Removal of joint prosthesis due to infection and remodeling "Prosthetic joint infection"

Background

A request was received to add a concept for "Removal of a joint prosthesis due to infection". The issues associated with this request were discussed.

Initial problem statement

We have a number of terms, both disorder and procedure that deal with "infected prosthesis". In general, prostheses themselves are not infected, but the surrounding soft (or bone) tissue adjacent to the prosthesis can become infected. This infection often does not have a demonstrable causal or temporal relationship to the procedure. Currently these are modeled with an ASSOCIATED WITH relationship:

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Question:
How do we best represent the true nature of the infection? This is especially important when we deal with "Removal of prosthesis due to infection" and concepts such as "Infection of implanted cardiac device (disorder)"?

Based on previous discussions regarding "causal chain", should this be a DUE TO relationship since the infections would not have occurred if the procedure had not been done?

Initial discussions by EAG

A prosthesis can be colonized (e.g. vegetation on a prosthetic heart valve). The need to associate a procedure with these would be unnecessary and in many cases incorrect. The use of a DUE TO relationship to the device or the procedure is not appropriate.

Currently, the involved concepts inherit ASSOCIATED WITH = "Procedure" from the parent "Complication associated with device". This relationship is not appropriate as the infection may not have any causal relationship to the procedure (which is a subtype of ASSOCIATED WITH).

There are also timing aspects that are not represented in these terms, which make them more vague.

The associated problem is the need for a definition of what is meant by "infected device". If we view the presence of the device as just another acquired body structure, then these may not be complications. The timing of the infection in relation to a procedure, may be the reason to classify something as a Complication of a procedure (i.e. within a certain number of days).

The two approaches are "close to reality", which is multi-dimensional and challenging to determine, or "simplified model" that just describes what is certain. The determination of whether something is a complication or not is often unknown. Some testing will need to be done to see the impact of applying a simplified model. If it does not meet the needs from a classification standpoint, then a more complex model will be needed.

This argues for the use of ASSOCIATED WITH = "X device" to describe the relationship for devices.

For the procedures such as "Removal of prosthesis due to infection" the possibility of the use of HAS FOCUS.

There are guidelines on the evaluation of patients prior to implantation, where pre-existing infection would cause abortion of the procedure.

Clarification on the current understanding of Complications can be found here.
Modeling approach

A recent review of prosthetic joint infections (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3993098/) indicates that the term "Prosthetic joint infection" is really a misnomer and refers to the colonization of a prosthetic joint by an infectious organism and infection of the periarticular tissue. This was confirmed by a joint conference on periprosthetic joint infections (https://www.efort.org/wp-content/uploads/2013/10/Philadelphia_Consensus.pdf). This spread of the infection to the surrounding tissues must be taken into account in the modeling approach. Additionally, while the majority of this type of infection occur within the first two years after implantation, there are a substantial number (up to 30%) that occur much later, thus the direct association of the implantation procedure with the infection is not supported. However, as the colonization of the implant cannot occur with having been implanted, there is a temporal relationship (i.e. AFTER) with the Implantation procedure. Given these considerations, the following changes to the modeling of "Prosthetic joint infection" were tested.

Prior stated form

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<th>New stated form</th>
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Prior inferred form

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Modeling analysis

This modeling approach:

1. removes the incorrect causal associations (i.e., DUE TO = Procedure)
2. makes explicit the infection localization to the joint structure (which subsumes the periarticular tissues in the anatomy hierarchy)
3. To correct the inference, the prior “Disorder of prosthetic joint” was remodeled and made fully defined. This may need to be re-evaluated as to whether a disorder of an implant is in itself a complication, which would again make “Prosthetic joint infection” a subtype.
4. The resulting classification places this term under a large number of fully defined groupers, none of which appear to be incorrect. There are still a number of terms in this area of the terminology that are primitive and would benefit from a review and remodeling according to this pattern.

Modeling "Removal of prosthetic device due to infection"

The remodeling of "Prosthetic joint infection" allows Procedure terms to be modeled using the HAS FOCUS relationship. In order to be more specific in the FSN, the term was changed to "Removal of joint prosthesis for periprosthetic joint infection (procedure)". The following modeling approach was taken:

### Stated form

- **Stated form**
  - 764280009
  - Removal of joint prosthesis for periprosthetic joint infection (procedure)

### Inferred form

- **Inferred form**
  - 71390002
  - Procedure (procedure)
  - 365700105
  - Has focus (attribute)
  - 213121005
  - Prosthetic joint infection (disorder)
  - 405814001
  - Procedure site - indirect (attribute)
  - 39522004
  - Joint structure (body structure)
  - 209080004
  - Method (attribute)
  - 129009000
  - Surgical removal - action (classifier value)
  - 38590004
  - Direct device (attribute)
  - 15447007
  - Joint prosthesis, device (physical object)
Modeling analysis

This approach seems to have met the requirements of the initial request. The pattern proposed here, i.e. use of the HAS FOCUS relationship, is an acceptable pattern for "Procedures for disorders".