INTERNATIONAL HEALTH TERMINOLOGY
STANDARDS DEVELOPMENT ORGANISATION

Mapping SNOMED CT to ICD-10
Technical Specifications

A collaborative project in healthcare information interoperability with the World Health Organization

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Amendment History

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1.13	20101016	James Campbell	MapSIG revisions from Toronto training activities
1.14	20101110	James Campbell, Hazel Brear	MapSIG revisions from Toronto meeting and tooling evaluations

Contents

1 Document Purpose

This document organizes and presents the use cases and technical procedures for the co-development of a SNOMED CT to ICD-10 map by the International Health Terminology Standards Development Organization (IHTSDO) and the World Health Organization (WHO). 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 (© World Health Organization 1994) second edition (2008) are created to support the epidemiological, statistical and administrative reporting needs of the IHTSDO member countries and WHO Collaborating Centers.

The business application principles of relevance to the deployment of this map include:

- Re-use of clinical data for additional 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
- Promulgation of widespread comparable data epidemiologic and statistical data
- Cost saving for IHTSDO member countries which maintain ICD-10 derivative product maps

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

3 Mapping purpose

- To provide a semi-automated coding of ICD-10 classification data from a clinical record which is clinically encoded in SNOMED CT
- For development of ICD-10 classification codes from SNOMED CT encoded records for use in registries and diagnosis groupers
- To serve as a SNOMED CT to ICD-10 map validated and sanctioned by WHO and the IHTSDO which may serve as a source for development of maps to ICD-10 extension classifications developed and maintained by a member country

4 What the MAP is not

- A completely automated ICD-10 coding from a SNOMED CT source
- Support for social, cultural, ethical or financial constraints on ICD-10 coding required by members or other organizations
- A map that supports management of context beyond that found in the coded record and ICD-10 conventions and rules as noted in General approach and Heuristics
- A map that optimizes or manipulates ICD-10 codes for reimbursement purposes.

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 second edition of ICD-10 employed in systems for purposes of 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 hospital. The attending physician has maintained a diagnosis and health-related problem list coded in SNOMED CT during the stay and updates the entries at discharge. The vendor software employs the MAP, which uses a knowledge-based algorithm of sequential computable Map Rules. These rules evaluate context (data recorded about the patient in the electronic health record) and co-morbidities in the electronic record to identify the most

appropriate candidate ICD-10 code list based on ICD-10 exclusion / inclusion guidance and other conventions. Vendor software which cannot employ these knowledge 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 an ICD-10 code. The ICD-10 coding professional later reviews and edits the classification list prior to submission for statistical morbidity reporting. The Map Advice data further guides them with information regarding additional WHO rubrics and requirements.

7 Scope and Procedures

This mapping is a tabular, knowledge-based cross-link from SNOMED CT to ICD-10 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 classification.

7.1 Map relationships

The granularity and purpose of ICD-10 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) 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 is a classification of diseases and injuries with granularity of definition that has been chosen to provide utility for purposes of epidemiology and statistical reporting of mortality and morbidity. ICD-10 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 classes.

Only domains of SNOMED CT which overlap in meaning with those of ICD-10 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 class or classes which contain the elements of meaning of the SNOMED concept as conceptualized by ICD-10.

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 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 excluding Procedure with explicit context SCTID 129125009 and its descendants

7.3 Target domain context and scope

ICD-10 is a classification of diseases and findings for purposes of statistical reporting, epidemiology, cancer registries, injury and other registries, quality reporting, safety reporting and research. All chapters of ICD-10, excluding morphology of neoplasms, are considered within scope for this MAP.

The scope of ICD-10 is described in Volume 2 of the authoritative source as follows: "The ICD 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'."

Many SNOMED CT concepts within the source domains may be normal findings or other concepts not intended for classification by ICD-10. (See Appendix B - Exemplar maps:Out of scope worksheet, examples #1-20 for examples. Throughout the rest of this document, these exemplar references will be abbreviated “B:Out of scope:#1-20”)

7.4 Cardinality

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

One or more Map records will be required for the knowledge-based mapping to each ICD-10 classification target. These Map records will be coordinated in Map groups each yielding at most one target.

8 Authoritative resources

The SNOMED CT mapping is constructed using the SNOMED CT, current version published by the International Health Terminology Standards Development Organization; and the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (© World Health Organization 1994) ICD-10 second edition (2008), published and maintained by the World Health Organization. The MAP will be reviewed and updated for each new release of SNOMED CT.

