



# Terminology Binding in DCM

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# Content of presentation

- Importance of standardisation
- What is the meaning of 'terminology binding'
- Why is terminology binding important
- When terminology binding matters
- Terminology binding in DCM, some examples
- Issues in DCM work
- Conclusion

# Importance of standardisation: Languages and synonyms

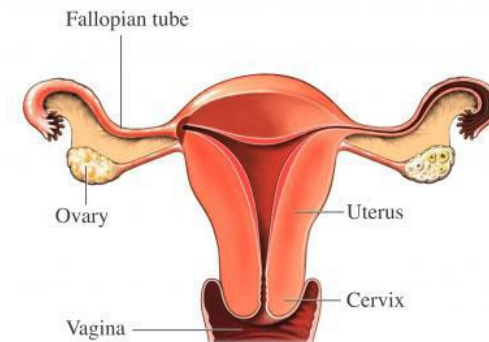


- Natural language
- Synonyms:
  - Myocard infarct
  - Cardiac infarct
  - Mi
  
  - Hb SS disease
  - Sickle cell anemia
  - Hereditary hemoglobinopathy disorder homozygous for hemoglobin S

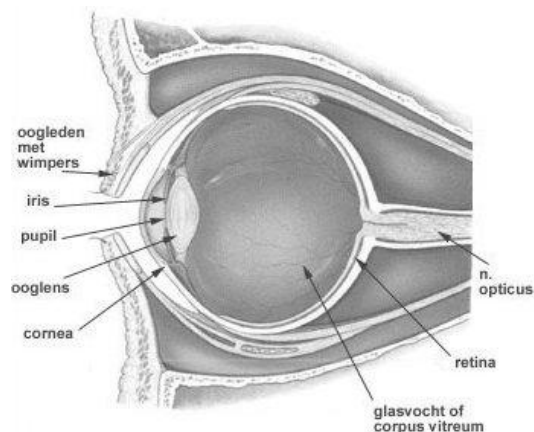


# Ambiguity - Fundus

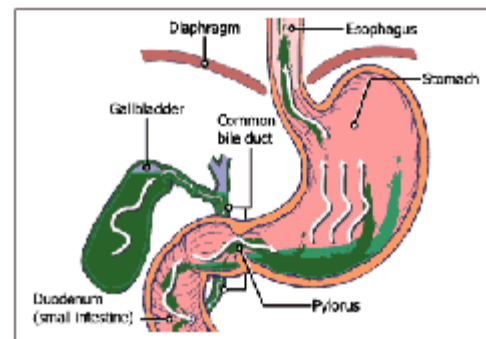
For a gynecologist: uterus



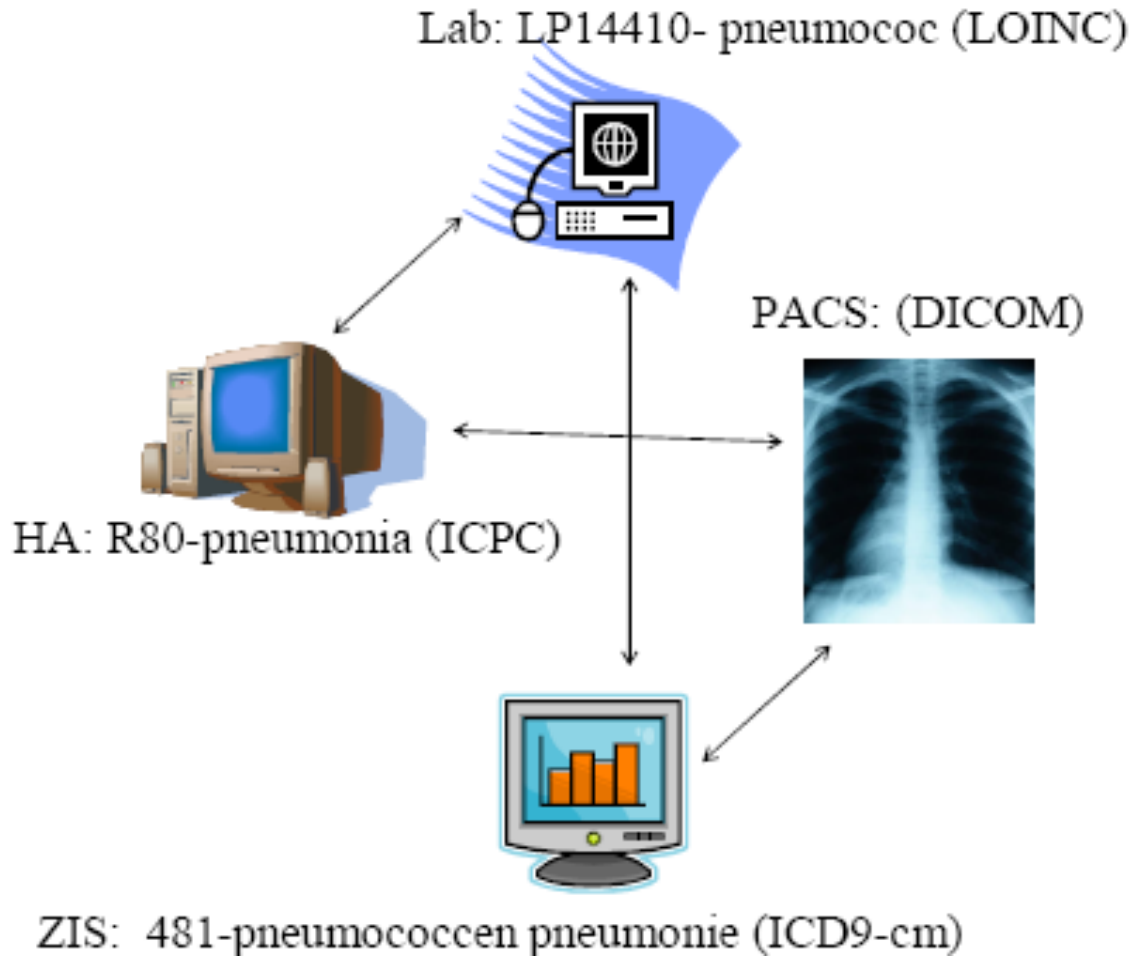
For an ophthalmologist:  
eye



For a surgeon during a laparoscopic cholecectomy :  
gall bladder



# Illustration with 4 different standards

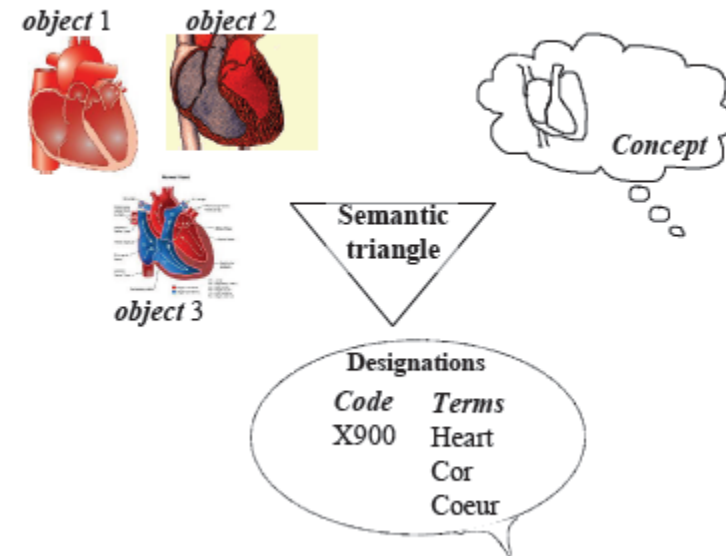


# Standardizing vocabulary



- It is not what you say (terms), but what you mean (concept).
- Terminology system: a system that assigns terms and definitions to concepts and objects based on the specification of these concepts and objects.

For instance SNOMED CT





# Recording standard, coded data

- Is important to reduce medical errors caused by misinterpretation and misrepresentation of data.
- The clinical data model must be unambiguous to increase the quality and accuracy of the data mapping to terminology codes.

(Qamar et al, 2007)

# What is the meaning of 'terminology binding'



- ***Terminology binding* (noun): an instance of a link between a terminology component and an information model artefact.**

Examples:

- A set of coded values that may be applied to a particular attribute in an information model. The set may be expressed either explicitly (extensionally) or as a definitional constraint (intensionally).
- The association between a named attribute value in the information model and a specific coded value or expression.
- A rule that determines the way that a coded expression is constructed based on multiple attribute values in the information model.

