Complication and Sequela Modeling

Complication and sequela attributes

Complications and sequelae are modeled using the Causal and Temporal attributes under the Associated with attribute hierarchy:

- Associated with (attribute)
  - Causative agent (attribute)
  - Due to (attribute)
  - Temporally related to (attribute)
    - During (attribute)
    - After (attribute)

A complication is a disorder caused by another disorder, procedure, or event which is not a natural progression or expected outcome of its cause; temporally may be During and After the causative disorder, procedure, or event.

When there is a causal relationship with the preceding disorder, procedure, or event, a sequela may also be a complication i.e. the resultant disorder is not a natural progression or expected outcome of the preceding disorder, procedure, or event.

A sequela, by definition, is a disorder that is a consequence, but not an unexpected outcome, that follows another disorder, procedure, or event.

Complication and sequela relationships

Modeling

If a request is received for inclusion of a concept with an FSN containing complication or sequela and it is unclear whether the relationship is causal and/or temporal, request additional information from the submitter.

A concept should always be modeled, primarily, according to its relationship to a procedure when the nature of these relationships are clear.

- Causation: Due to
- Temporal relationship, i.e Temporally related to: During, After

For those occasions for which it is clear that an ensuing disorder starts during a procedure, but persists after the procedure has been completed, both during and after attributes may be used in the model.
The words *complication* and *sequela* may or may not be part of an FSN.

**Naming conventions for FSNs**

- Complication: X due to Y
- Sequela: X following Y
- Complication & Sequela: X due to and following Y

### Modeling

- This modeling facilitates auto-classification. However, in SNOMED CT both 116223007 Complication (disorder) and 362977000 Sequela (disorder) are primitive, which means the relationship to these two concepts has to be explicitly modeled with an IS_A relationship.
- The semantic pattern *Complication of implies Due to*.
  - For new requests with the FSNs stating *complication of*, the FSN should be written as *complication due to* and modeled accordingly.
  - There are legacy SNOMED CT terms for which there are duplicates, one with *complication of* and one with *complication due to*. The duplicates will eventually be removed.

### Complication and Sequela Allowable Relationships

<table>
<thead>
<tr>
<th>Attribute</th>
<th>IS A Sequela</th>
<th>IS A Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due to</td>
<td>Possible/Allowable</td>
<td>Necessarily true</td>
</tr>
<tr>
<td>During</td>
<td>Not allowable</td>
<td>Possible/allowable</td>
</tr>
<tr>
<td>After</td>
<td>Necessarily true</td>
<td>Possible/allowable</td>
</tr>
</tbody>
</table>

### Types of complications and sequelae

The three types are as follows:

- Only the cause is specified
- Only a temporal relationship is specified
- Both a cause and a temporal relationship to the cause are specified

### Types of Complications and Sequelae

<table>
<thead>
<tr>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>Cause only</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temporal only</th>
<th>NA</th>
<th>Exception</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-procedure/preoperative anxiety (Not yet modeled in SNOMED CT)</td>
<td>Before X before Y</td>
<td>Use to model pre-procedure complications (e.g. preoperative complication), without causal relationships</td>
</tr>
<tr>
<td>Preoperative hyponatremia (Not yet modeled in SNOMED CT)</td>
<td>713419002 Intraoperative cardiorespiratory arrest (disorder)</td>
<td>During X during Y</td>
</tr>
</tbody>
</table>

These concepts are modeled with the Combined disorder guidelines.
Causal + Temporal

These concepts are modeled with the Combined disorder guidelines.

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Due to and During</th>
<th>Due to and After</th>
</tr>
</thead>
<tbody>
<tr>
<td>36561000119109 Post-traumatic acute tubular necrosis (disorder)</td>
<td>X due to and during Y</td>
<td>Use to model a disorder that occurs during a procedure (e.g. intraoperative complication), with a causal relationship</td>
</tr>
<tr>
<td>196040003 Aspiration pneumonitis due to anesthesia during labor and delivery (disorder)</td>
<td>X due to and during Y</td>
<td>Both a cause and a temporal relationship to the cause are specified</td>
</tr>
<tr>
<td>A Relationship, makes the concept analogous to the use of an After relationship</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Due to and During

Use to model a disorder that occurs during a procedure (e.g. intraoperative complication), with a causal relationship.