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 which assembles knowledge-based data required to validate the link between a single SNOMED CT concept and at most one ICD-10 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 classification code.
- **Map Group:** an integer assigned to each set of map records which are coordinated to specify one target ICD-10 code for the map, or the null map if the source concept does not require an additional ICD-10 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:

    - Outside of the scope of ICD-10(**OS**), no mapping is possible. (for scope definition - refer to section 8.3, B:Out of scope: #1-20)
    - The map source concept is properly classified(**PC**) within the target ICD-10 classification for this map record, no additional data is necessary for selection of this target code of the map(B:One to one: #1-11)
    - The map source cannot be classified(**NC**) and cannot be assigned a target without additional data (B:Exclusions: #3)
    - The map is context dependent(**CD**) and requires additional patient information for accurate mapping as specified in the Map Rule (B:Exclusions:#1-6)

  Four 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(**ACT**) in its SNOMED CT definition; ambiguity is undergoing resolution before map classification can be concluded. See definition of ambiguity in 11.1.1.
    - The source SNOMED CT concept is incompletely modeled(**INC**). This may occur if the source SNOMED CT concept does not have a complete set of subtypes that would be expected for ICD coding, or if the source concept is understandable but not comprehensively defined (B:Incomplete for example)
    - Guidance from WHO is ambiguous(**AWH**) relative to the map target; awaiting clarification from WHO
    - Retired from map scope(**RET**); 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 A but generally is one of three forms:

- **IFA SCTID| FULLY SPECIFIED NAME | [= VALUE][“OR DESCENDANTS”]**: a Map Rule which evaluates for the existence of one or more SNOMED CT concept instances, their descendant concepts, or an observable and value found 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”. It may include an optional phrase “OR DESCENDANTS” if all instances of children of the clinical finding concept is also to be included in the rule evaluation. 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(PC) or non-classifiable(NC).

- **Map Advice:** human-readable textual advice that a software vendor may employ to inform the clinician user or the classification expert during a semi-automated mapping session. 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:

    - WHO ADVISES TO ASSUME CLOSED FRACTURE
    - FOURTH CHARACTER REQUIRED TO IDENTIFY PLACE OF OCCURRENCE
    - ADDITIONAL CODES NOT MAPPED
    - USE AS PRIMARY CODE ONLY IF SITE OF BURN UNSPECIFIED, OTHERWISE USE AS A SUPPLEMENTARY CODE WITH CATEGORIES T20-T29(Burns)
    - THIS IS AN EXTERNAL CAUSE CODE FOR USE IN A SECONDARY POSITION
    - MAP IS CONTEXT DEPENDENT FOR GENDER
    - POSSIBLE REQUIREMENT FOR CAUSATIVE DISEASE CODE
    - POSSIBLE REQUIREMENT FOR AN EXTERNAL CAUSE CODE
    - POSSIBLE REQUIREMENT FOR MORPHOLOGY CODE
    - MAPPED WITH WHO GUIDANCE
    - MAPPED WITH IHTSDO GUIDANCE

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 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 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 is designed for statistical and epidemiological purposes, one ICD-10 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 semantic space as identified by one or more ICD-10 classification codes, and to create a link between the SNOMED CT concept identifier and the correct ICD-10 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 semantics, as specified in Section 11 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 D72.8 "Other specified disorders of white cells" in ICD-10. 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 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 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 SNOMED CT source concept(**ACT**). 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. 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 reference has separate classifications for "Epidermal cyst" L72.0 and "Trichilemmal cyst (sebaceous cyst)" L72.1. The mapper will map 419603000 to ICD-10 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 an 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 classification "Duodenitis" K29.8. 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 term implies “paralytic or adynamic ileus” which is a subtype of the source concept having a different ICD-10 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 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 classification.

11.2 Choosing Initial Target Codes

Once the map specialist has reviewed and understands the SNOMED CT source concept to be mapped, they will employ the ICD-10 alphabetic index of diseases and nature of injury to research and select candidate ICD target codes for the map. They will research the Fully Specified Name from the SNOMED source concept for all but poisonings, searching the best textual references in the alphabetic reference that capture the meaning of the SNOMED CT concept. The WHO 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 though related cross references. Two types of cross-reference in the WHO 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 - subcutaneous - *see* Swelling, localized

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

Hyperbilirubinaemia - neonatal (transient) (*see also* Jaundice , fetus or newborn) P59.9

When a code is given alongside the term showing the '-*see also…'* appearing 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 "Enlargement", the mapper must also evaluate the alpha references for "Hypertrophy" for relevant target classifications:

Enlargement, enlarged - *see also* Hypertrophy

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 11.9 below. For source concepts that represent examples of poisonings caused by drugs or chemicals, the map specialist will use section III of the Alphabetic Index: Table of

Drugs and Chemicals to research the default maps and essential modifiers. An example of this is provided in section 11.9 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.

11.3 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(PC) in ICD-10, the Map Rule will default to TRUE and Map Advice will be NULL.

- Female infertility 6738008 maps to N97.9 Female infertility unspecified (B:Gender:#1)
- Male infertility 2904007 maps to N46 Male infertility (B:Gender:#2)
- Female epispadias 428680008 maps to Q64.0 Epispadias

If the source concept does not assert gender yet only gender restricted target codes are found within ICD-10, 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 structures, and a default record providing Map Advice for the user should rule evaluation fail to specify an ICD-10 target code. Map rules for gender context will be of the form “IFA {1086007 Female(finding) OR 248153007 Male(finding)}”.

