1. References
   1. HL7 V3 References

[Clinical Statement Pattern](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=40)  
[Version 3 Datatypes](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=264)

[Reference Information Model](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=77)

[CDA Release 2](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7)

* 1. SNOMED CT Reference materials

The following SNOMED CT reference materials (or their successors) are available at <http://ihtsdo.org/fileadmin/user_upload/doc/>. Most of the previously referenced materials (or equivalent) are now included in the SNOMED CT Technical Implementation Guide ([TIG](http://www.ihtsdo.org/fileadmin/user_upload/doc/en_us/tig.html)):

* **SNOMED CT Reference Set Specification** - includes information about:
  + Representation and use of sets of SNOMED CT components using the Reference Set mechanism (and its predecessor the Subset mechanism).
* **SNOMED CT User Guide** - includes information about:
  + Defining relationships in the SNOMED CT concept model.
* **SNOMED CT Guide to Abstract Models and Representational Forms** - includes information about:
  + SNOMED CT concept definitions;
  + Representation of context in the SNOMED CT concept model;
  + Pre-coordinated and post-coordinated SNOMED CT expressions;
  + Alternative representation of SNOMED CT expressions, including HL7 Concept Descriptor (CD) datatype and the SNOMED CT compositional grammar.
* **SNOMED CT Guide to Transformation and Normal Forms** - includes information about:
  + Transformation between close-to-user representation of SNOMED CT expressions and normal forms that can be used for comparison and computation;
  + Comparison of normal forms to determine equivalence and subsumption;
  + Optimization of the process of normal form comparison.
* Compositional Grammar for SNOMED CT Expressions in HL7 Version 3
  + Makes available, as a DSTU, the SNOMED CT Compositional Grammar.

All efforts have been made to ensure that the SNOMED CT identifiers used in this version of the guide are currently active in the SNOMED CT International Release.

* 1. SNOMED CT Compositional Grammar - extended

This document uses the SNOMED CT Compositional Grammar to refer to SNOMED CT concepts and expressions. Table 11 provides an overview of this grammar which is intended to meet the needs of readers of this document. However, those with a more detailed interest in this topic should read the relevant section in the Technical Implementation Guide (TIG), which explains the underlying abstract model and includes a full Backus-Naur Form (BNF) definition of the grammar.

The abstract model of expressions and definitions is at the heart of SNOMED CT. In contrast, the grammar is just one way of representing instances of concepts, definitions and expressions. As noted in the Formal rules for post-coordinated expressions (§ 1.7.5.2), there are other ways to represent expressions, including the HL7 Concept Descriptor data type. The reason for using the compositional grammar in this document is that it offers a terse representation which is both human-readable and computer-processable.

The grammar used in this document extends the SNOMED CT Compositional Grammar in two respects:

1. To improve the clarity and processability of references to SNOMED CT concepts and expressions within blocks of narrative text:

* Compositional grammar expressions are separated from the text of the document by square brackets (“[]”);

1. To enable a simple representation of constrained value-sets of concepts and expressions based on post-coordinated refinement:

* To support clear documentation of relatively simple constraints, an informal extension has been made to the compositional grammar. This extended grammar is used in this document for pragmatic reasons. It is not proposed as a formal extension to the SNOMED CT Compositional Grammar and has neither been discussed or approved by the IHTSDO (http://www.ihtsdo.org) or the wider SNOMED community.
* This extension includes:
  + Additional symbols specified in Table 12 to represent different types of constraints.
  + Specification of the elements that can be constrained as documented in Table 13.
  + Logical 'AND' and 'OR' operations as described in Table 14.

