



SNOMED CT Style Guide: Introduction and Overview

Purpose, Scope, Boundaries and Requirements

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Purpose of this document

This document is the introduction and overview of the Style Guide, which serves as the primary reference regarding the editorial policies and content of SNOMED CT. This document also outlines the purpose, scope, boundaries and requirements of the terminology that inform and constrain the activities of terminology maintenance, improvement and quality assessment.

Status

The document is a working draft.

Source documents

Significant parts of this document were derived from “SNOMED Clinical Terms Requirements Document: Proposals for the New Terminology”, and “SNOMED Clinical Terms Consultation Document: Requirements Analysis”, both dated June 3, 2000. These documents were prepared by David Markwell for the SNOMED International Editorial Board during the design phase of SNOMED CT.



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1 Style Guide Introduction

The Style Guide sets forth the editorial policies, purpose, scope and requirements of SNOMED CT. It uses a concept-oriented documentation style, rather than a task-oriented style, and therefore it is not intended as a how-to manual on concept modeling or use of any particular editing environment; those task-oriented aspects are to be covered in separate materials.

This introduction is intended to address editorial issues that are not specific to any single concept domain, and to set forth the overall purpose of SNOMED CT, as well as its scope, boundaries, and design requirements.

2 SNOMED CT Purpose

SNOMED CT is a terminological resource that can be implemented in software applications to represent clinically relevant information reliably and reproducibly. Through the use of this information, SNOMED CT enabled applications will support effective delivery of high quality healthcare to individual people and populations. It has an international and multilingual scope and can also be localized to represent concepts and terms unique to particular organizations or localities.

2.1 A Terminological Resource

A terminological resource consists of concepts, terms, and interrelationships between them. SNOMED CT includes a reference terminology foundation with extensions that support effective implementations. Content development by expert clinicians is intended to ensure comprehensive coverage of terms that are appropriate and expressive. The resource is distributed in sets of electronic files. Supporting software tools are not necessarily provided directly by IHTSDO.

2.2 Implementation in software applications

Use of the terminology requires that it be implemented in software applications. A criterion for the success of SNOMED CT is widespread implementation. Ease of implementation is therefore a design constraint for the product. Considerations of implementability take account of performance issues and the ability of applications to migrate to SNOMED CT from other coding schemes and terminological resources.

2.3 Representing clinically relevant information

The purpose of the terminology is to represent clinically relevant information. Clinically relevant information means information that is used to support multidisciplinary delivery of effective healthcare to individual people and to populations. The scope of the clinically relevant information that SNOMED CT is able to represent began with the union of the scopes of NHS Clinical Terms Version 3 and



SNOMED RT, and has been updated to reflect clinically contemporary clinical practice and changes in medical technology. However, it is probable that there will be some future variation in this scope, to take account of changes in perceived requirements.

2.4 Reliability and reproducibility

Information represented using SNOMED CT must be reliable and reproducible. The form of representation should enable reliable retrieval, processing and rendering. Reliability is evaluated in terms of the sensitivity and specificity of selective retrieval supported by SNOMED CT. Effective use of clinical information demands consistency and reproducibility. The underlying SNOMED CT representation of the same item of information should not vary according to the nature of the interface, user preferences or the time of entry.

2.5 SNOMED CT enabled applications

On its own, a terminological resource cannot improve the effectiveness of healthcare delivery. The terminology is to be used to enable applications (e.g. clinical information systems) to meet those needs. These software applications are not part of SNOMED CT and are independently developed. However, SNOMED CT may include tools for use by developers to ease development of SNOMED CT enabled software applications.

2.6 Effective delivery of high quality health care

The primary purpose of reliable and reproducible representation of clinical information using SNOMED CT is to support effective delivery of high quality healthcare. SNOMED CT will contribute to direct improvements in the quality of care by enabling improvements in the reliability and reproducibility of clinical information presented to clinicians and accessible by decision support tools. Use of SNOMED CT will also enable more effective review and analysis of health information to support research, audit, health needs assessment and service planning. Use of SNOMED CT will reduce the administrative burden by allowing appropriate information to be reused for statistical and administrative purposes.

2.7 Individuals and populations

Health care is delivered to both individual people and populations. Clinical information and the terminologies used to express this information may be designed to support either individuals or populations. SNOMED CT is intended to support both aspects. Thus it is to be usable for recording and selectively retrieving information in a patient's record and for selective retrieval, aggregation and analysis of the records of a population of patients.

2.8 International terminological resource

The goal is that SNOMED CT should become the accepted international terminological resource for health care. It must therefore be capable of supporting multilingual terminological renderings of common concepts. For the terminology to be acceptable to the widest possible range of users it must include translations as well as alternative spellings and other variations that arise from a national or



regional dialect. Furthermore, it must be capable of representing differences between underlying concepts that arise from cultural, ethnic or linguistic variations.

2.9 Localization

There are some concepts and terms that are particular to an organization or locality. SNOMED CT is centrally authored and maintained but also provides a mechanism for the representation of organizational and local concepts and terminologies. This mechanism ensures consistency in approach while allowing sufficient flexibility to meet most legitimate terminological requirements.

3 Scope and boundaries

The scope of SNOMED CT has been driven by its historical legacy and by the perceived requirements of current user communities. Scope can be defined separately for three dimensions: 1) domain coverage or breadth, 2) granularity or depth, and 3) knowledge representation.

3.1 Scope of domain coverage

3.1.1 Initial scope encompassing CTV3 and SNOMED RT

While the design aims for a widespread applicability and localization, the initial release of SNOMED CT was designed to meet the clinical terminological requirements for use in the US and UK (the home countries of the two contributing partners). A minimum requirement for success in the UK NHS was that SNOMED CT deliver a net-benefit over earlier versions of NHS Clinical Terms and Read Codes. Similarly within the US there was to be a net-benefit from adopting SNOMED CT and from migrating to it from earlier SNOMED editions.