- "Infertile (finding)" 8619003 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 Category for each will indicate that the record is context dependent(CD), the Map Rule will be “IFA 1086007 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 (NC), 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. (B: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 (B:Gender:#4)

- "Herniated urinary bladder (disorder)" 410070006 is somewhat more complicated and requires an exclusion rule as well as gender restrictions. See section 11.5 *Acquired versus congenital* for additional guidance. (B:Gender:#5)

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 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 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 (0 days < age =< 28 days)
- "Perinatal": 22 weeks of gestation to 7 days of life (0 days < age =< 7 days)
- ""Childhood": birth to 19th birthday (0 days < age =< 18 years)
- "Adult": 19th birthday until death (19 years < age)
- "Infant (infancy)": birth until 2nd birthday (0 days < age =< 1 year)
- "Juvenile": 2nd birthday until 19th birthday (2 years < age =< 18 years)
- "Adolescence": 12th birthday until 19th birthday (12 years < age =< 18 years)
- "Pre-senile": birth until 65th birthday (0 hours < age =< 64 years)
- "Senile": after 65th birthday (65 years < age)

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

If the source concept does not assert age or time of life and only restricted targets are within scope, 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 target classification. The map Rule will be constructed with reference to the SNOMED CT observable for "Age at onset of clinical finding".

- "Bronchitis" 32398004 will be flagged for age context. WHO advice specifies that Bronchitis(unspecified) should map to J20.9 "Acute bronchitis" for patient under

age 15 while all other cases should map to J40 Bronchitis, not specified as chronic or acute. The map for J20.9 Acute bronchitis, is further complicated by several exclusions within the section of ICD (refer for guidance to 11.9), leading to fourteen additional nested rules. By the 11.9.3 “Rule of ten” these are collapsed to a single alternative for older patients. (B:Age:#1)

- "Sleep apnea" 73430006 will be identified as dependent upon age context. Guidance from WHO 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 G47.3 (B:Age:#2)
  - Map Group=1, Map Order=1, Map Category=context dependent, Map Rule = "IF AGE OF ONSET=birth - 28 days Map Advice = "IF AGE OF ONSET BEFORE 28 DAYS OF LIFE CHOOSE P28.3", Map Target = "P28.3"
  - Map Group=1, Map Order=2, Map Category=categorized with WHO guidance, Map Rule = "OTHERWISE TRUE", Map Advice = NULL, Map Target = "G47.3" (B:Age:# 2)
- "Omphalitis" 239095007 will be identified as dependent upon age context. WHO guidance indicates that the correct map will be L08.9 for onset of findings after 28 days of life, and P38 for onset at or before 28 days.
  - Map Group=1, Map Order=1, Map Category=context dependent, Map Rule = "IF AGE OF ONSET> 29 daysMap Advice = "IF AGE OF ONSET AFTER 28 DAYS OF LIFE CHOOSE L08.9", Map Target = "L08.9"
  - Map Group=1, Map Order=2, Map Category=categorized with WHO guidance, Map Rule = "OTHERWISE TRUE", Map Advice = NULL, Map Target = "P38" (B:Age:#3)
- "Asthma" 195967001 will be identified as dependent upon age context. WHO guidance indicates that the correct map is J45.0 from birth to 19 years of age. All other age groups should map to J45.9:
  - Map Group=1, Map Order=1, Map Category=context dependent, Map Rule = "IF AGE OF ONSET=birth - 19 years, Map Advice = "IF AGE OF ONSET BEFORE 19 YEARS CHOOSE J45.0", Map Target = "J45.0"
  - Map Group=1, Map Order=2, Map Category=categorized with WHO guidance, Map Rule = "OTHERWISE TRUE", Map Advice = NULL, Map Target = "J45.9" (B: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
-

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, ID-10 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 (PC) Properly Classified, Map Rule=NULL, Map Advice = “MAPPED WITH WHO 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) (B:Acquired Congenital:#1)
- "Acquired deformity of hip(disorder)" 67321002 maps to M21.9 Unspecified acquired deformity of hip(Map category="Properly classified", Map Rule=TRUE, Map Advice=NULL) (B:Acquired Congenital:#2)
- "Deformity of hip joint (finding)" 299233007 map will be identified as context dependent. The default map target will be M21.9 in agreement with ICD-10 guidance and Map category shall be assigned "PROPERLY CLASSIFIED"with Map Advice “MAPPED WITH WHO GUIDANCE” (B:Acquired Congenital:#3)