Table 1: Summary of SNOMED CT Compositional Grammar

|  |  |  |
| --- | --- | --- |
| Symbol | Notes | Examples |
| digits | ConceptId | A sequence of digits in an expression represents a SNOMED CT concept identifier. The only exception to this is where digits occur between a pair of pipe symbols, in which case the digits are part of the display name (see next row of this table).  The simplest expression is a concept identifier on its own. For example:     87628006 |
| **|** text **|** | Display name delimiter | A pair of pipe ("|") symbols are used to delimit an optional display name for the immediately preceding concept identifier. For example:     87628006 | bacterial infectious disease |  The display name may be the term string of any of the descriptions associated with the concept in a current version of SNOMED CT. For example any the following are a sample of valid representations of the same concept:     87628006 | bacterial infectious disease (disorder) |     87628006 | disease caused by bacteria |     87628006 | enfermedad infecciosa bacteriana |     87628006 | infección bacteriana |  Note: In this document all expressions include display names to aid understanding. Although the Fully Specified Name is more precise, use of the Preferred Term makes the document easier to read and full details can be found by looking up the concept identifier. Except where otherwise specified, the display name used in this document is the Preferred Term in US English in the SNOMED CT International Edition. |
| space tab linefeed return | Whitespace characters | Whitespace characters are ignored and can thus be used to format the appearance of an expression where this aids clarity. The only exception to this rule is that spaces are not ignored within a display name.  Note: Spaces before or after the last non whitespace character of a display name are ignored. The text between the pair of pipe characters is trimmed of any surrounding whitespace but spaces within the enclosed text are treated as part of the display name. |
| **:** | Refinement prefix | A colon (":") precedes a refinement of meaning of the concept to the left of the colon. A refinement consists of one or more attributes and/or attributes groups and these are illustrated by examples in subsequent rows of this table. |
| **=** | Attribute value prefix | Each of the attributes that make up a refinement consists of an attribute name and an attribute value. The attribute name precedes the value and is separated from it by an equals sign ("=").  The attribute name is represented by a concept identifier and the attribute value. The attribute value may be represented by a concept identifier as in the following example or by a nested expression (see example later in this table).  The following example specifies a bacterial infectious disease caused by streptococcus pneumoniae.  87628006 | bacterial infectious disease | :      246075003 | causative agent | = 9861002 | streptococcus pneumoniae | |
| **,** | Attribute separator | A refinement may includes more than one attribute. In this case, a comma (",") is used to separate attributes from one another.  The following example specifies a bacterial infectious disease affecting the lung and caused by streptococcus pneumoniae.  87628006 | bacterial infectious disease | :      246075003 | causative agent | = 9861002 | streptococcus pneumoniae | ,      363698007 | finding site | = 39607008 | lung structure | |
| **(** exp **)** | Nested expression | The value of an attribute may be represented by a nested expression rather than a single concept identifier. In this case, the nested expression is enclosed in parentheses.  The following example specifies a bacterial infectious disease affecting the left upper lobe of the lung and caused by streptococcus pneumoniae. The nested expression localizes (upper lobe of the lung) and lateralizes (left) the site of the disease.  87628006 | bacterial infectious disease | :      246075003 | causative agent | = 9861002 | streptococcus pneumoniae | ,      363698007 | finding site | = (45653009 | structure of upper lobe of lung | :           272741003 | laterality | = 7771000 | left | ) |
| **{** group **}** | Attribute group | In some cases different sets of attributes apply to different facets of the same concept. For example, some common fractures involve two adjacent bones and the nature of the fracture of each bone may differ. Similarly, some procedures involve removal of one structure and repair of another and different refinements of these actions may be required.  In SNOMED CT concepts that have multiple facets are defined with each facet represented by a separate relationship group. When these concepts are refined it may be necessary to specify which group is being refined. In these cases, curly braces are used to group together sets of attributes that act together.  The following example represents a fracture of the shaft of the tibia and fibula. The tibia has a spiral fracture while the nature of the fracture of the fibula is incomplete.  271577005 | fracture of shaft of tibia and fibula | :      {116676008 | associated morphology | = 73737008 | fracture, spiral |        ,363698007 | finding site | = 52687003 | bone structure of shaft of tibia | }       {116676008 | associated morphology | = 30543000 | fracture, incomplete |        ,363698007 | finding site | = 113224005 | bone structure of shaft of fibula | } |
| **+** | Combination | A disorder that is both a bacterial disease and disorder of the respiratory systems. For example "bacterial pneumonia".  87628006 | bacterial infectious disease | + 50043002 | disorder of respiratory system |  It does not mean two separate disorders that for some reasons are being linked. For example, this use of the plus sign is not the appropriate way to represent that someone has both a separate respiratory disorder (e.g. allergic asthma) and a separate bacterial disease (e.g. impetigo). |