3.1.2 Current content scope

The terminology domains covered by SNOMED include:

- Clinical findings, including disorders
- Procedures, broadly defined as including all health related activities such as history taking, physical examination, testing, imaging, surgical procedures, disease-specific training and education, counseling, and so forth.
- Observable entities which, when given a value, provide a specific finding or assertion about health related information. Examples include the names of lab tests, physical exam tests, dates of significant events, and so forth.
- Anatomy, morphology, and other body structures
- Chemicals and other substances of relevance to health and health care, including generic drug ingredient names, generic drug products (virtual medicinal products)
- Generic physical devices relevant to health care, or to broad categories of injury or accident
- Organisms relevant to health and health care of humans and animals
- Other etiologies of disease, including external forces, harmful events, accidents, genetic abnormalities,



- Functions and activities
- Social contexts relevant to health, including general categories of status of employment, education, housing, care provision, family relationships, and so forth.
- Types of clinical records, documents, certificates and other records and record components relevant to health care.
- Staging, scales, classifications, and other miscellaneous health information
- Attributes and values necessary to organize and structure the terminology

3.2 Scope of granularity

Terms and concepts in the terminology can be characterized by the point on a scale from very general to very specific. The degree to which the terminology includes highly specific terms is often referred to as “granularity.” More properly, terms can be said to be at a level that is coarsely granular, or at a level that is finely granular.

At upper levels, SNOMED CT accepts coarsely granular concepts that are useful only for aggregation and are not useful for individual patient data recording. Examples include “clinical finding”, “procedure”, “measurement procedure”, etc. Progressive levels of refinement are allowed to the extent required to meet clinical data requirements. There are, however, limits to the degree of pre-coordination of certain types of complex statements. There is a general rule that the concepts in SNOMED CT should be names, not complete sentences or paragraphs. The terminology originated as a nomenclature, and it is intended to be used in concert with an information model that can carry full clinical statements along with their attribution, dates, times, and statement inter-relationships. There is an evolving understanding of the boundary between items named in the terminology and more complex statements that should be represented as combined terminology-information elements. More detailed advice and guidance can be found in the document “Content Inclusion: Principles and Process”.

3.3 Scope of knowledge representation

SNOMED concept definitions represent terminological knowledge. In other words, they represent what is always necessarily true about the concepts. The concept definitions are not intended to provide definitions that cover the entire range of medical knowledge, and are not intended to include probabilistic or uncertain knowledge. Such knowledge is beyond the scope of SNOMED CT’s concept definitions.

For example, consider “myocardial infarction (MI).” Terminological knowledge about this concept includes the fact that it must involve the myocardium, and it must involve an infarction. Additional knowledge that is not terminological, and therefore not included in the SNOMED concept definition, might include the fact that an MI is usually associated with crushing substernal chest pain, diaphoresis, arrhythmia, ST-segment elevation on EKG, and elevated levels of cardiac enzymes. Not every case of MI will have chest pain, nor will every case show ST segment elevation, etc. While these are valuable clues to the diagnostician, they are not necessarily always present, and therefore they are not part of the terminological knowledge base. As another example, consider “appendicitis.” Terminological knowledge about this concept includes the fact that it is a kind of inflammatory



disorder, and that it involves the appendix. Additional knowledge that is not terminological might include that fact that it often involves central abdominal pain that migrates to the right lower quadrant, and that it is associated with anorexia, nausea, elevated white blood count, and rebound tenderness over McBurney's point. These additional pieces of knowledge are variably present and therefore represent uncertain or probabilistic knowledge. Such variable or probabilistic knowledge is highly valuable for decision support algorithms, but is beyond the scope of SNOMED CT's concept definitions.

4 Requirements

This section summarizes the key requirements that drive the design, development and maintenance of SNOMED CT. There are several identifiable groups of requirements for meeting the stated goals.

- Requirements related to electronic patient records
 - Support for effective delivery of high quality healthcare to individuals
 - Support for effective delivery of high quality healthcare to populations
- General requirements for a terminology
- Implementation and migration requirements
- Requirements related to the intended user communities
 - International, multilingual applicability
 - Support for particular local requirements.
- National and strategic priorities
- Summary of requirements
 - This final section brings together the requirements identified in each of the previous sections as a summarized statement of all the requirements for SNOMED CT.

These groups of requirements are closely interrelated. The design objective is to enable all the potential user communities to realize all the potential benefits. However, it is possible to envisage a situation in which the benefits delivered to different user communities vary. Indeed such a situation is almost certain to arise as a temporary consequence of any pragmatic development and maintenance timetable. To meet the overall objectives, the design must take account of the entire range of needs, and the approach taken to meeting requirements must be scalable, to enable extension to new user communities.

4.1 Requirements related to electronic patient records

4.1.1 Introduction

The anticipated benefits of SNOMED CT are derived from use of information to support effective delivery of high quality healthcare to individuals and populations.



4.1.2 Delivery of health care to individuals

4.1.2.1 As an aide-memoire for the clinician

Clinically relevant information in a patient record acts as an aide-memoire for the clinician, enabling him or her to recall previous interactions with the patient. Free-text notes can serve this purpose so it presents no special requirements for SNOMED CT.

4.1.2.2 Structuring data entry

Structured data entry enhances the value of an electronic patient record in various ways. It may:

- Simplify recording of frequently collected data;
- Ensure that information is collected in a reliable and reproducible form;
- Help clinicians to think logically about a patient's condition.

Clinical applications may combine several data entry methods applicable to different circumstances. Some of the most commonly used methods outlined below with notes on SNOMED CT requirements that arise directly from them:

- Searching a coded terminology for matching terms using words or phrases.
 - See – [Text searches](#).
- Navigating a hierarchical structure to refine or generalise a concept.
 - See – [Navigating relationships](#).
- Using templates or protocols to record structured information based on answers to questions or values entered on a particular data entry form.
- See – [Subsets for specified contexts](#).
- Parsing of natural language to identify and retrospectively code and structure the data.
- This may include typing, speech recognition and document scanning.
- See – [Parsing or encoding free text](#).

Data entry may require selection from a list of choices. Such lists must be manageable in size and appropriate to the needs of the user.

- A multilingual, multidisciplinary terminology requires mechanisms that limit and/or prioritise access to terms and concepts in ways that are appropriate to:
 - Languages and dialects.
 - Countries, organisations, disciplines, specialties and users.
 - Contexts within a record or protocol.
 - See – [Subsets](#).
- When a concept is to be displayed in a list that has not been derived from a text search, the term displayed must be intelligible and appropriate to the user.
 - See – [Preferred Terms](#)



When a concept is entered in a record it may require structured entry of additional qualifying information.