Both a cause and a temporal relationship to the cause are specified.

A Due to and During relationship, makes the concept analogous to the use of an After relationship.

Due to and After

Use to model a disorder that occurs after a disorder or procedure (e.g. postoperative complication), with a causal relationship.

Both a cause and a temporal relationship to the cause are specified.

Sequeleae and Late Effects

ICD uses the phrase late effects, which is equivalent to sequela. Thus it should be modeled with after (and due to if there is a causal relationship) and with an IS A relationship to 362977000 Sequela (disorder).

Naming conventions for sequelaes

FSN: Disorder X due to and following <<disorder /<<procedure /<event

PT: Disorder X due to and following <<disorder /<<procedure /<event

SYN: [Disorder X as a] Sequela of <<disorder /<<procedure /<event

SYN: [Disorder X as a] Late effect of <<disorder /<<procedure /<event

For example,

- Disorder due to and following another disorder (disorder)
- Disorder due to and following meningitis (disorder)
- Disorder due to and following procedure (disorder)

Surgical complications, sequelaes, and late effects

Not all surgical sequelae are complications of surgery, but rather expected late effects.

Postoperative complications are complications following surgery, but not necessarily due to the surgery and, thus, are modeled only with an after relationship.

Naming conventions for surgical sequelae (temporal only)

FSN: Disorder X following <=387713003 Surgery procedure (procedure)
PT: Disorder X following <<387713003 |Surgical procedure (procedure)

For example,
- Contraction of eye socket after enucleation (disorder)
- Scar following surgery (disorder)

**Naming conventions for postoperative complications (temporal only)**

FSN: Postoperative X (disorder)

PT: Postoperative X

For example,
- Postoperative infection (disorder)
- Postoperative ileus (disorder)
- Postoperative hypothyroidism (disorder)

**Naming conventions for postoperative complications due to surgery**

Complications that occur after surgery and are modelled with a parent of 116223007 |Complication (disorder)| and with |after | surgical procedure|.

FSN: Disorder X due to [and following] <<387713003 |Surgical procedure (procedure)

PT: Disorder X due to [and following] <<387713003 |Surgical procedure (procedure)|

For example,
- Encephalopathy due to and following cardiopulmonary bypass (disorder)
- Cataract lens fragments in vitreous of eye due to and following cataract surgery (disorder)
- Disorder due to and following breast reduction (disorder)

**Exceptions**

**Perioperative complications**

Peri-operative complications refer to complications temporally related to a surgical procedure. They include pre-operative, intra-operative and post-operative complications and are modelled with a parent of |complication| and a relationship consisting of |temporally related to| or an appropriate subtype with a value of 387713003 |Surgical procedure (procedure)|.

Such complications do not necessarily imply a causal relationship to the surgery itself as they may be related to any disorder, event or procedure occurring prior, during and/or after surgery. For this reason, perioperative complications do not have a stated causal relationship unless an underlying cause is clearly stated in the FSN.

**Preoperative complications**

A preoperative |complication| can occur prior to surgery. Strictly it is a disorder that complicates the procedure rather than being a complication of that procedure. A preoperative complication might be considered to be a disorder that exists prior to surgery that adversely affects the surgery or that results in an intra-operative or post-operative complication. Such concepts should be modelled using the |before|, but not assigned a parent of complication or a causative relationship.

For example,
Determining the causal relationship

Most combined disorders have a direct or indirect causal relationship. Concepts containing the words following, after, post, or sequela in the FSN, and/or are modeled using the after attribute, should be considered to be sequela and usually complications as well.

Figure 1: Causal relationship flowchart