Table 2: Compositional Grammar extension - Constraint symbols

|  |  |  |
| --- | --- | --- |
| Symbol | Notes | Examples |
|  | This specific concept  (No symbol prefix) | 71388002 | procedure |  The concept "procedure" SHALL be used. Note: By default, unless the surrounding context states otherwise, this implies this precise concept (i.e. not one of its subtypes) shall be used. However, the context within a sentence or parsable expression may imply a less specific requirement. For example, if the concept is followed by any options for addition of refinements these implicitly permit refinement of the concept. |
| **<<** | This concept or any subtype permitted | <<71388002 | procedure |  Either the concept "procedure" or one of its subtypes SHALL be used. Note: this differs from the "<=" symbol used to indicate the same constraint in other HL7 specifications. The reason for the difference is to limit the use of "=" as the operator that joins an attribute name and an attribute value in the un-extended compositional grammar.  Supersedes “<=”. |
| **<=** | **Deprecated symbol**  Has same meaning as **<<** (see above) | In HL7 Version 3 information models the symbol "<=" is used to indicated a concept domain consisting of the specified concept or one of its subtypes. This symbol may be confused with the use of the "=" symbol between the attribute name and value in a post-coordinated expression. Therefore, it SHOULD be replaced by "<<" in the extended SNOMED CT compositional grammar. |
| **<** | Any subtype of this concept (but not the concept itself) | | procedure | :   363704007 | procedure site |     = ( 29836001 | hip region structure | :             272741003 | laterality | = <182353008 | side | )  The procedure site SHALL be the value "hip region structure" and SHALL include the attribute "laterality" The value of "laterality" SHALL be a subtype of "side" but SHALL NOT be "side" itself. |
| **~** | Optional attribute (only applicable as a prefix to AttributeName) | 71388002 | procedure | :   <<363704007 | procedure site |     = ( <<29836001 | hip region structure | :              ~272741003 | laterality | = <182353008 | side | )  The attribute "procedure site" or one of its subtypes (e.g. "procedure site – direct") SHALL be applied and its value SHALL be "hip region structure" or one of its subtypes. The attribute "laterality" MAY BE applied and if present its value SHALL be a subtype of "side" but SHALL NOT be "side" itself. |
| **!** | This concept is prohibited and SHALL NOT be used. | 71388002 | procedure | :   363704007 | procedure site |     = ( 29836001 | hip region structure | :             !272741003 | laterality | )  The procedure site SHALL be the value "hip region structure" and SHALL NOT include the attribute "laterality". Note: This example conflicts with the SNOMED CT compositional grammar as no value is supplied for the laterality attribute. Since the laterality attribute is not permitted, it makes no sense to provide a value. Alternatively a dummy value could be provided but it has been omitted here and in the examples in this document as it would decrease rather than enhance clarity. |
| **!<** | This concept and all its subtypes are prohibited and SHALL NOT be used. | 71388002 | procedure | :   363704007 | procedure site |     = ( 29836001 | hip region structure | :           ~272741003 | laterality | = !<66459002 | unilateral |)  The procedure site SHALL be the value "hip region structure" and MAY include the attribute "laterality" The value of "laterality" SHALL NOT be "unilateral" or a subtype of "unilateral". |

Table 3: Compositional Grammar Extension - Constrainable elements

|  |  |
| --- | --- |
| Element | Notes and examples |
| ConceptId | A constraint symbol MAY directly precede a ConceptId. In this case, it requires, allows, or prohibits use of the referenced concept (and/or subtypes of that concept) in that logical position in the expression.  Unless otherwise stated, the comparison between an instance expression and a constraint assumes both are transformed to normal forms before testing.  For example, the following constraint:    [ 71388002 | procedure | :         260686004 | method | << 129304002 | excision – action ]. Permits expressions such as    [ 38102005 | cholecystectomy ] or [ 80146002 | appendectomy ] because the concepts "cholecystectomy" and "appendectomy" are defined in SNOMED CT release data as subtypes of "procedure" and have [ 260686004 | method | = 129304002 | excision – action ]. |
| Attribute Name | A constraint symbol MAY directly precede the concept id that specifies the name of an attribute. In this case it requires, allows or prohibits use of that attribute (or a subtype of that attribute). Unless the use of the attribute is prohibited, the value of that attribute MAY be separately constrained.  The following example asserts that the attribute "procedure site" or one of its subtypes (e.g. "procedure site – direct") SHALL be applied and its value SHALL be "hip region structure" or one of its subtypes.  [ 71388002 | procedure | :      <<363704007 | procedure site |           = <<29836001 | hip region structure ] |
| Nested *Expression* | A constraint symbol may directly precede an expression enclosed in parentheses. In this case, it requires, allows or prohibits inclusion of the parenthesized expression (and/or subtypes of that expression) in that logical position in the expression.  Note: It is generally clearer to specify the individual constraints on the elements within the nested expression rather than to apply a constraint to the nested expression as a whole. However, this form is also included. |
| Attribute Group | A constraint symbol MAY directly precede an attribute group. In this case, it requires, allows or prohibits inclusion of the specified group (and/or refinements of that group) in that logical position in the expression.  The following example asserts that the group shown or a refinement of that group must be present. [ 71388002 | procedure | :      <<{260686004 | method |= 129304002 | excision - action | ,          ,405813007 | procedure site - Direct | = 113345001 | abdominal structure | } ] |
| Other | The constraints cannot be used elsewhere in the expression. In particular a constraint cannot be applied to a refinement as whole or to a display name. Therefore, the constraint symbols cannot immediately follow the concept identifier, nor can they precede the pipe ("|") or colon (":") symbols. |