- Qualifying information may be coded.
 - For example, the concept "Removal of kidney" may require a statement of laterality.
 - See – [Qualifying characteristics](#)
- Qualifying information may be numeric.
 - For example, the concept "Hemoglobin measurement" may enable entry of a numeric value expressed in a substance concentration.

To meet all the needs for coded structured data entry in a patient record, a terminology must cover an adequate scope.

- The main body of SNOMED CT should cover the required scope.
 - See – [Content scope](#).
- It is difficult to achieve this desirable outcome because individual organisations, specialties and users may need to use specific terms or concepts to meet their own operational requirements. Therefore, the structure of SNOMED CT should be designed to safely accommodate additions to meet different needs.
 - See – [Extensions](#).

A clinical terminology requires frequent changes including new concepts, new terms, and new or revised relationships between concepts. The requirements for these changes include:

- New threats to health.
- Changes in understanding of health and disease process.
- Introduction of new drugs, investigations, therapies and procedures.
- See – [Content updates](#)

4.1.2.3 Presentation

Presenting the content of a patient record in ways that highlight key information and indicate links between associated items may help a clinician to understand the patient's condition.

Presentation of information may be determined entirely by record structure without regard to the terminological resource (e.g. to present clinical information in date order, by author or by the type of recorded event).

- It may be useful to select information for presentation based on its semantic content (e.g. listing procedures, investigation results or observations relevant to a particular disease process).
 - See – [Retrieval for presentation](#).

4.1.2.4 Supporting decisions

Interfaces between recorded clinical information and appropriate decision support tools and reference works may assist the clinician to make the correct decisions of diagnosis, investigation and treatment.

- Decision support requires selective retrieval and processing of information in an individual patient record to determine whether the patient has particular characteristics relevant to the decision support protocol. The algorithms for establishing the presence of characteristics need to take account of relationships between concepts and other aspects of record structure. Performance is also important as decision support algorithms are typically run in real-time during data recording.
 - See – [Retrieval for decision support](#)



- Decision support algorithms may depend on numeric or other values associated with particular observations and the units in which such values are expressed.
 - See – [Kind-of-Value](#)
- Decision support algorithms need to take account of the context in which information is recorded. For example, the date of recording and any stated relationships between individual items of information.
 - See – [Data structures and patient record architectures](#)
- Information of interest to decision support algorithms may include factors such as age, sex, clinical conditions, findings, operative procedures, medication and social/environmental factors such as occupation.
 - See – [Content scope](#)
- Authoritative reference works and/or available decision support tools may represent clinical concepts using codes or identifiers from other terminologies, classification or proprietary schemes. Mapping tables are required to allow applications that use a terminology to interface with these resources.
 - See – [Mapping to reference works](#)

4.1.2.5 Communication

Effective delivery of high quality healthcare to an individual requires communication between those involved in providing care to that patient. This requirement includes communication within a team or organisation and communication across organisational boundaries.

The primary objective of many clinical communications is to convey information to a human recipient. Professional and legal advice in several countries indicates that communications with this purpose should include human-readable text. It is considered to be unwise to rely on reconstituting text from coded representations. Coded data is therefore not relevant to the requirement for human-to-human communication.

- Clinical communications may convey information for processing by a receiving application. This information may need to be retrieved and processed to meet requirements identified elsewhere in this document. To meet this requirement specification of messages (or other means of electronic communication) must permit the communication of SNOMED CT identifiers and associated structures.
 - See – [Data structures for communication](#)

Communication specifications, such as those produced by HL7 and CEN TC251, define structures designed to meet particular requirements. These used coded information in two distinct situations:

- Coded elements that must be filled with codes enumerated in the specification.
 - These codes enumerated in the specifications are generally concerned with mission critical features of the message.
 - Some of the enumerated codes may overlap with concepts in a clinical terminology.
 - See – [Mapping to communication specification](#)
- Coded element designed to be populated with clinical codes from any appropriate identifiable coding scheme.
 - The open coded elements are those where the full expressiveness of a terminology may be required.
 - Some of the open coded elements may be restricted to codes that express particular types of concept.



For example, HL7 requires that coding schemes used in its message meet certain criteria, one of which is the ability to express limited subsets of codes appropriate to particular elements.

- See – [Subsets for specified contexts](#).

There are two situations in which communication of coded information may be of value for human-to-human communication.

- Where the storage capacity or communication bandwidth is restricted. In this case, receiving systems must contain (or have real-time access to) a table listing the text descriptions associated with each code.
 - See – [Availability for limited applications](#)
- Where there is a need for translation between the languages of the sender and the recipient. In this case, a coded representation of a concept may allow display of the appropriate Description in the recipient's language.
 - See – [Availability of terms in different languages](#)

Recording a particular concept may trigger a communication and receipt of a particular concept may trigger specific processing in the receiving system. For example recording a decision to prescribe a medicine might trigger an electronic prescription sent to the pharmacy. Receipt of such a prescription might trigger dispensing and stock management activities.

- The relationship of a trigger is an additional characteristic of a concept that may be context dependent.
 - See – [Additional characteristics](#)

4.1.2.6 Patient involvement

There is an increasing trend towards the involvement of patients in their own care. Patients may have a wish or indeed a right to view, and comprehend, their own records.

- If SNOMED CT is to meet this requirement the inclusion of patient-friendly colloquial terms should be considered. However, this possible requirement should not take precedence over the need for an accurate professional terminology.
 - See – [Content scope](#)
- Patients may also be allowed to contribute to their own records. For example, diabetic patients may record their blood glucose or insulin regime. In this case the patient may need to be a user of SNOMED CT.
 - See – [Availability to patients](#).

4.1.3 The role of information in delivery of health care to populations

4.1.3.1 Identifying and monitoring the health needs of a population

The provision of effective high-quality care to a population of patients requires an understanding of the state of health and healthcare needs of that population. Information recorded about individual patients must be available for analysis to determine trends in the prevalence of conditions.

