 maps to Q65.9 Unspecified congenital deformity of hip(Map category="Properly classified", Map Rule=TRUE, Map Advice=NULL) (Exemplars:Acquired Congenital:#1)
- "Acquired deformity of hip (disorder)" 67321002 maps to M21.959 Unspecified acquired deformity of unspecified thigh with four exclusion rules that apply pertinent to SNOMED subtype concepts. (Exemplars:Acquired Congenital:#2)
- "Deformity of hip joint (finding)" 299233007 map has multiple exclusions as well, but with more than 10 subtype concepts, it will be identified as a high level concept and not be exhaustively mapped. The default map target will be M21.959 in agreement with ICD-10-CM guidance and Map category shall be assigned "PROPERLY CLASSIFIED"

with Map Advice "MAPPED WITH NCHS GUIDANCE" and "DESCENDANTS NOT EXHAUSTIVELY MAPPED" (Exemplars:Acquired Congenital:#3)

11.6 Multiple Targets: Poisonings

Source concepts representing a poisoning from a drug or noxious substance may be mapped to one, two or three target classification codes depending upon the specificity of the source concept. The poisoning code for the drug or substance will be designated as the primary target code (MAP GROUP = 1), ICD chapter T36-T50. NCHS guidance dictates that the sole exception to this rule occurs when the manifestation is a neoplastic disorder. Neoplasms are always mapped as the first target code.

Should the source concept specify the symptoms or findings resulting from the poisoning, the appropriate target code will be mapped as the second map (MAP GROUP = 2) except in cases of neoplastic complications when the poisoning code will occur second.

When the SNOMED CT concept specifies the action intent/site of injury involved within the event, a specific ICD classification code from the range V00-Y99 External causes of morbidity will be employed as the second or third target code (MAP GROUP = 2 or 3). If the source concept does not specify intent, NCHS guidance will be reviewed for a default map which will be assigned a Map Category of "Properly classified" with Map advice of "MAPPED WITH NCHS GUIDANCE".

- "Toxic effect of arsenic AND/OR its compounds (disorder)" 81844008 maps to T57.0X1 "Toxic effects of arsenic compounds". No symptoms are specified. NCHS guidance specifies the default intent will be accidental poisoning.   This is a secondary code to be employed when the type of injury is specified. (Exemplars:Poisoning: #1)

- 296934007 "Accidental warfarin overdose" maps to T45.511? "Poisoning by anticoagulants, accidental (unintentional)" (Map Group 1, Map Category="Properly classified", Map Rule=TRUE, Map Advice="Always T45.514?. (Exemplars:Poisoning:#2)

- 7248001 "Poisoning by salicylate (disorder)" maps to T39.091? "Poisoning by salicylates, accidental (unintentional), episode of care unspecified" (Exemplars:Poisoning:#3)

- 216471009 "Accidental salicylate poisoning (disorder)" maps to:

- First exclusion rule –IFA 216472002 | Accidental poisoning by aspirin (disorder) |target T39.011? "Poisoning by aspirin, accidental, episode of care unspecified"
- Second exclusion rule – IFA 290147007 | Accidental salicylic acid salt poisoning (disorder)|; target T39.091? " Poisoning by antimycobacterial drugs, accidental (unintentional), episode of care unspecified"
- Third exclusion rule – IFA 290387005 | Accidental 5-aminosalicylic acid poisoning (disorder)|; target T37.1X1? " Poisoning by antimycobacterial drugs, accidental (unintentional), episode of care unspecified"
- Otherwise T39.091? "Poisoning by salicylates, accidental (unintentional), episode of care unspecified". (Exemplars:Poisoning:#4)

- 290148002 "Intentional salicylate poisoning (disorder)" maps to
  - One exclusion rule – IFA 290145004 |Intentional aspirin poisoning (disorder)"| T39.012? " Poisoning by aspirin, intentional self-harm, episode of care unspecified"
  - Otherwise T39.092? "Poisoning by salicylates; intentional self harm; episode unspecified" (Exemplars:Poisoning:#5)