(Sato & Markwell, NHS)





# What is the meaning of 'terminology binding'

- ***Terminology binding (verb):* is the process of establishing links between elements of a terminology, for example Snomed CT, and an information model (Benson, 2010).**

Examples:

- Reviewing user-specified information requirements and assigning appropriate code values to express the underlying concepts in a way that enables consistent reusable representation of the required information.
- Assigning a set of code values to a field in an information model to express the range of possible meanings that can be expressed within that field. (Sato & Markwell, NHS)

# Why is terminology binding important



- **For health record information to be reusable it must be processable in a meaningful way by a variety of different applications**
- Reliable interpretation of the meaning of information depends on
  - The way information is structured
    - A common reference information model
  - The way clinical concepts are represented
    - A common clinical terminology
  - The way the terminology is used within the structure
    - A consistent approach to the interface between structural and terminological representations of information

(Sato & Markwell, NHS)

# Terminology binding supports reusable meaningful health records



- Requirements for meaningful processing of health record information come from different sources including:
  - Clinicians involved in direct patient care
  - Epidemiologists and researchers
  - Service managers at local and national levels
- To meet these varied requirements the health record content must be represented in ways that encompass multiple perspectives

(Sato & Markwell, NHS)

# When terminology binding matters



- Clinical information goes through several life-cycle stages ...
  - Entry, storage, retrieval, display and communication
- These stages affect ways people specify data content requirements
  - A consistent view of terminology binding must support all these stages

(Sato & Markwell, NHS)

# Several approaches



- Producing separately packaged subsets of SNOMED for particular usage contexts.
- 'Refsets'; based on a mechanism for tagging a set of terms within the SNOMED database as belonging to a predefined constrained use set. Any term can belong to one or more such Refsets.
- Intension; the set of permissible values for a data point is expressed by a query or formula.
- Query-based terminology binding is usually performed for a specific datapoint in an Archetype.

<http://www.openehr.org/wiki/display/healthmod/Archetypes+and+Terminology>



# Issues in terminology binding

- Several possible ways to express the same meaning -> Terminfo Guide recommendations
- Binding time
- Temporal effects
- The effect of changes to the terminology over time, and how different versions of the terminology can be managed,
- The use of more than one terminology in a DCM

Benson, 2010;

<http://www.openehr.org/wiki/display/healthmod/Archetypes+and+Terminology>

# Example terminology binding in DCM: Intolerance & allergy



class SNOMED CT Modelling

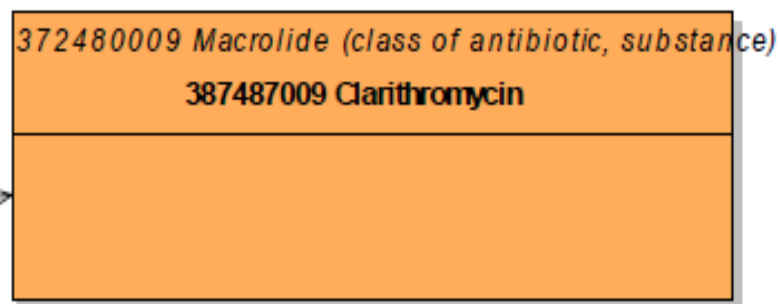
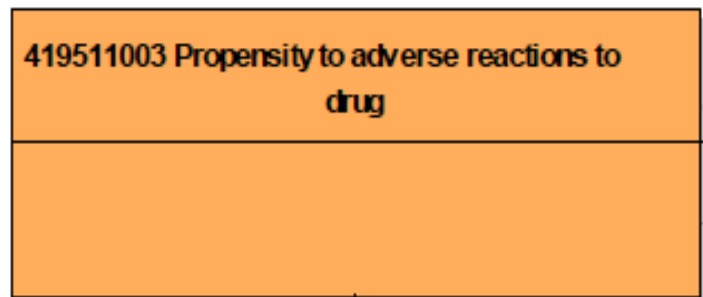
## SNOMED CT Concept

- 404684003 Clinical Finding

has (causative agent)