- It must be possible to retrieve and analyse information about specified conditions, procedures or other information recorded using SNOMED CT.
 - See – [Retrieval for analysis](#).



Population trends are usually monitored at a higher level of abstraction, using concepts that are more general than those used in individual patient records. Therefore SNOMED CT should allow analysis of information aggregated in clinical rational ways. This may be achieved by one or both of the following methods:

- Using hierarchical relationships and/or equivalences defined within SNOMED CT.
 - See – [Aggregation of related concepts](#)
- By mapping concepts in SNOMED CT to appropriate classifications.
 - See – [Mapping to classifications](#)

Appropriate analysis of information requires that all relevant information is represented in a form that can be reliably and reproducibly queried.

- The scope of SNOMED CT must be appropriate for the types of information relevant to health needs assessment.
 - See – [Content scope](#).
- Some aspects of health needs assessment require information about more than one clinical characteristic. These depend upon queries that interrogate records taking account of the record structure as well as the terminology used to populate it.
 - See – [Data structures and patient record architectures](#).

4.1.3.2 Auditing the quality of service

The requirements for analysis of records to audit the quality of service are similar to those for identifying and monitoring health needs. The main difference is that the scope of the analysis must be extended to cover consultations, referrals, procedures, medication and other interventions.

- See – [Content scope](#)

4.1.3.3 Supporting research

The requirements for analysis of records research are similar to those for identifying and monitoring health needs. The main differences are the need to accommodate:

- Recording interventions in ways that do not compromise blind and double blind trials.
- Recording of experimental observations or treatments that have not been added to the main body of SNOMED CT and which may never require permanent addition to SNOMED CT.
 - See – [Extensions](#)

4.1.3.4 Reducing bureaucracy while managing and funding care delivery

The management and funding of healthcare delivery often depends on recording and reporting of particular activities or packages of care. Separate procedures for collection of this management related clinical information create a bureaucratic overhead. Mechanisms for deriving the information automatically from the clinical record should offer a way of reducing or removing this overhead. This is dependent on the form in which this management information is required and the ability to map to this form from clinical information recorded using SNOMED CT.

- Current requirements include information represented as Diagnosis Related Groups (DRGs) or Health Resource Groups (HRGs) that are based on classifications of the primary diagnosis, complications and procedures undertaken.
 - See – [Mapping to groupers](#) and [Data structures and patient record architectures](#)



Some information required for management and funding purposes is more specifically related to claims for particular events or services. For example in the NHS, part of the funding of GPs is dependent on hitting targets for immunisations and cervical cytology screening. The types of additional information required for administrative and management purposes are likely to be specific to particular countries or organisations.

- The scope of SNOMED CT must be adequate to meet these administrative needs or must be capable of extension to meet these needs.
 - See – [Content scope](#).
- The aspects of SNOMED CT specific to the administrative needs of one country or organisation must be available to those who need them without presenting irrelevant terms or concepts to those outside the realm in which these are used.
 - See – [Subsets of concepts](#).

4.1.3.5 Enabling reporting of externally specified health statistics

Organisations such as WHO and some government bodies specify requirements for presentation of healthcare statistics in particular forms. Ideally clinical information recorded using SNOMED CT should be reused to generate these statistics. Where this is not possible, the clinical information should at least assist manual generation of these statistics. One option is to use structured data entry to force information to be refined or qualified to a level that allows direct mapping.

The reuse of clinical information for this purpose is similar to identifying and monitoring health needs and/or auditing the quality of service (see [\[4.1.3.1\]](#) and [\[4.1.3.2\]](#)).

- SNOMED CT must enable mapping to statutory national and international classifications such as ICD9.CM, ICD10, CPT4, OPCS4, etc.
 - See – [Mapping to classifications](#)

4.1.3.6 Identifying patients in need of proactive intervention

Within a population there will be patients who will benefit from particular types of preventative care. Information systems should be able to identify these patients based on their health records so that they can be offered appropriate advice. The analysis required varies but typically takes account of age, sex, time lapse since a previous preventative intervention and one or more clinical characteristics.

Identification of patients in need of intervention can be regarded as a type of decision support.

However, it is a batch process to which different optimizations may apply.

See – [Retrieval for patient review](#) and [Data structures and patient record architecture](#)

4.2 General requirements for a terminology

4.2.1 Introduction

The headings in this section are the requirements identified in the paper "Desiderata for Controlled Medical Vocabularies in the Twenty-First Century" by J.J. Cimino as published in *Methods of Information in Medicine* 1998:37:394-403.



4.2.2 Desired features

4.2.2.1 Content, content and content

SNOMED CT content must be adequate both in scope and quality.

- The scope must extend to cover a wide variety of domains, different organisational needs, different clinical disciplines and different specialties.
 - See – [Content scope](#).
- Meeting the needs of an extending scope while retaining quality requires a structured systematic approach.
 - See – [Terminology structure](#).

4.2.2.2 Concept orientation

Concepts must have one meaning ("nonvagueness") and no more than one meaning ("nonambiguity").

- See – [Terminology structure – concepts](#).

A concept may be represented by more than one term. The terms related to concepts vary between languages and dialects. In any language or dialect there may be several synonymous terms with a similar meaning.

- See – [Terminology structure – terms](#).

4.2.2.3 Concept permanence

Once assigned a meaning a concept must not change its meaning. Refinements due to changes in the state of knowledge may lead to concepts being retired from SNOMED CT. A retired concept may be replaced by new more precisely defined concept.

- See – [Persistence](#).

4.2.2.4 Nonsemantic concept identifier

The identifier for a concept should not contain semantic information about the meaning or relationships of that concept.

- See – [Terminology structure - identifiers](#).

4.2.2.5 Polyhierarchy

SNOMED CT should support multiple concept hierarchies. A concept may have more than one hierarchical parent and there may be many paths from a concept to the root concept.

- See – [Terminology structure - hierarchies](#).

4.2.2.6 Formal definitions

Where possible, concepts should be formally defined by relationships to other concepts.

- See – [Defining characteristics](#).