- 295830007 "Overdose of antidepressant drug (disorder)" maps to:
  "T43.201? Poisoning by unspecified antidepressants, accidental (unintentional), episode of care unspecified" as the default target code. (Exemplars:Poisoning:#6)

11.7 Multiple Targets: External causes

Source concepts denoting a condition with an identifiable cause within scope of ICD-10-CM chapter XX (20) will be mapped to two target classification codes. The external cause classification will be assigned to the second target record (MAP GROUP=2)

If the external cause or location is not explicit in the SNOMED CT concept, the generic external cause code will not be listed as a target ICD-10-CM code.

- Closed skull fracture (disorder) 371162008 maps to:

  - S02.91X? "Unspecified fracture of skull, episode of care unspecified" Map group 1, Map category="Properly classified", Map Rule=TRUE, Map Advice= "POSSIBLE REQUIREMENT FOR AN EXTERNAL CAUSE CODE; EPISODE OF CARE INFORMATION" (Exemplars:External cause:#1). The ICD-10-CM code X59.9, Exposure to unspecified factor, unspecified place will not be listed as a second target ICD-10-CM code.

Source concepts which are SNOMED CT 272379006 Events will be mapped as External causes or as Factors influencing health status when these are within the scope of ICD-10-CM

- Fall down steps (event) 414189000 maps to:

  o W10.9XX? "Fall (on) (from) unspecified stairs and steps, episode of care unspecified", Map Category="Properly classified", Map Rule=TRUE, Map Advice= "EPISODE OF CARE INFORMATION NEEDED; THIS IS AN EXTERNAL CAUSE CODE FOR USE IN A SECONDARY POSITION" (Exemplars:External cause: #2)

- Assault by hot liquid (event) 219239003 maps to:

  o X98.2XX? " Assault by hot fluids, episode of care unspecified" Map category="Properly classified", Map Rule=TRUE, Map Advice=" EPISODE OF CARE INFORMATION NEEDED; THIS IS AN EXTERNAL CAUSE CODE FOR USE IN A SECONDARY POSITION"(Exemplars:External cause:#3)

11.8 Multiple or Single Targets: Dagger and asterisk cases from ICD-10

ICD-10-CM guidance does not include dagger and asterisk conventions found in the WHO publication of ICD-10. Mapping many concepts which follow those conventions internationally may NOT require two ICD-10-CM codes. NCHS guidance instead employs "USE ADDITIONAL" guidelines when necessary, otherwise more specific ICD-10-CM codes may have been generated to codes these cases.

- Pneumonia in aspergillosis (disorder) 111900000 maps to B44.1 Other pulmonary aspergillosis :
  o B44.1 "Other pulmonary aspergillosis" Map Group 1, Map category="Properly classified", Map Rule=TRUE, Map Advice="Always B44.1", Target = "B44.1" :(Exemplars:One to one:#6)"

- Syphilitic aortitis (disorder) 20735004 maps to A52.02 "Syphilitic aortitis":
  o A50.02 "Syphilitic aortitis". Map group=1; Map Group=1, Map Priority=1, Map Category="Properly classified", Map Rule=TRUE, Map Advice="Always A52.02", Target = "A52.02" (Exemplars: One-to-one:#7)

11.9 Multiple Targets: Use additional code

Guidance provided by NCHS includes frequent examples of advice of the form:
"USE ADDITIONAL: code to...."

When encountered as advice during selection of a map target, the map specialist will consider this advice to be required for analysis relating to the possible addition of an additional map group. For example:

- 46113002 |Hypertensive heart failure (disorder)| maps to I11.0 "Hypertensive heart disease with failure". The notes for target code I11.0 include the statement: 'USE ADDITIONAL: code to identify type of heart failure (I50.-)" Although the SNOMED source concept does specify the type of heart failure, the specialist will nonetheless add a second map group with target code I50.9 "Heart failure, unspecified" (Exemplars: One-to-many:#1)
- If the referenced code range from the inclusion statement does not have a classification code which is properly included in the definition of the SNOMED source concept, then the map specialist will add map advice "CONSIDER ADDITIONAL CODE TO IDENTIFY SPECIFIC CONDITION OR DISEASE" to the map record.
- Advice including "Use additional code" must be reviewed by the map specialist to the category level (three character codes).