    - Map Group=1, Map Order=1, Map Category=context dependent, Map Rule = "IFA 2749000 Congenital deformity of hip OR DESCENDANTS", Map Advice = IFA CONGENITAL DEFORMITY OF HIP CHOOSE Q65.9", Map Target = "Q65.9"
    - Map Group=1, Map Order=2, Map Category=Context dependent, Map Rule = " IFA 240241003 Coxa plana", Map Advice = "IF COXA PLANA DUE TO PREVIOUS JUVENILE OSTEOCHRONDOSIS CHOOSE M91.25", Map Target = "M91.25”
    - Map Group=1, Map Order=3, Map Category=Context dependent, Map Rule = " IFA 16979000 Acquired coxa valga", Map Advice = " IF ACQUIRED COXA VALGA CHOOSE M21.05", Map Target = "M21.05”
    - Map Group=1, Map Order=4, Map Category=Context dependent, Map Rule = " IFA 12067001Acquired coxa vara", Map Advice = IF ACQUIRED COXA VARA CHOOSE M21.15", Map Target = "M21.15”
    - Map Group=1, Map Order=5, Map Category=Context dependent, Map Rule = " IFA 67321002 Acquired deformity of hip", Map Advice = "IF A ACQUIRED DEFORMITY OF HIP CHOOSE M21.95", Map Target = "M21.95”

    - Map Group=1, Map Order=6, Map Category=pROPERLY CLASSIFIED, Map Rule = "OTHERWISE TRUE", Map Advice = MAPPED WITH WHO GUIDANCE, Map Target = "M21.95"

- "Pyloric stenosis" 367403001 will be identified as context dependent for congenital or acquired origin.
    - Map Group=1, Map Order=1, Map Category=context dependent, Map Rule = "IFA 204671009 Congenital pyloric stenosis OR DESCENDANTS", Map Advice = “IFA CONGENITAL PYLORIC STENOSIS CHOOSE Q40.0", Map Target = "Q40.0"
    - Map Group=1, Map Order=2, Map Category=Properly classified, Map Rule = "OTHERWISE TRUE", Map Advice = MAPPED WITH WHO GUIDANCE, Map Target = "M31.1"

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. WHO 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 range X40-X49, X60-X84, Y10-Y34, Y40-Y59 will be employed as the second or third target code (MAP GROUP = 2 or 3). If the source concept does not specify intent, WHO guidance will be reviewed for a default map which will be assigned a Map Category of "Properly classified” with Map advice of “MAPPED WITH WHO GUIDANCE".

- "Arsenic poisoning(disorder)" 81844008 maps to T57.0 "Toxic effects of arsenic compounds". No symptoms are specified. WHO guidance specifies the default intent will be accidental poisoning. (B:Poisoning: #1)
    - Map Group = 1, Map Category="Properly classified", Map Rule=TRUE, Map Advice=”Always T57.0”, Target = “T57.0”,

- Map group = 2, Map category = “Properly classified”, Map Rule = TRUE, Target = X44. Map advice will be added to indicate that a fourth code character is required and that the map followed WHO advice.

- 296934007 "Accidental warfarin overdose" maps to:
  - T45.5 "Poisoning by anticoagulant" (Map Group 1, Map Category="Properly classified", Map Rule=TRUE, Map Advice=”Always T454.5, Target = “T45.5”
  - X44.9 "Accidental poisoning unspecified activity" (Map Group 2, Map Category="Mapped with WHO advice", Map Rule=TRUE, Map Advice=”Fourth character required to identify place of occurrence”, Target = “X44. (B:Poisoning:#2)

- 403742006 "Arsenic induced skin malignancy" maps to:
  - C44.9 "Malignant neoplasm of skin unspecified" (Map group 1, Map Category="Properly classified", Map Rule=TRUE, Map Advice=NIL). This code is mapped first since the manifestation is a neoplasm.
  - T57.0 "Toxic effects of arsenic compounds" (Map group 2, Map category="Properly classified", Map Rule=TRUE, Map Advice=”Fourth character required to identify place of occurrence”
  - X48 “Accidental poisoning by and exposure to pesticides” (Map Group 3, Map Category = “Properly classified”, Map Rule = TRUE, Map Advice=”Fourth character required to identify place of occurrence”) (B:Poisoning:#3);

- 7248001 "Salicylate poisoning" maps to:
  - T39.0 "Toxic effects of salicylates" (Map group 1); and
  - X40.9 "Accidental poisoning by non-opioids" (Map group 2) based upon WHO guidance (B:Poisoning:#4)

- 216471009 “Accidental salicylate poisoning" maps to
  - T39.0 "Toxic effects of salicylates" (Map group 1)
  - X40 "Accidental poisoning by non-opioids" (Map group 2) (B:Poisoning:#5)

- 290148002 “Intentional salicylate poisoning" maps to
  - T39.0 "Toxic effects of salicylates" (Map group 1)
  - X60 “Intentional poisoning by non-opioids" (Map group 2) (B:Poisoning:#6)

- 295830007 “Overdose of antidepressant drug” maps to:
  - “T43.2” “Poisoning by other and unspecified antidepressants” as the default target code. However the alphabetic reference for poisoning by antidepressants lists three essential modifiers for subclasses of antidepressants which are found as children of the source concept and therefore qualify for mapping as exclusions. Hence the final mapping for Map group 1 are as follows:
    - Map Group=1; Rule order=1; Map Rule “IFA 29589900 |Overdose of monoamine oxidase inhibitor antidepressant drug|; Map Target = T43.1
    - Map Group=1; Rule order=2; Map Rule “IFA 297200009 |Overdose of tricyclic antidepressant|”; Map Target=T43.0
    - Map Group=1; Rule order=3; Map Rule “IFA 295943008 |Tetracyclic antidepressant drug overdose|”; Map Target=43.0
    - Map group=1; Rule order=4; Map Rule “TRUE”; Map target=T43.2
  - “X41” “Accidental poisoning by psychotropic drug” Map group 2, based upon WHO guidance (B:Poisoning:#7)