4.2.2.7 Reject "not elsewhere classified"

Many classifications contain concepts including the phrase "not elsewhere classified". These are used to catch any variants of a more general concept that are not specifically represented as individual concepts. The meaning of these changes over time, as additional specific concepts are added narrowing the range appropriate to the "not elsewhere classified" concept. Therefore, such concepts



should not be used. A possible balancing consideration is the need to map to classifications, which do include these categories.

- See – [Content – not elsewhere classified](#)

4.2.2.8 Multiple granularities

Different users will need to express more or less finely granular concepts.

- SNOMED CT must accommodate a wide variety of levels of detail in concepts to meet the widest possible range of needs.
 - See – [Content – levels of granularity](#).
- SNOMED CT structure must permit the relationships between concepts of different levels of granularity to be recognised.
 - See – [Terminology structure - hierarchies](#).
- SNOMED CT should allow selection of concepts by navigation to more or less finely grained concepts.
 - See – [Navigating relationships](#).
- It may be necessary to restrict the levels of granularity that are usable in different applications or in different contexts within the same application.
 - See – [Subsets for specified contexts](#).

4.2.2.9 Multiple consistent views

When a concept has multiple hierarchical parents, the view of that concept should not depend on whether it was reached by following the hierarchy from a particular parent.

- See – [Terminology structure - hierarchies](#).

4.2.2.10 Beyond medical concepts - representing context

The meaning of a concept in a patient record may be altered by the surrounding context. Work is progressing on standard patient record architectures and modelled healthcare communication standards. The role of SNOMED CT in the context of these structures should be evaluated and appropriate recommendations should be made.

- See – [Data structures and patient record architecture](#) and [Data structures for communication](#).

4.2.2.11 Evolve gracefully

Terminologies need to change over time.

- See – [Terminology maintenance and distribution](#).

4.2.2.12 Recognize redundancy

It is a fact that the same information can be stated two or more different ways. A controlled terminology that has an adequate scope cannot exclude this possibility. Instead it should facilitate recognition of equivalent statements.

- See – a [Concept coordination and equivalence](#)



4.3 Implementation and migration requirements

4.3.1 Implementation in software applications

A terminological resource is only one part of a software application. Implementation of SNOMED CT should assist applications to meet user needs rather than adding a burden to development.

The functions required to implement a terminology can be divided into:

- Functions that can be performed without reference to data stored in a particular application record structure.
 - See – [Implementation of terminology services](#).
- Functions that involve storing, retrieving or processing application data.
 - See – [Implementation advice](#).

Different applications may make use of different aspects of SNOMED CT. Some may only require SNOMED CT for a very limited range of uses.

- These applications may not require all the functions required for full implementation.
 - See – [Implementation in limited applications](#).
- A comprehensive terminology may offer minimal value to these limited applications. However, there may be a general benefit in consistency with other more terminology rich applications.
 - See – [Availability for limited applications](#).
- Some applications and users will not require all the terms and concepts used in SNOMED CT.
 - See – [Subsets](#).

4.3.2 Retention of value from legacy records and protocols

A substantial body of clinical information exists in existing electronic systems. Much of this information is represented using existing coding schemes, terminologies and classifications. This information may be of value to individual patient records or to population aggregations. Similarly, there are many queries and decision support protocols that contain knowledge representation based on existing terminologies.

A new terminology should make provisions for continuing use of information and knowledge stored in records, queries and protocols represented using other terminologies. There are too general approaches to this:

- Conversion of coded elements of legacy data into a form consistent with SNOMED CT.
 - See – [Legacy record conversion](#) and [Legacy protocol conversion](#).
- Enabling the co-existence of legacy data with current data. In this case, the legacy codes or identifiers must be recognisably different from the data encoded using SNOMED CT. In addition, the relationship between concepts in SNOMED CT and those in the legacy coding scheme must be recognised when retrieving data.
 - See – [Legacy code recognition](#) and [Legacy equivalence](#)

4.3.3 Reliable and reproducible representation of information

Applications should be able to store clinically relevant information using terminology elements such as concept identifier. Information represented in this way must be reliable and reproducible. The principal issues can be summarized as follows:



- The meaning of a concept should not change over time.
 - See – [Persistence](#) and [History](#).
- Information should be reproducible independent of the particular application or user interface through which it was entered.
 - See – [Implementation advice](#).
- Whenever this information is queried to search for particular concepts the results should be reliable. Reliability implies the following:
 - Completeness of recall, including specific, more detailed concepts subsumed by general concepts in a query.
 - Specificity and precision excluding concepts that are not subsumed by the concepts in the query.
 - Taking account of the effects of:
 - Pre-coordinated defining relationships between [Concepts](#) in the records or in a query when determining the completeness and specificity of the results.
 - Post-coordinated qualification applied to a concept in the records or in the query when determining the completeness and specificity of the results.
 - Relationships between [Concepts](#) and other contextual information implied by the record structure.
 - See – a [Concept coordination and equivalence](#)

4.4 Requirements related to intended user communities

4.4.1 Language variations

The terms required by users of a clinical terminology vary in different countries and regions according to the local language(s) and dialect(s).

- When using a terminological resource, users must see terms in a language and dialect with which they are familiar.
 - See – [Availability of terms in different languages](#)
- The display of terms must not be confused by inclusion of terms in other languages or dialects. The Terms used in different languages and dialects are not mutually exclusive sets. A term may be common to several languages or several dialects of a language.
 - See – [Subsets of terms](#)
- When a concept is presented without a specific reference to a term, an appropriate preferred term should be displayed. A term may be valid in two or more dialects but may be a preferred term in one dialect and a synonym in another.
 - See – [Preferred term](#)

Some terms differ between dialects only in respect of spelling conventions (e.g. "colour" "color"). The same spelling variants may recur in many different terms.

- It may be appropriate to recognise these cases and handle them differently from other term variants.

Users of a clinical terminology need access the names that concept expressed the meaning of each concept in their usual language. These names must be clear and unambiguous independent of any hierarchical context or formal definition.

- See – [Fully specified names](#)



An individual instantiation of an application may only require access to a single language or dialect. In such cases, it would be inappropriate to install and maintain all language and dialect variants.

- See – [Subset distribution and installation](#).

An application may need to support several languages with the ability to switch between languages and dialects in real-time to meet the needs of a particular user.