**Note:** According to the HL7 TermInfo criteria [Requirements and Criteria (§ 1.9.2)](file:///C:\\Users\\Lisa\\Documents\\05%20Professional\\90%20HL7\\00%20Standard%20-%20TermInfo\\TermInfo%20DSTU%201.5%2020130506\\html\\infrastructure\\terminfo\\terminfo.htm" \l "TermRandC) and the Technical Implementation Guide chapter 4.3, when alternative representations are semantically equivalent either representation may be used. Therefore, the constraints defined in this document specify the range of possible representations, rather than the precise way a meaning is represented. From an operational perspective it may sometimes be desirable to constrain the forms of representation permitted within a given community or realm. In these cases, additional constraints may be stated in an implementation profile.

Table 4: Compositional Grammar Extension - Logical constrain combinations

|  |  |  |
| --- | --- | --- |
| Symbol | Notes | Examples |
| OR | Where two or more values are permitted the set of conditions and the individual expressions SHALL both be enclosed in standard curved brackets () and the word "OR" SHALL be placed between the expressions. | [ 71388002 | procedure |: 363704007 | procedure site | = (29836001 | hip region structure |: ~ 272741003 | laterality | =(7771000 | left |) OR (24028007 | right |)) ]  The procedure site SHALL be the value "hip region structure" and MAY include the attribute "laterality" The value of "laterality" SHALL be either "left" or "right". |
| AND | Where two or more conditions are both required to apply the individual expression SHALL be enclosed in standard curved brackets and the word "AND" shall be placed between the expressions. ((exp1) AND (exp2)) | [ 71388002 | procedure |: 363704007 | procedure site | = ( 29836001 | hip region structure |: ~272741003 | laterality | =((<182353008 | side |) AND (!<66459002 | unilateral |))) ]  The procedure site SHALL be the value "hip region structure" and MAY include the attribute "laterality" The value of "laterality" SHALL be a subtype of "side" AND SHALL NOT be either "unilateral" or a subtype of "unilateral". |

* 1. Guidance on using SNOMED CT Compositional Grammar in CD R2 Datatype

**NOTE:** The material in this section is provided for reference, as it is likely to be incorporated in a future version of CDA. However, it does not apply currently to CDA R2, which is based on the R1 datatypes.

B.4.1 Introduction

The HL7 V3 “Data Types – Abstract Specification, Release 2” defines what can be carried in the Concept Descriptor (CD) data type as “the plain code symbol defined by the code system, or an expression in a syntax defined by the code system which describes the concept.”

In response to the requirement for “syntax defined by the code system” The IHTSDO has published a section on the SNOMED CT compositional grammar in the Technical Implementation Guide (TIG). The serialization syntax (SNOMED Compositional Grammar, SCG) defined is the same as the ‘unextended’ syntax described in this document.

This section describes the recommended way for communicating SNOMED CT expressions using the HL7 V3 Concept Descriptor (CD) datatype.

B.4.2 Rules and guidance on usage

B.4.2.1 Minimal representation

Where communicating parties agree that only ConceptId’s are required for communication, whether single ID’s or compositional code phrases, these SHALL be communicated using CD.code, with expressions structured according to the SCG.

|  |
| --- |
| Example 23. Minimal CD representation of single code (pre-coordinated) Fracture of humerus |
| <value code="66308002" codeSystem="2.16.840.1.113883.6.96"/> |

|  |
| --- |
| Example 24. Minimal CD representation of one pattern of compositional (post-coordinated) Fracture of humerus |
| <value code="127278005:363698007=85050009,116676008=72704001" codeSystem="2.16.840.1.113883.6.96"/> |

It is, however, likely that good recording/communication practice between communicating parties will require the communication of associated human readable elements. Guidance is therefore provided for the following circumstances:

B.4.2.2 Single code SNOMED CT expression associated with a valid SNOMED CT description

Where a term of a valid description for the communicated SNOMED CT ConceptId has been selected to make the originating record entry, or where communicating parties wish to communicate a valid description for a code it may be communicated as:

CD.displayName - subject to the rules of the terminology, e.g. by use of a designated reference set that specifies the term to be selected for each code:

|  |
| --- |
| Example 25. valid description “Fracture of humerus” communicated as displayName |
| <value code="66308002" codeSystem="2.16.840.1.113883.6.96">  <displayName value="fracture of humerus"/>  </value> |