11.7 Multiple Targets: External causes

Source concepts denoting a condition with an identifiable cause within scope of ICD-10 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)

- Thermal burns from lightning (disorder) 242012005 maps to:
  - T30.0 “Burn of unspecified region” Map group 1, Map category="Properly classified", Map Rule=TRUE, Map Advice= “Always T30.0”, Target = “T30.0”
  - X33 “Victim of lightning” Map Category = “Properly classified”, Map Rule = TRUE, Map Advice = “”Always X33” with advice regarding need for fourth character, Target = ”X33” (B:External cause:#1)

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 code.

- Closed skull fracture (disorder) 371162008 maps to:
  - S02.90 “Fracture of skull and facial bones, part unspecified, closed” Map group 1, Map category="Properly classified", Map Rule=TRUE, Map Advice=”Always S02.90”, Target = “S02.90”(B:External cause:#2). The ICD-10

code X59.9, Exposure to unspecified factor, unspecified place will not be listed as a second target ICD-10 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

- Fall down steps (event) 414189000 maps to:
  - W10.9 “Fall on or from stairs or steps, unspecified place: Map Category="Properly classified", Map Rule=TRUE, Map Advice=”Always W10.9, Fourth character required, This is an external cause code for use in secondary position” Target = “W10.9” (B:External cause: #3)
- Lightning (event) 5193003 maps to:
  - X33 “Victim of lightning” Map category="Properly classified", Map Rule=TRUE, Map Advice=”Always X33, Fourth character required, This is an external cause code for use in secondary position”, Target = “X33” (B:External cause:#4)

11.8 Multiple Targets: Dagger and asterisk

Source concepts which map to ICD chapters with asterisk conventions will be mapped to two target classification codes. The asterisk classification will always be the second target record (MAP GROUP =2).

- Pneumonia in aspergillosis (disorder) 111900000 maps to B44.1 Other pulmonary aspergillosis (dagger) and J17.2 Pneumonia in mycoses (asterisk):
  - B44.1 “Other pulmonary aspergillosis” Map Group 1, Map category="Properly classified", Map Rule=TRUE, Map Advice=”Always B44.1”, Target = “B44.1” (B:Dagger & Asterisk:#1)
  - J17.2 Pneumonia in mycoses” Map group 2, MapCategory="Properly classified", Map Rule=TRUE, Map Advice=”Always J17.2”, target = “J17.2”

- Syphilitic aortitis (disorder) 20735004 maps to A52.0 “Cardiovascular syphilis” and I79.1 “Aortitis in diseases classified elsewhere” except that one exclusion is identified for A50.5 “Congenital syphilis”:
  - A50.5 “Other late congenital syphilis”. The map specialist notes an alpha modifier for Congenital syphilis and recognizing that congenital syphilis is a specialized instance of the etiology syphilis in SNOMED CT, adds a map

record to include this (see section 11.9 Exclusions). Map Group=1, Map Priority=1, Map Category=”Context dependent”, Map Rule=”IFA 35742006 Congenital syphilis”, Map Advice “If congenital syphilis use A50.5”, Target = “A50.5”

- A52.0 “Cardiovascular syphilis” Map Group 1, Map priority 2, Map category="Properly classified", Map Rule=TRUE, Map Advice=“Always A52.0”, Target = “A52.0”
- I79.1 “Aortitis in disease classified elsewhere” Map group 2, MapCategory="Properly classified", Map Rule=TRUE, Map Advice=”Always I79.1” (B:Dagger and Asterisk:#2)

- “Psoriasis with arthropathy” 33339001 maps to L40.5 and M07.39 with three exclusions in Map Group 2:
  - L40.5 Arthropathic psoriasis(Map Group=1, Map Category="Properly classified", Map Rule="TRUE", Map Advice=”Always use L40.5”, Target=L40.5 (B:Dagger & Asterisk:#4)
  - M07.09 Distal interphalangeal psoriatic arthropathy (Map Group=2, Map Priority =1, Map category = context dependent, Map Rule = “IFA 239812005 PSORIATIC ARTHRITIS WITH DISTAL INTERPHALANGEAL JOINT INVOLVEMENT”, Map Advice = “IF PSORIATIC ARTHRITIS WITH DISTAL INTERPHALANGEAL JOINT INVOLVEMENT USE M07.09”, Map target= “M07.09”)
  - M07.29 Psoriatic spondylitis (Map Group=2, Map priority = 2, Map category = context dependent, Map Rule = “IFA 200956002 PSORIATIC ARTHRITIS WITH SPINE INVOLVEMENT”, Map Advice = “IF PSORIATIC ARTHRITIS WITH SPINE INVOLVEMENT USE M07.29”, Map target= “M07.29”)
  - M09.09 Juvenile arthritis in psoriasis (Map Group=2, Map priority = 3, Map category = context dependent, Map Rule = “IFA 239802003 JUVENILE PSORIATIC ARTHRITIS”, Map Advice = “IF JUVENILE PSORIATIC ARTHRITIS USE M09.09”, Map target= “M09.09”)
  - M07.39 Other psoriatic arthropathies(Map Group=2, Map priority = 4, Map Category="Properly classified", Map Rule=TRUE, Map Advice=”Always use M07.39”, Map target = “M07.39”)