Apart from the "USE ADDITIONAL: code to...." case, multiple targets (multiple map groups) will generally be needed in the following two situations:

- If the index clearly indicates the need for 2 codes, e.g. Amyloid heart (disease) E85.4 [I43]
- If the SNOMED CT concept is a combination of two conditions, joined by conjunctions such as "and", "due to" and "with" e.g. 200628009 Cellulitis and abscess of finger and toe (disorder) ((Exemplars: One-to-many:#2)

    A second target code will not be used to capture the residual meaning of a SNOMED CT concept that is not explicitly covered by the ICD-10-CM code e.g. 301783004 |Abnormal perimenopausal bleeding (disorder) is mapped to N95.8 "Other specified menopausal and perimenopausal disorders" which broadly encompasses the meaning of the SNOMED CT concept. A second map group will not be added to capture the specific symptom of bleeding.

11.10 Exhaustive mapping of SNOMED CT descendants to handle exclusion and other rules in ICD-10-CM

Managing context for ICD-10-CM exclusions proceeds with the assumption that mapping is occurring <u>from</u> SNOMED CT concepts in a clinical diagnosis list (problem list) <u>to</u> the ICD classification. It is possible that a SNOMED CT encoded problem can be further specified or that other concepts in that diagnosis list may be more specific statements of the same or similar diagnoses. More often than not, the more specific SNOMED CT diagnosis will have the same ICD-10-CM target. However, sometimes a more specific SNOMED CT concept will require a different map target for proper classification due to the exclusion and other rules in ICD-10-CM. In order to alert users of the MAP that the refinement of the SNOMED CT code can lead to a different ICD-10-CM code, exhaustive mapping of all descendants of relatively low level SNOMED CT source concepts is done. For all SNOMED CT concepts with 10 or less descendants ("low level concepts"), every descendant concept is evaluated independently to see if they map to a different ICD-10-CM target according to the exclusion and other rules in ICD-10-CM. Each descendant with different targets than their parent concepts will be represented by a separate Map Rule. Due to pragmatic considerations, and to avoid over-proliferation of Map Rules, SNOMED CT concepts with more than 10 descendants ("high level concepts") are not exhaustively mapped. Those concepts will only have a default ICD-10-CM target and the Map Advice DESCENDANTS NOT EXHAUSTIVELY MAPPED.

Each descendant of a low level concept that has been exhaustively mapped will appear in the final publication file as an independently-mapped source concept.

Sometimes, a descendant concept will require an age or gender rule. This will result in a compound rule e.g. IFA (SNOMED CT concept1) AND age of onset < x years, map to target code T1.

Exclusion guidelines from NCHS coding publications will be evaluated to determine the appropriate target code. Generally, these exclusions are presented as essential modifiers in the alpha index or as "Excludes:" notes in the tabular list. The process of reviewing the exclusions is outlined below.

11.10.1 Review of alpha modifiers:

There are two types of modifier which appear in the ICD-10-CM Alphabetical Index, Volume 3. These are non-essential and essential modifiers.

Non-essential modifiers appear in parentheses following the terms they modify and **do not** affect the target code selection for a given condition, sign or symptom but are considered as alternatives to the expression of the term.

Polyuria (nocturnal) R35

Essential modifiers appear next to a lead term or as subterms indented below lead terms in the alphabetical index and **do** affect the selection of target code. They describe essential differences in site, etiology or type of disorder and must appear in the clinical statement for the code to be assigned. When an essential modifier denotes an alternative map target to the source term statement, the modifier will be considered as a possible exclusion to the map target selected. An exclusion rule will be created if that exclusion applies to a descendant of the source SNOMED CT concept.