CD.code, using the SCG rules:

|  |
| --- |
| Example 26. Minimal CD representation of single code (pre-coordinated) Fracture of humerus |
| <value code="66308002 | fracture of humerus |" codeSystem="2.16.840.1.113883.6.96"/> |

Both CD.code and CD.displayName:

|  |
| --- |
| Example 27. Valid description “Fracture of humerus” communicated as displayName |
| <value code="66308002 | fracture of humerus |" codeSystem="2.16.840.1.113883.6.96">  <displayName value="fracture of humerus"/>  </value> |

Where both CD.code and CD.displayName are used, the terms must be the same.

CD.originalText may, of course, also be communicated - subject to the rules of the data type specification:

|  |
| --- |
| Example 28. Valid description “Fracture of humerus” communicated as originalText and displayName |
| <value code="66308002" codeSystem="2.16.840.1.113883.6.96">  <displayName value="fracture of humerus"/>  <originalText mediaType="text/plain" value="fracture of the humerus"/>  </value> |

B.4.2.3 Single code or compositional SNOMED CT expression with an associated human-readable string

Where either a pre-crafted human-readable string or a relevant fragment from analysed narrative text is associated with a single code or compositional SNOMED CT expression, this string SHALL be communicated as CD.originalText:

|  |
| --- |
| Example 29. Text string “Open repair of outlet of muscular interventricular septum” communicated with associated code-only compositional code phrase |
| <code code="387713003:363704007=264116001,260507000=129236007,260686004=257903006" codeSystem="2.16.840.1.113883.6.96">  <originalText mediaType="text/plain" value="Open repair of outlet of muscular interventricular septum"/>  </code> |

Where the recording process also presents a valid SNOMED CT description (or descriptions) to assist in the selection/creation of the communicated SNOMED CT expression, or where communicating parties wish to communicate a valid description for a code (or each code in a compositional expression) the associated term (or set of terms) MAY be communicated as follows:

|  |
| --- |
| Example 30. Concept representing “Open repair of outlet of muscular interventricular septum” communicated with SCG structured code and term phrase in CD.code |
| <code code="387713003 | Surgical procedure |:363704007 | Procedure site | =264116001 | Outlet muscular septum |,260507000 | Access | =129236007 | Open approach - access |"  codeSystem="2.16.840.1.113883.6.96">  <originalText mediaType="text/plain" value="Open repair of outlet of muscular interventricular septum"/>  </code> |

If communicating parties agree that CD.code will only convey ConceptIds, then there is no current support, according to the rules of the datatype specification and the SCG rules, for unambiguously communicating descriptions using available CD attributes.

In the future, if alternative standard term-phrase composition rules become part of the SNOMED CT standard (and are regarded as such by relevant communicating parties) then the value of displayName could be generated according to these to be specified rules.

B.4.2.4 Compositional SNOMED CT expression without an associated human-readable string

If neither a pre-crafted human-readable string, nor a relevant fragment from analysed narrative text is associated with a single code or compositional SNOMED CT expression, then:

1. The minimal representation pattern MAY be used (if this is regarded as satisfactory for recording/communication purposes between communicating parties) – see ‘Minimal representation’ above.
2. If recording process also presents a valid SNOMED CT description (or descriptions) to assist in the selection/creation of the communicated SNOMED CT expression, the associated term (or set of terms) must be communicated in CD.code, structured according to the SCG rules, as has been the convention used in examples elsewhere in this implementation guide.

|  |
| --- |
| Example 31. Code phrase corresponding to one representation of “Open repair of outlet of muscular interventricular septum” communicated with SCG structured code and term phrase in CD.code |
| <code code="387713003 | Surgical procedure |:363704007 | Procedure site | =264116001 | Outlet muscular septum |,260507000 | Access | =129236007 | Open approach - access |"  codeSystem="2.16.840.1.113883.6.96"/> |

B.4.3 Supporting discussion and rationale

The approach described is based on the following principles:

* CD.code should only be used to communicate expressions in a syntax defined by the code system | |
* Equality – “The equality of two CD values is determined solely based upon code and codeSystem”. From the perspective of HL7 datatypes, "66308002" is not equivalent to "66308002 | Fracture of humerus |” – however according to SNOMED CT and the rules of the SCG it is.
  + Users wishing to test for true equality of concepts should therefore refer to SCG guidance from the IHTSDO.
* For the simple case of a single SNOMED CT code and corresponding description, use of CD.code and CD.displayName is allowed.