- See – [Subset configuration](#).

4.4.2 Specialty variations in term preferences

Some specialties or disciplines prefer to use different terms to describe the same concept. This applies where a specialty uses a more precise (or up to date) term for a condition or procedure within its domain, while generalists continue to prefer a more colloquial term.

- See – [Subsets of terms](#)

4.4.3 Variation in the use of terms and concepts

The frequency with which particular concepts and terms are used varies due to various factors:

- Geographical and seasonal differences in the prevalence of particular disorders.
 - Malaria is common in some places and rare in others.
 - Hay fever is common in late spring and the summer but rare at other times.
- Cultural differences in the perception of health, illness and treatment.
 - Alternative therapies may be used by some practitioners and not by others.
- Variation in the scope covered by particular disciplines or specialties.
 - Obstetricians use "fundus" to mean "fundus of the uterus", gastroenterologists use the same term to mean "fundus of the stomach".
 - Surgeons record operative procedures relevant to their specialties.
- Professional variations in clinical criteria
 - The definition of hypertension may vary between the professional guidelines of different bodies and may change over time.
- Organisational requirements for recording and reporting particular conditions.
- Differences in national or organisational administrative or funding procedures.
- Particular topics of special interest to individual clinicians.

These variations may affect:

- The range of terms or concepts that a user is permitted to record.
 - See – [Subsets of terms](#) and [Subsets of concepts](#)
- The frequency with which a particular term or concept is used.
 - See – [Subsets of concepts](#)

In some cases, particular terms or concepts needed may be specific to a particular organisation. In this case it may not be appropriate to provide these as part of a global terminology.

- To meet these specific needs, organisations or users must be able to add terms or concepts to SNOMED CT, without devaluing the main body of SNOMED CT.
 - See - [Extensions](#)



The effects of several of the factors listed above may need to be superimposed on one another to meet the needs of a particular user. For example, to combine the requirements of a country, a particular organization and a specialty, several subsets and extensions may need to be combined.

- Consistent rules are needed for combinations of subsets and extensions.
 - See – [Subset combinations](#).

The requirements of a particular user may change according to the role they are performing and a single instance of an application may need to support the differing requirements of several users.

- See – [Subset distribution and installation](#).
- See – [Subset configuration](#).

4.5 Requirements summary

4.5.1 Introduction

This section summarises all the requirements identified elsewhere in this document. Some of these requirements are also the subject of more detailed documents.

4.5.2 Terminology structure

4.5.2.1 Terminology structure – concepts

The central component of SNOMED CT must be the concept. This must have a single clear and unambiguous meaning.

4.5.2.2 Terminology structure – identifiers

Concepts and other components of SNOMED CT must have unique identifiers. The structure of these identifiers must not imply the meaning or relationships of a concept.

4.5.2.3 Terminology structure – terms

SNOMED CT must represent the association between terms (text strings) and the concepts that they may describe. These associations may be language or dialect dependent.

- See – [Subsets of terms](#)

4.5.2.4 Terminology structure – preferred terms

SNOMED CT must represent the special association between each concept and a term, which should be used to display it – unless a particular term is stored or chosen by the user. This preferred term association is language or dialect dependent.

- See – [Subsets of terms](#)

4.5.2.5 Terminology structure – fully specified names

SNOMED CT should provide each concept with a structured fully specified name that unambiguously describes it. This fully specified name should be specified in a reference language (the language of first use). Translations of the fully specified name may also be required.

- See – [Subsets of terms](#)



4.5.2.6 Terminology structure - hierarchies

SNOMED CT must represent hierarchical relationships between concepts. The form of representation must allow a concept to have multiple hierarchical parents and must guarantee that any alternative hierarchical views of a concept are consistent.

4.5.2.7 Terminology structure – relationships

SNOMED CT must represent various non-hierarchical relationships between concepts.

- See [Relationships](#)

4.5.3 Content

4.5.3.1 Content scope

The scope covered by SNOMED CT must be adequate to meet the requirements of various countries, organisation, disciplines and specialties. The extent to which the content requirements of different realms are covered is likely to develop over time. However, the initial release should cover:

- The scope of the existing clinical terminologies that it is intended to replace:
 - All versions of the Read Codes and NHS Clinical Terms.
 - All versions of SNOMED including SNOMED RT.
- Other scope requirements to be identified by the Editorial Board.

4.5.3.2 Content updates

The content of SNOMED CT must be regularly updated.

4.5.3.3 Content – levels of granularity

SNOMED CT must allow concepts to be expressed at different levels of granularity.

4.5.3.4 Content – not elsewhere classified

The Editorial Board should consider whether concepts from existing terminologies with the "not elsewhere classified" label should be retained or removed.

4.5.3.5 Extensions

To allow scope requirements not met by the main body of SNOMED CT, the terminology structure must be designed to accommodate extensions to the main body of work. Extensions should be distinguishable from components issued as part of the main body of SNOMED CT and should be traceable to a responsible organisation. It must be possible to distinguish and trace the source of a concept identifier used in a patient record.

4.5.4 Terminology maintenance and distribution

4.5.4.1 Distribution

SNOMED CT must be distributed in a format that is readily usable by application developers. This format must be fully specified and must not change from release to release.



SNOMED CT may also be distributed in a form that can be used directly with associated software, such as a browser.

4.5.4.2 Persistence

The meaning of a concept is persistent. It must not be changed or deleted by updates. However, a concept may be marked as retired where its meaning is found to be ambiguous, redundant or otherwise incorrect.

Changes to the association between a term and a concept must not result in a change or deletion of that description. Instead the description must be marked as retired and a new corrected description must be created.

4.5.4.3 History

After initial release of SNOMED CT all changes to components must be recorded in a history file. This file must include details of all changes and must be distributed with each release.

If a component is retired and replaced by another similar or equivalent component, appropriate cross-reference information should be provided. This information should be in a form that allows necessary updates and/or recognition of equivalent concepts during retrieval.

4.5.5 Subsets

4.5.5.1 Subsets of terms

SNOMED CT should include a mechanism for representing subsets of terms appropriate to use in a particular language, dialect or specialty. The form of representation should allow:

- Specification of the terms used as synonyms, preferred terms and translated fully specified names in each language or dialect.
- Rational combination of languages and modification of language subsets to meet the need of particular organisations or specialties.