Encephalopathia hyperbilirubinemica, newborn P57.9 -   due to isoimmunization (conditions in P55.-) P57.0 **Polyuria (nocturnal)** R35 - psychogenic F45.3

11.10.2 Tabular exclusion statements:

Once target codes are selected employing the essential modifiers, the map specialist will examine "Excludes:" notes in the tabular list to see if any of them apply to descendants of the source SNOMED CT concept. If so, exclusion rules will be created.

11.11 Neoplasms

All source concepts representing neoplastic disorders will be mapped. Map Groups will specify the ICD-10-CM code(s) from Chapter II for the concept. Morphology mapping with ICD-O is out of scope for the MAP.

11.12 Location and multiplicity at birth

Source concepts which specify birth findings by location will be mapped to a specific ICD-10-CM target when such exists. SNOMED CT birth findings which do not specify numbers of child born will be assumed to be singleton births.

- 169813005 "Home birth" will map to Z38.1 Singleton born outside hospital
- 169814004 "GP unit birth" will map to Z38.0 Singleton born in hospital
- 169828001 "Twins both live born" will map to Z37.2 Twins both born live

12 Data sets and distribution format

12.1 Editorial (long) form

For purposes of editorial clarity and error reduction, in the editing environment, the source MAP will be maintained in LONG editorial form which assigns a mapping row to each and every descendant of a low level SNOMED CT source concept that is exhaustively mapped.

12.2 Publication (short) form

To reduce cluttering and improve readability, at publication, the map records for descendant concepts is evaluated algorithmically, and concepts whose descendants' maps match exactly that of the source concept are not shown. This is the short form which is the only form in which the map is published. This means that all maps can be interpreted as applicable to a source concept and its descendants, unless when it is stated to be different by an IFA rule. High level concepts are an exception to this, since the descendants are not exhaustively mapped (as stated in the map advice).

The MAP is released as refsets according to the Release Format 2 (RF2) specification of the IHTSDO. A human-readable text-delimited file is also available to facilitate browsing of the MAP. The IHTSDO publications SNOMED CT Users Guide and Technical Reference Manual will provide documentation as to the MAP and definitions and description of the mapping data sets.

National Library of Medicine will identify publication mechanisms as they see fit.

The MAP shall be subject to review with each new version of ICD-10-CM and SNOMED CT.

13 Documentation and education

Modifications and expansion of mapping heuristics and procedures may be made throughout the mapping project and will be documented by updating of this publication.

14 Translations

The MAP, MAP data structures and all documentation will be maintained and distributed in US English.