## Causative Agent

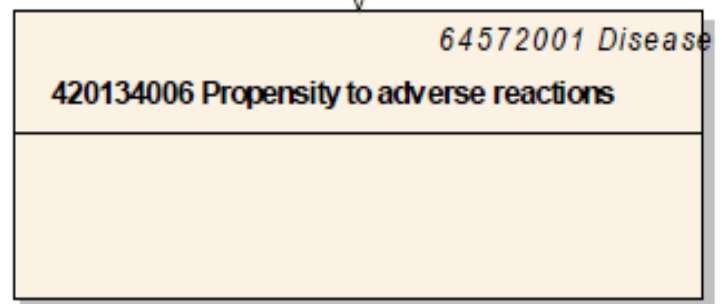
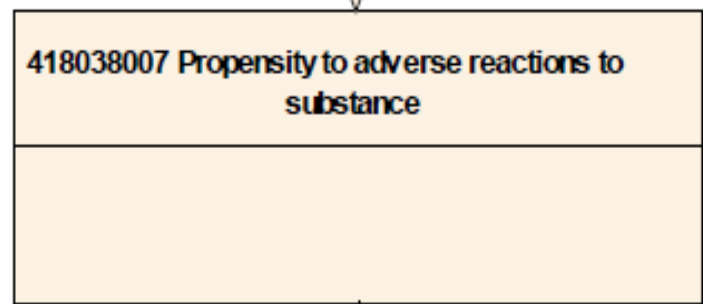
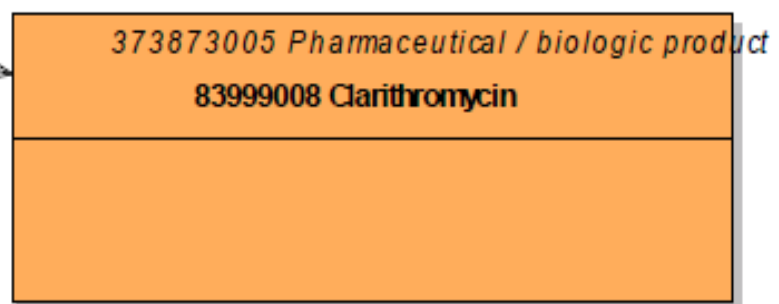
- 410607006 Organism
- 105590001 Substance
- 373873005 Pharmaceutical/biological product
- (Physical Object)
- (Physical force)