4.5.5.2 Subsets of concepts

SNOMED CT should include mechanisms for representing subsets of concepts that are used in a particular country, organization, discipline or specialties. The form of representation should allow:

- An indication of the priority, or frequency of use, of a concept in a given realm.
- Rational combinations of the subsets for different realms to meet the needs of particular users or groups of users.

4.5.5.3 Subsets for specified contexts

SNOMED CT should include mechanisms for representing subsets of concepts and terms that are applicable to particular contexts in a record, decision support protocol or data entry field.

4.5.5.4 Subset combinations

The mechanisms for representing subsets must include consistent rules for combining subsets in ways that meet the requirements of users.



4.5.5.5 Subset distribution and installation

Subsets must be distributed in a format that is readily usable by system developers. This format must be fully specified and must not vary from release to release. The distribution format should allow:

- Individual subsets to be installed separately.
- Related or interdependent subsets to be selected and installed as a group.
- Subsets to be updated with each new release without needing to repeat the selection of subsets previously installed.

4.5.5.6 Subset configuration

It should be possible to configure an application to use a particular subset or combination of subsets and to switch to alternative configurations without repeating the installation process for each change.

4.5.6 Relationships

4.5.6.1 Navigating relationships

SNOMED CT must include relationships that allow hierarchical navigation from a chosen concept to a concept that represents either a subtype or part of the chosen concept. SNOMED CT must also support navigation from a specific concept to more general concepts that represent a supertypes of that concept.

4.5.6.2 Aggregation of related concepts

SNOMED CT must include relationships that allow aggregation of related concepts to enable comprehensive and accurate retrieval from patient records. These relationships together with appropriate history and cross-reference tables should enable the aggregation to include retired concepts with similar or equivalent meanings.

4.5.6.3 Defining characteristics

SNOMED CT should include formal definitions of concepts represented by relationships with defining characteristics.

- For example, the anatomical site of the concept "Appendicitis" is the "Vermiform appendix".

4.5.6.4 Qualifying characteristics

SNOMED CT should enable a concept recorded in a record to be qualified by the addition of relevant qualifying characteristics. Each qualifying characteristic should itself be a concept with a specified relationship to qualified concept. SNOMED CT should specify the possible qualifying characteristics for each concept or for a group of related concepts.

- For example, an anatomical site could be added to the concept "Osteoarthritis".

4.5.6.5 Kind-of-Value

SNOMED CT should enable concepts to be qualified by the addition of relevant values. SNOMED CT should specify the types of value that can be added to particular concepts.

- For example, a substance concentration value can be added to the concept "Hemoglobin concentration".



4.5.6.6 Additional characteristics

SNOMED CT should be able to assert other characteristics of a concept that may be time or context dependent.

- For example, medical progress may result in the need to continuously update some concepts based on new information (e.g., newly discovered genes or gene products).

4.5.7 Retrieval

4.5.7.1 Retrieval for analysis

SNOMED CT must enable the consistent and reproducible storage of information, which can subsequently be selectively retrieved for analysis. This requires the ability to select the concepts to be retrieved in ways that allow the inclusion of subtypes and equivalent concepts to be included in the analysis. Equivalent concepts may include:

- Equivalent concepts represented in another (legacy) coding scheme.
- Equivalent redundant concepts that have been retired from the current version of SNOMED CT.
- Combinations of a general concept and qualifying characteristics that are semantically equivalent to the selected concept.

Analysis usually requires retrieval of selected records from a population of patient records. In most cases, this can be performed as a batch task.

4.5.7.2 Retrieval for patient review

SNOMED CT must enable the consistent and reproducible storage of information, which can subsequently be retrieved to allow patients in need of recall for preventive procedures or review. The requirements are generally similar to those for analysis.

4.5.7.3 Retrieval for decision support

SNOMED CT must enable the consistent and reproducible storage of information, which can subsequently be retrieved for decision support. SNOMED CT requirements are broadly similar to those for analysis. However, decision support requires retrieval of selected records from an individual patient record. Effective decision support requires real-time processing so the routines for determining concept equivalence must be extremely fast.

4.5.7.4 Retrieval for presentation

SNOMED CT must enable the consistent and reproducible storage of information, which can subsequently be retrieved for presentation on a screen or in a paper report. The requirements for this are similar to those for decision support. The retrieval must be accomplished in real-time but usually involves filtering by broad categories of concept. Thus it is less exacting than for decision support.



4.5.8 Searches and test parsing

4.5.8.1 Text searches

SNOMED CT should facilitate searches for terms. The nature and extent of specific resources required to assist searches is a subject for discussion. However, it is clear that the naive view that a simple SQL pattern search will suffice is incorrect.

A simple keyword index may be generated from the terms and used for more effective searching. However, this may fail to find the terms that a user requires due to the following factors:

- Use of abbreviations
- Word form variants
- Word order variants
- Word equivalences and combinations
- Locally added mnemonics for frequently used terms.
- Composite concepts that can only be represented by
 - Combinations of a concept with one or more qualifying characteristics
 - Multiple concepts related together by the patient record structure components
- Searches with multiple redundant hits for a single concept
 - When several synonyms of the same concept match the search key.
 - When techniques for word equivalences and combination are applied and return alternative terms related to the same concept for two or more word equivalences.
- Searches with multiple redundant hits for a large number of closely related concepts.
 - When a search key matches terms associated with a generalised concept and many of its hierarchical descendents.

A further complication is the application of searches within subsets, which restrict the range of available terms or concepts. The efficiency of these searches may depend on the ways in which keyword indices and subsets are related to one another.

4.5.8.2 Parsing or encoding free text

There is increasing interest in the feasibility of using natural language parsing to encode free-text derived from typing, scanning or voice recognition. The text of the terms and associated search indices may assist this process.

Specific resources to support free text parsing are not considered to be an immediate requirement for SNOMED CT.

4.5.9 Implementation

4.5.9.1 Implementation of terminology services

Aspects of implementation that relate only to terminology should be specified in ways that allow them to be implemented independent of application data. These may then be implemented either by individual applications or by terminology servers accessible by many applications.