15 Future plans and outstanding items

- The coverage of the MAP will be expanded gradually to include more SNOMED CT concepts that are within the scope for mapping, subject to availability of mapping resources. Candidates for inclusion include: newly added concepts to each SNOMED CT release, the US extension, donated subsets from the Convergent Medical Terminology of Kaiser Permanente, SNOMED CT concepts used in quality measurement value sets and others.
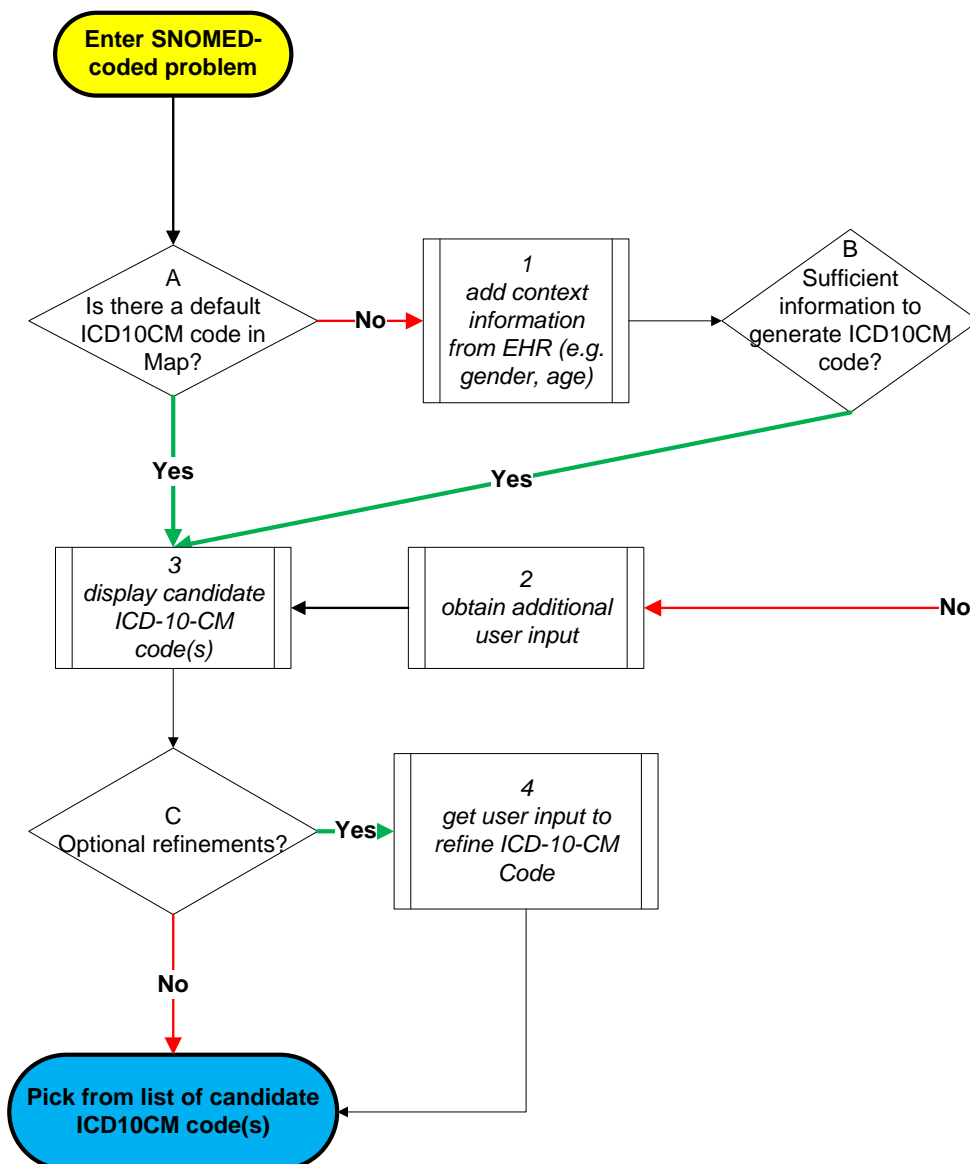
Appendix A: Frequently asked questions

1. Are all SNOMED CT and ICD-10-CM codes included in the Map?
   - The direction of the Map is from SNOMED CT (source) to ICD-10-CM (target). All pre-coordinated SNOMED CT concepts that are appropriate for use in a problem list (about a third of all active SNOMED CT concepts) are within scope. Initially, a smaller subset of frequently used SNOMED CT concepts will be mapped. Not all ICD-10-CM codes will appear as targets. It is expected that frequently occurring ICD-10-CM codes will be covered in the initial phase. This can only be verified when real-life usage statistics of ICD-10-CM codes are available. Because of the difference in granularity of the two terminologies, some ICD-10-CM codes will not have SNOMED CT correspondents (e.g. concepts with laterality or episode of care information). Full representation of these ICD-10-CM codes will require post-coordination, which is not included in this Map.

2. Can the Map be used to automatically generate ICD-10-CM codes?
   - The Map is intended to be used in a semi-automatic manner. The Map will suggest candidate ICD-10-CM codes based on SNOMED CT codes and, if applicable, additional information obtained from the electronic patient record or direct user input. Review of the candidate ICD-10-CM codes by either the healthcare provider or professional coder is recommended. The Map contains map rules and advice that can be used to highlight specific coding principles, or point to additional information required for coding. For the simple cases with one-to-one mappings, it is likely that a high proportion of the candidate ICD-10-CM codes will be adopted by the reviewer.