- Anemia in ovarian carcinoma(clinical finding) 307726001 maps to:
  - C56 Malignant neoplasm of ovary(Map Group 1, Map category="Properly classified", Map Rule=TRUE, Map Advice=”Always use C56”, Target = “C56”(B:DAGGER & Asterisk: #5)

- D63.0 Anemia in neoplastic disease(Map group 2, MapCategory="Properly classified", Map Rule=TRUE, Map Advice="Always use D63.0", Target = "D63.0")

Dagger and asterisk codes may appear in maps employing multiple other complex features. When doing so, the dagger exclusions are given priority in the Map priority sequence so as to avoid coding conflicts in the record with other exclusion codes.

Dagger codes identified during tabular review which do not have a corresponding asterisk are called "virtual dagger" references. These do not require second target addition as in the following example.

- "Urinary tract infectious disorder" 68566005 maps to N39.0 with multiple exclusions. One exclusion is dagger code A18.1 Tuberculosis of genitourinary system. However review of the tabular guidance from WHO documents (B:Exclusions:#7)

11.9 Context: Exclusions, Alpha Modifiers and Co-morbidities

Managing context for ICD-10 exclusions proceeds with the assumption that mapping is occurring from SNOMED CT concepts in a clinical diagnosis list (problem list) to the ICD classification. Other concepts in that diagnosis list may sometimes be more specific statements of the same or similar diagnoses and may require a different map target for proper classification. Exclusion guidelines from WHO coding publications will be evaluated as a last step in context evaluation and relevant diagnoses of greater specificity will be added as additional context mapping. This will occur as a three step process: 1) review of alpha modifiers for essential subterms, 2) identification of relevant tabular exclusion statements or sibling targets and 3) restrictions of exclusions in cases of excessive target codes (rule of ten).

11.9.1 Review of alpha modifiers:

There are two types of modifier which appear in the ICD-10 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 initial map target selected.

Encephalopathia hyperbilirubinemica, newborn P57.9
- due to isoimmunization (conditions in P55.-) P57.0

Polyuria (nocturnal) R35
- psychogenic F45.3

The map specialist will review the WHO ICD-10 Alphabetical Index to Diseases and Nature of Injury, Volume 3 to identify any essential modifiers which represent SNOMED CT concepts that are children of: a) the source concept to be mapped, or b)the source concept etiology SNOMED code when dagger and asterisk guidance requires a separate target for cause of the disorder. The map specialist will add new map records with the associated target specific to the alpha reference as context dependent maps with a map rule.

For example: Syphilitic aortitis 20735004 maps to a)Cardiovascular syphilis A52.0 and b)Aortitis in diseases classified elsewhere I79.1. Upon reviewing the WHO alphabetic index, the map specialist notes that the etiology syphilis has a subtype of congenital syphilis.

Aortitis (nonsyphilitic) (calcific) I77.6
- syphilitic A52.0† I79.1*
- - congenital A50.5† I79.1*

Checking the SNOMED CT taxonomy, they note that Congenital syphilis 35742006 is a child of the concept Syphilis 76272004 and so the map specialist adds a new context dependent map record for congenital syphilis as an alternative etiology target(B: Dagger and asterisk:#2)

For example (Etiology and Manifestation):

Herpetic iridocyclitis 420485005 maps to a) Herpes viral ocular disease B00.5 and b) Iridocyclitis in infectious and parasitic diseases classified elsewhere H22.0. Upon reviewing the WHO alphabetic index, the map specialist notes the etiology Herpetic iridocyclitis has a subtype of zoster.

Iridocyclitis
-herpes, herpetic (simplex) B00.5† H22.0*
--zoster B02.3† H22.0*
OR
Herpes, Herpetic
-iridocyclitis (simplex) B00.5† H22.0*
--zoster B02.3† H22.0*

Checking the SNOMED CT taxonomy, Herpes zoster iridocyclitis 10698009 is a child of the concept Herpetic iridocyclitis 420485005 and so the map specialist adds a new context dependent map record for Herpes zoster iridocyclitis as an alternative etiology target (B: Dagger and asterisk:#3).

Context dependent map records for designation of an exclusion rule will be recorded with a Map category of “CD”, a Map Rule of the format “IF A SCTID |PREFERED TERM| (AND DESCENDANTS)” and Map Advice of the format “IF PREFERED TERM USE ICDID” For the exemplar quoted above, the Map Rule would be “IF A 10698009 |HERPES ZOSTER IRIDOCYCLITIS|” and the Map Advice would be “IF HERPES ZOSTER IRIDOCYCLITIS USE B02.3”.