4.5.9.2 Implementation advice

Aspects of implementation that relate to application data cannot be specified to the same level of detail as terminology services. They are dependent on the general functionality of the application and its record structure. However, many of the requirements identified in this document pose implementation issues that may not be immediately apparent to developers. Therefore, there is a requirement for early advice on implementation of SNOMED CT.

4.5.9.3 Implementation in limited applications

Advice on implementation of SNOMED CT should not place onerous requirements on applications with limited requirements for use of clinical terminologies. Therefore, it would be inappropriate to state an "all-or-nothing" set of requirements for all SNOMED CT enabled applications.

4.5.10 Legacy data and migration

4.5.10.1 Legacy code recognition

It should be possible to distinguish a code from an earlier version coding schemes (SNOMED, Read Codes or NHS Clinical Terms) from the identifiers used to represent components of SNOMED CT.

4.5.10.2 Legacy equivalence

It must be possible to relate each concept code in earlier version coding schemes (SNOMED, Read Codes or NHS Clinical Terms) to a concept identifier in SNOMED CT.

4.5.10.3 Legacy protocol conversion

Consideration must be given to supporting the task of converting queries and protocols expressed using earlier versions coding schemes (SNOMED, Read Codes or NHS Clinical Terms) to a SNOMED CT compatible form

4.5.10.4 Legacy record conversion

Subject to medico-legal constraints, It should be possible to convert legacy data represented using earlier versions coding schemes (SNOMED, Read Codes or NHS Clinical Terms) to a SNOMED CT compatible form.

4.5.10.5 Migration of terminology dependent projects

Projects in the UK NHS that currently make use of Read Codes or NHS Clinical Terms must plan migration to enable the future use of SNOMED CT.

4.5.11 Data structures

4.5.11.1 Data structures and patient record architectures

The components of SNOMED CT are intended to represent the clinical concepts in patient records. A patient record consists of series of related statements that may be organized under a variety of headings. The statements may contain clinical concepts derived from SNOMED CT and the headings



may also be concepts from SNOMED CT. Headings and other contextual elements may modify the meaning of related statements.

The relationship between a terminology such as SNOMED CT and record architectures can be summarised as follows:

- SNOMED CT concepts and terms may populate different elements in the record structure.
 - Different SNOMED CT concepts may be applicable to different elements in the record. Some concepts may not be appropriate for inclusion in the record.
- The meaning of a SNOMED CT concept may be modified by its contextual surroundings within the record structure.

Work is progressing on standard patient record architectures and modelled healthcare communication standards. The role of SNOMED CT in the context of these structures should be evaluated. Several possible results may arise from this evaluation:

- Comments suggesting changes in record architecture proposals to accommodate or realise benefits from SNOMED CT.
- Additions or modifications to SNOMED CT to fit more consistently into the record structures.
- Recommendations on the SNOMED CT concepts to be used in specific contexts within the record.

4.5.11.2 Concept coordination and equivalence

Some concepts may be entered in a pre-coordinated or a post-coordinated manner.

- For example, "Cemented replacement of hip joint" might be entered by:
 - Selecting the pre-coordinated concept "Cemented replacement of hip joint"
 - Selecting the concept "Joint replacement" and adding the qualifying characteristics "Site"="Hip joint" and "Cemented"

These concepts could be stored:

- In the forms entered.
 - In this case, a retrieval query must search for the pre-coordinated and all possible post-coordinated ways of expressing an equivalent concept.
- In the pre-coordinated form irrespective of the method of data entry
 - In this case, the application must recognise the equivalent pre-coordinated form on data entry.
- In the post-coordinated (decomposed) form irrespective of the method of data entry
 - In this case, the application breaks the pre-coordinated concept into its constituent defining characteristics at the time of data entry.

All of these methods depend on appropriate defining characteristics, to allow recognition of equivalence. It follows that it is a requirement for the formal definitions of each SNOMED CT concept to be as complete as possible. Missing defining characteristics may result in failing to recognise equivalence or incorrect assumption of equivalence.

4.5.11.3 Data structures for communication

It must be possible to communicate clinical information represented using SNOMED CT components between applications. Message specifications and other communication structures must accommodate SNOMED CT identifiers (including where appropriate combinations of these identifier use to express a post-coordinated concept).



Current message specifications (including EDIFACT, HL7 and XML messages) use plain text files. SNOMED CT identifiers must have an agreed plain text representation that can be used in these messages.

Communication of post-coordinated concepts may be possible using specific qualifier fields in a message or using syntactic representation of a combination of identifiers. In the latter case this representation must be consistent with message syntax and field size limitations.

4.5.12 Mapping

4.5.12.1 Mapping to classifications

SNOMED CT must include mapping tables that assist generation of statistical and administrative information from information recorded using concept identifiers. The extent to which this process can be automated will depend on the nature of the classification, the richness of the mapping table and the functionality of the mapping software.

4.5.12.2 Mapping to groupers

SNOMED CT should include mapping tables that assist generation of groupings for funding, administrative and other purposes. In some cases an alternative may be to map to a classification and then to use the classification codes for generating groupings.

4.5.12.3 Mapping to communication specifications

SNOMED CT may contain concepts that map to particular values in the enumerated list associated with a message or communication specification. Recognition of these mapping may avoid the need for double entry of data when sending or receiving such messages.

4.5.12.4 Mapping to reference works

SNOMED CT may contain concepts that are useful for establishing links with decisions support protocols or other relevant sources of reference. Maps between these concepts and the equivalent representations in the reference sources may facilitate use of these resources.

4.5.13 Availability

4.5.13.1 Availability for limited applications

Applications will vary in the extent to which they use or process terminological components. Special consideration may be necessary for those applications that only require occasional access to SNOMED CT.

4.5.13.2 Availability of terms in different languages

There is a requirement to translate SNOMED CT into languages other than UK and US English. Once multiple translations have been produced there may be a requirement to make the translated terms available to support communication of clinical information across language barriers.



4.5.13.3 Availability to patients

Patients may be users of SNOMED CT if they record information in their own records. Support for this may require limited licensing of SNOMED CT for use by general populations.