3. Is the order of the ICD-10-CM codes important?
   - When a single SNOMED CT concept generates a combination of ICD-10-CM codes, the order of the ICD-10-CM codes complies with ICD-10-CM coding guidelines. For example, in a 'dagger-and-asterisk' (etiology and manifestation) code combination, the etiology code will be in Map group 1 and the manifestation code Map group 2. For injury or poisoning cases, the clinical condition code will be in Map group 1 and the external cause/poisoning code Map group 2. However, when a patient has multiple SNOMED CT-coded problems for a single encounter, each mapping to a different ICD-10-CM code, the Map does not include information to determine the order in which the ICD-10-CM codes should be submitted e.g. as primary or secondary diagnosis.

4. Are all ICD-10-CM codes in the Map authorized for reimbursement?

- No. In planning for the development of this map, advice was sought from the Center for Medicare and Medicaid Services (CMS) regarding ICD-10-CM code restrictions for reimbursement in the US. Due to regional variations in care profiles and carrier procedures for authorization of reimbursement, no authoritative resource could be identified to guide target code selection beyond those published by National Center for Health Statistics (NCHS).

5. Are the ICD-10-CM codes optimized for reimbursement?
- No. The mappings are created to accurately reflect the meaning of the SNOMED CT concept. The level of reimbursement is not considered.

16 Appendix B: Interactive Map-Assisted Generation of ICD-10-CM Codes (I-MAGIC) Algorithm

The I-MAGIC Algorithm (Interactive Map-Assisted Generation of ICD Codes)

This is an algorithm which utilizes the SNOMED CT to ICD-10-CM Rule Based Map in a real-time, interactive manner to generate ICD-10-CM codes from SNOMED CT encoded clinical problems.

```
                    ┌──────────────────┐
                    │ Enter SNOMED-    │
                    │ coded problem    │
                    └──────────────────┘
                             │
                             ▼
          ╱─────────╲                    ┌──────────────┐         ╱─────────╲
         ╱     A     ╲        No         │      1       │        ╱     B     ╲
        ╱ Is there a  ╲─────────────────▶│ add context  │───────▶╱ Sufficient ╲
        ╲ default      ╱                 │ information   │        ╲ information to╱
         ╲ ICD10CM    ╱                  │ from EHR (e.g.│         ╲ generate ICD10CM╱
          ╲ code in   ╱                  │ gender, age)  │          ╲  code?   ╱
           ╲ Map?    ╱                   └──────────────┘           ╲───────╱
            ╲──────╱                                                     │
               │                                                     No  │
              Yes                                                        │
               │                                                         │
               │        Yes                                              │
               ▼                                                         │
        ┌──────────────┐      ┌──────────────┐                          │
        │      3       │◀─────│      2       │◀─────────────────────────┘
        │ display      │      │ obtain       │
        │ candidate    │      │ additional   │
        │ ICD-10-CM    │      │ user input   │
        │ code(s)      │      └──────────────┘
        └──────────────┘
               │
               ▼
          ╱─────────╲          ┌──────────────┐
         ╱     C     ╲   Yes   │      4       │
        ╱ Optional    ╲───────▶│ get user     │
        ╲ refinements? ╱       │ input to     │
         ╲───────────╱         │ refine       │
              │                │ ICD-10-CM    │
             No                │ Code         │
              │                └──────────────┘
              ▼                       │
     ┌──────────────────┐             │
     │ Pick from list of│◀────────────┘
     │ candidate        │
     │ ICD10CM code(s)  │
     └──────────────────┘
```