For example:
Obstructed incisional ventral hernia 414924006 maps to Ventral hernia with obstruction, without gangrene K43.0. Upon reviewing the WHO alphabetic index, the map specialist notes Incisional hernia has areference to “see Hernia, ventral”. To determine the target, the map specialist follows the ‘see’ reference and checks under “Hernia, ventral”. ICD-10 code K43.0 is listed under Hernia, ventral, with, obstruction

(the last three being subterms or essential alpha modifiers). In addition, are the essential and nonessential modifiers:

Hernia, hernial
-incisional — see Hernia, ventral
-ventral K43.9
--with
---gangrene (and obstruction) K43.1
---obstruction K43.0

Checking the SNOMED CT taxonomy, Obstructed incisional ventral hernia 414924006 has a child Incisional ventral hernia with obstruction and gangrene 414476004 so the map specialist adds a new context dependent map record for Incisional ventral hernia with obstruction and gangrene as an alternative target (B:Exclusions:#5).

Mapping for concepts of poisoning and overdose will require analysis of the Alphabetic Index; Table of Drugs and Chemicals. This table organizes the default target codes for mapping drug or chemical mishaps including advice for accidental events, intentional self harm, undetermined intent and adverse effects in therapeutic use. This table also may include essential modifiers which require attention for possible exclusion rules. For example, when mapping the SNOMED CT source concept 295830007 Overdose of antidepressant drug (disorder) a review of the drugs table will expose these entries for Antidepressant poisoning:

Substance	Poisoning				Adverse effect in therapeutic use
	Chapter XIX	Accidental	Intentional self-harm	Undetermined intent	
Antidepressant NEC	T43.2	X41	X61	Y11	Y49.2
– monoamine-oxidase-inhibitor	T43.1	X41	X61	Y11	Y49.1
– triazolpyridine	T43.2	X41	X61	Y11	Y49.2
– tricyclic or tetracyclic	T43.0	X41	X61	Y11	Y49.0

In this case, the default target code for mapping of Antidepressant poisoning is T43.2 for map group one and X41 for map group two based upon WHO advice of assumption of accidental intent when unspecified. However required modifiers are included for this map for agents MAO inhibitors, tricyclic and tetracyclic antidepressants. These concepts are all subtypes of the SNOMED source code and must be mapped as exclusions since they represent essential modifiers. The concept of overdose of triazolpyridine is also an essential modifier, however there is no child of the source concept in SNOMED CT corresponding to this classification and so that exclusion rule is ignored. (B: Poisoning: #7)

11.9.2 Tabular exclusion statements and target siblings:

Once target codes are selected employing the essential modifiers, the map specialist will examine a) category and code level exclusion statements and b) subcategory siblings of the target classification (excluding NEC classes) within the WHO authoritative tabular source for candidate exclusion classes. This mapping project will ignore chapter and block level exclusions for purposes of simplification. Each exclusion classification statement or subcategory sibling will be explored for a SNOMED CT concept of like meaning. The map specialist will not expand this search employing any additional inclusion statements. Any such SNOMED CT concept which is found to be a sub-type (child) of the SNOMED CT map source concept, or a frequent co-morbidity of the source concept, will cause the generation of an additional map record modeling the ICD-10 exclusion statement. A final (default) map record will designate a target only if WHO guidance indicates that a default is appropriate. Otherwise the final map record will designate the source concept as Not Classifiable(NC).

For example:

- Neonatal hyperbilirubinemia 281610001 maps to P59.9 Neonatal jaundice unspecified. A review of the code, section and chapter exclusions for P59.9 include: a) inborn errors of metabolism, b) kernicterus, c) congenital stenosis and stricture of bile ducts, d) Crigler Najjar syndrome, e) Dubin Johnson syndrome, f) Gilberts syndrome, g) hereditary hemolytic anemias.

  Reviewing the children of 281610001 identifies seven concepts relevant to these restrictions and other section classifications: 1)Kernicterus due to isoimmunization 359007, 2)Neonatal jaundice associated with pre-term delivery 73749009, 3) Neonatal jaundice with Crigler Najjar 206454000, 4) Neonatal jaundice with Dubin Johnson syndrome 206455004, 5)Neonatal jaundice with Gilberts syndrome 206456003, 6)Perinatal jaundice due to inspissated bile syndrome 73876000, 7)Perinatal jaundice from hereditary hemolytic anemia 56921004.

  From this review, the map specialist creates seven map records with exclusion rules for the conditions identified, and an eighth map record which is otherwise correct for the default map to P59.9.(See the appendix; worksheet Exclusions; exemplar #1)

- Hypertensive disorder 38341003 maps to I10 Essential hypertension. Exclusions applicable to this classification include: a) hypertensive vascular disease of eye, b) hypertensive vascular disease of brain, c) hypertension complicating pregnancy, childbirth or puerperium, d) hypertensive vascular disease of coronaries, e)neonatal hypertension, f) pulmonary hypertension.