Item	Description	Example
A	Whether a default ICD-10-CM target code is present in the Map	Yes: 6020002 Tinea pedis (disorder)→ B35.3 Tinea pedis No: 410070006 Herniated urinary bladder (disorder)
B	With additional information from the EHR, whether there is sufficient information to arrive at a valid ICD-10-CM code	Yes: 410070006 Herniated urinary bladder (disorder) + gender information, e.g. if gender = Female → N81.10 Cystocele, unspecified No: 371162008 Closed fracture of skull (disorder)
C	A valid ICD-10-CM code is identified for the SNOMED CT problem, but in some cases, it is possible to refine the code by adding extra information. The user decides whether the additional refinement is necessary	67321002 Acquired deformity of hip (disorder) maps to M21.959 Unspecified acquired deformity of unspecified thigh by default. User can specify laterality if desired 34842007 Antepartum hemorrhage maps to O46.90 Antepartum hemorrhage, unspecified, unspecified trimester by default. User can specify trimester if desired 187057005 Histoplasmosis with meningitis maps to B39.9 Histoplasmosis, unspecified in Map group 1 by default. The SNOMED CT concept has two descendants 187048004 Histoplasma duboisii with meningitis (disorder) and 187038001 Histoplasma capsulatum with meningitis (disorder), which will map to different ICD-10-CM codes. The user can pick one of the descendants if appropriate
1	The application gathers patient	In the case of 410070006 Herniated urinary

	context information (e.g. age, gender) from the EHR	bladder (disorder), the application looks for patient gender in the EHR, if Female → N81.10 Cystocele, unspecified, if Male → N32.89 Other specified disorders of bladder
2	Get additional input from user	The method to interact with the user is implementation dependent. For example, for 371162008 Closed fracture of skull (disorder), the application can display the following list for the user to pick: S02.91- Unspecified fracture of skull • initial encounter for closed fracture • initial encounter for open fracture • subsequent encounter for fracture with routine healing • subsequent encounter for fracture with delayed healing • subsequent encounter for fracture with nonunion • sequela
3	The application displays the applicable ICD-10-CM codes after evaluating the map rules based on patient context information, additional input from user and other problems on the problem list	
4	Get user input to refine ICD-10-CM code	For 67321002 Acquired deformity of hip (disorder), the application displays the following choices • Unspecified acquired deformity of right thigh • Unspecified acquired deformity of left thigh • Unspecified acquired deformity of unspecified thigh

Notes:

1. The algorithm is applied to each SNOMED CT coded problem. One problem may lead to more than one ICD-10-CM codes (when there is more than one Map group).
2. It is possible to encode the additional information gathered in the process with SNOMED CT and store it together with the SNOMED CT problem, if the system is able to handle post-coordination.
3. How refinement of the ICD-10-CM code (box C) is handled depends on the workflow, institution policy and coding requirement. For example, some institutions may choose to default episode of care to the initial episode, others may make use of other information in the EHR to determine episode of care.

17 Appendix C: Map Rule Grammar and Formatting

```
Rule = TruthStatement / Clause
Clause = (ClauseFinding / ClauseObservable) [ ws ANDOP ws (ClauseFinding / ClauseObservable) ] ws
TruthStatement = ws 1*1("true" / "otherwise true") ws
   ;;; A Rule is either a truth statement or a clause
   ;;; A truth statement is either "true" or "otherwise true"
   ;;; A clause is either a clause with a finding or a clause with an observable
   ;;; and value optionally followed by the AND operator and a clause with a
   ;;; finding or observable and value.
ClauseObservable = "IFA" ws ( AttributeObservable ws NumericOperator ws Value )
   ;;; Observable clause has a mandatory value
ClauseFinding = "IFA" ws ( AttributeFinding )
   ;;;
AttributeObservable = ConceptObservable
   ;;; This could be removed and AttributeObservable changed to
   ;;; ConceptObservable without affecting the grammar
AttributeFinding = ConceptFinding
   ;;; This could be removed and AttributeFinding changed to
   ;;; ConceptFinding without affecting the grammar
NumericOperator = ("<" / ">=")
   ;;;Age at onset rules use greaterthanorequals for lower bounds and lessthan for upper bound
Value = ConceptAny / Numeric / OtherText
   ;;; Added in ConceptAny, which allows any Concept to be used as a Value,
   ;;; although clearly not all concepts are suitable
ConceptObservable = SctId ws pipe ws FullySpecifiedNameObservable ws pipe
ConceptFinding = SctId ws pipe ws FullySpecifiedNameFinding ws pipe
ConceptAny = SctId ws pipe ws FullySpecifiedName ws pipe
SctId = 6*18( digit )
FullySpecifiedNameObservable = 1*nonwsnonpipe *( ( 1*SP "(" *SP 1*nonwsnonparennonpipe *SP ")" !( ws pipe ) ) / ( 1*SP
1*nonwsnonparennonpipe !( ws pipe ) ) ) *SP 1*1( "(observable entity)" )
   ;;; The FSN of an observable must have a semantic tag = "observable entity"
   ;;; and may contain other embedded parenthesised strings. The ! (NOT)
   ;;; look-ahead operator serves to prevent the parser consuming the
   ;;; semantic tag when it's looking for words before the tag.
FullySpecifiedNameFinding = 1*nonwsnonpipe *( ( 1*SP "(" *SP 1*nonwsnonparennonpipe *SP ")" !( ws pipe ) ) / ( 1*SP
1*nonwsnonparennonpipe !( ws pipe ) ) ) *SP 1*1( "(finding)" / "(disorder)" )
   ;;; The FSN of a finding must have a semantic tag = "disorder" or
   ;;; "finding" and may contain other embedded parenthesised strings.
   ;;; The ! (NOT) look-ahead operator serves to prevent the parser consuming
   ;;; the semantic tag when it's looking for words before the tag.
```

FullySpecifiedName = 1*nonwsnonpipe *((1*SP "(" *SP 1*nonwsnonparennonpipe *SP ")" !(ws pipe)) / (1*SP 1*nonwsnonparennonpipe
!(ws pipe))) *SP 1*1("(" SemanticTag ")")
   ;;; Any FSN must have a semantic tag and may contain other embedded
   ;;; parenthesised strings. The ! (NOT) look-ahead operator serves to
   ;;; prevent the parser consuming the semantic tag when it's looking for
   ;;; words before the tag.
Numeric = 1*(digit) !(*ws /OtherText)
OtherText = 1*(nonwsnonsemicolonnonpipe) *(1*SP 1*nonwsnonsemicolonnonpipe)
   ;;; OtherText is used in Value and may not contain a semicolon because
   ;;; semicolon is the AND operator and follows a Value. Note that FSNs in
   ;;; Values may contain semicolons.
SemanticTag = 1*(nonwsnonparennonpipe) *(1*SP 1*nonwsnonparennonpipe)
   ;;; A Semantic Tag may consist of words separated by whitespace, but may
   ;;; contain whitespace.
digit = %x30-39
ws = *(SP / HTAB / CR / LF)
SP = %x20
HTAB = %x09
CR = %x0D
LF = %x0A
pipe = %x7C
nonwsnonparennonpipe = %x21-27 / %x2A-7B / %x7D-7E / UTF8-2 / UTF8-3 / UTF8-4 ; no parentheses
nonwsnonsemicolonnonpipe = %x21-3A / %x3C-7B / %x7D-7E / UTF8-2 / UTF8-3 / UTF8-4 ; no parentheses
nonwsnonpipe = %x28-29 / nonwsnonparennonpipe
ANDOP = "AND" ;
UTF8-2 = %xC2-DF UTF8-tail
UTF8-3 = %xE0 %xA0-BF UTF8-tail / %xE1-EC 2(UTF8-tail) / %xED %x80-9F UTF8-tail / %xEE-EF 2(UTF8-tail)
UTF8-4 = %xF0 %x90-BF 2(UTF8-tail) / %xF1-F3 3(UTF8-tail) / %xF4 %x80-8F 2(UTF8-tail)
UTF8-tail = %x80-BF