A review of the related SNOMED CT concepts descendant to 38341003 which relate to these exclusion include: 1) 198941007 Hypertension complicating pregnancy childbirth and puerperium, 2) 367390009 Hypertension in the obstetric context, 3) 206596003 Neonatal hypertension.

From this review, the map specialist creates three map records with exclusion rules and a fourth default map. (See appendix; Exclusions, exemplar #2)

- Epicondylitis 73583000 has two possible maps for medial and lateral epicondylitis, both listed within code group M77. Additional exclusions listed are for bursitis, osteophytes and enthesopathies. A review of the SNOMED children for 73583000 discloses only two: 202855006 Lateral epicondylitis and 53286005 Medial epicondylitis. The map specialist creates two map records, one for each option, and a third default which is given map category NC since no default guidance exists from WHO. (B: Exclusions: #3)

11.9.3 Rule of ten

While evaluating the map of a single source concept, the map specialist will tally the number of target codes accruing from exclusion analysis including alphabetic index required modifiers, category and code exclusion statements and siblings of the target. If the number of target codes within a single Map group is ten or greater, the map specialist will reduce the records for that Map Group to a single record specifying the appropriate default target as properly classified and will add Map Advice metadata for that record: “ADDITIONAL CODES NOT MAPPED”.

11.9.4 Target code ranges: Rule of two

When evaluating exclusion targets for inclusion in the MAP, the Map specialist may sometimes encounter WHO guidance that specifies a range of codes. In such cases, the specialist will evaluate the codes within the range for relevance following the rubrics above. If the number of target codes in the range exceeds two, the specialist will choose the most appropriate default code and add Map Advice metadata for that record: “ADDITIONAL CODES FROM *XX-YY*(map specialist insert) NOT MAPPED”.

11.9.5 Mapping descendants of concept exclusions

When mapping concepts to be excluded, the map specialist will review the children of the exclusion concept and determine whether they should be included in the map rule. If the exclusion concept is a “leaf” concept with no SNOMED children, the map specialist will create the map rule to include only the single concept (“SELF”). If the exclusion concept has one or more children which can be readily reviewed for meaning and that meaning will have the same map target, the map specialist can specify that the children should also be included in the map rule (Map rule to include “DESCENDANT OR SELF”). If the number of children of the exclusion concept is too large to reasonably review or if there are children which clearly require a different map target, the map specialist will err on the side of caution and map only the exclusion concept (Map rule only for “SELF”).

11.10 Neoplasms

All source concepts representing neoplastic disorders will be mapped. Map Groups will specify the ICD-10 code(s) from Chapter II for the concept. Morphology mapping with ICD-O is out of scope for the MAP. A warning will be recorded in the Map Advice field that certain governments may require morphology coding for completeness.

11.11 Location and multiplicity at birth

Source concepts which specify birth findings by location will be mapped to a specific ICD-10 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

SNOMED CT is released with cross-mapping tables from clinical concepts in SNOMED CT to categories listed in ICD-10. The IHTSDO mapping publication provides two refsets which provide the map records as described above. The first refset has all map record data with the exception of Map Category. Map Category data is linked within a second refset which ties the

concept identifier for the Map category to the Map Record. (See appendix Exemplars; Release Datasets)

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.

The World Health Organization will identify publication mechanisms as they see fit.

Agreed updated versions of ICD-10 released by the WHO Update and Revision Committee shall be subject to a revision of MAP twice yearly and included in the next following SNOMED CT release. Incremental changes to the MAP shall be documented employing the SNOMED CT Enhanced Release Format.

13 Documentation and education

Modifications and expansion of mapping heuristics and procedures will be documented within this publication as consensus management proceeds throughout the MAP project.

Education of map leads, mappers, consensus managers and supporting personnel will be prepared and conducted following the document: "Guidance on the Preparation of Terminology / Classification Map Development Personnel: SNOMED CT to ICD-10", which is supplemental to this technical documentation.

14 Translations

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

15 Future plans and outstanding items

- Implement algorithms for limiting numbers of rules required for exclusion mapping including the ‘rule of 10’, ‘rule of two’ and restriction of block and chapter level exclusion guidance. After mapping the first 500 concepts including ample rules-based mapping cases, statistics will be prepared profiling the frequency of map restrictions in order to inform revision as necessary of the technical plan.
- Use computational methods as proposed by NLM to maximize the context-free map candidate, improve efficiency of manual curation, enhance mapping procedures and participate in validation and extension mapping activities. When validated, these will be considered for the tooling environment.
- Consider morphology code quality assurance for neoplasms on subsequent maps.

16 Appendix A: 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 "=" ws Value )
   ;;; Observable clause has a mandatory value
ClauseFinding = "IFA" ws ( AttributeFinding [ws "OR DESCENDANTS"] )
   ;;; Finding clause has optional "OR DESCENDANTS"
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
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 containg 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 = %x3B  ; semicolon
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
```