has causative agent

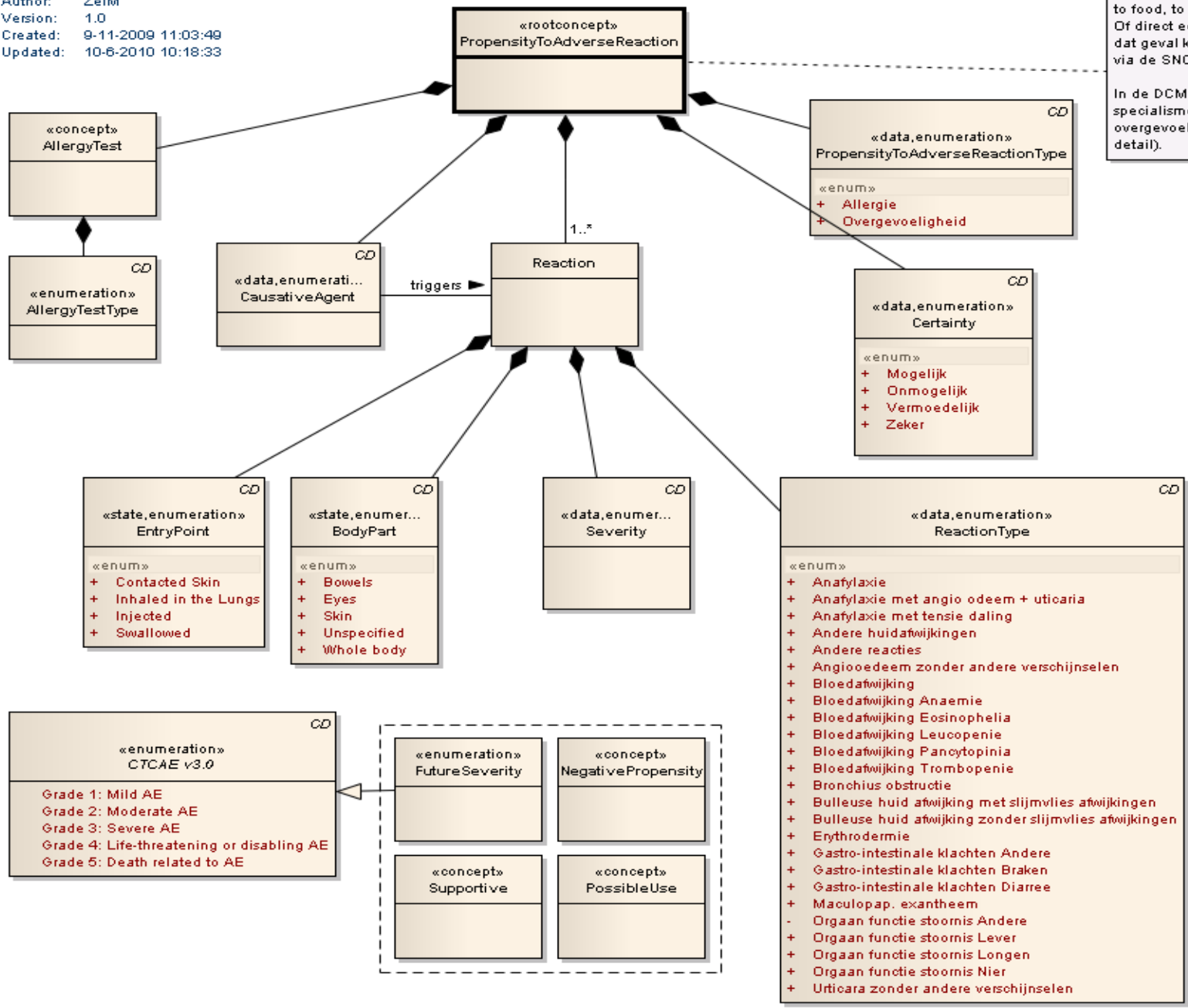


has causative agent





Name: Information Model  
 Author: ZeIM  
 Version: 1.0  
 Created: 9-11-2009 11:03:49  
 Updated: 10-6-2010 10:18:33



to food, to drug, to substance, to plant  
 Of direct een "Allergy to <allergeen>", in dat geval kan allergeen worden afgeleid via de SNOMED CT ontology.

In de DCM staat de algemene top X. Elke specialisme kan weer specialistische overgevoeligheden hebben (> meer detail).

- «data,enumeration» ReactionType**
- + Anafylaxie
  - + Anafylaxie met angio oedeem + urticaria
  - + Anafylaxie met tensie daling
  - + Andere huidafwijkingen
  - + Andere reacties
  - + Angiooedeem zonder andere verschijnselen
  - + Bloedafwijking
  - + Bloedafwijking Anaemie
  - + Bloedafwijking Eosinophelia
  - + Bloedafwijking Leucopenie
  - + Bloedafwijking Pancytopenia
  - + Bloedafwijking Trombopenie
  - + Bronchius obstructie
  - + Bulleuse huid afwijking met slijmvlies afwijkingen
  - + Bulleuse huid afwijking zonder slijmvlies afwijkingen
  - + Erythrodermie
  - + Gastro-intestinale klachten Andere
  - + Gastro-intestinale klachten Braken
  - + Gastro-intestinale klachten Diarree
  - + Maculopap. exantheem
  - Orgaan functie stoornis Andere
  - + Orgaan functie stoornis Lever
  - + Orgaan functie stoornis Longen
  - + Orgaan functie stoornis Nier
  - + Urticaria zonder andere verschijnselen

- «enumeration» CTCAE v3.0**
- Grade 1: Mild AE
  - Grade 2: Moderate AE
  - Grade 3: Severe AE
  - Grade 4: Life-threatening or disabling AE
  - Grade 5: Death related to AE



### ReactionType Attributes: Anafylaxie met angio oedem + urticaria

General | Detail | Constraints | **Tagged Values**

**Anafylaxie met angio oedem + urticaria (Attribute)**

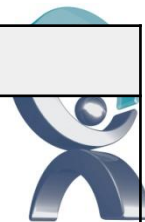
DCM::DefinitionCode	SCT:39579001   anaphylaxis   : 47429007   associated with   = 402392000   allergic urticaria a...
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### Enumeration : ReactionType

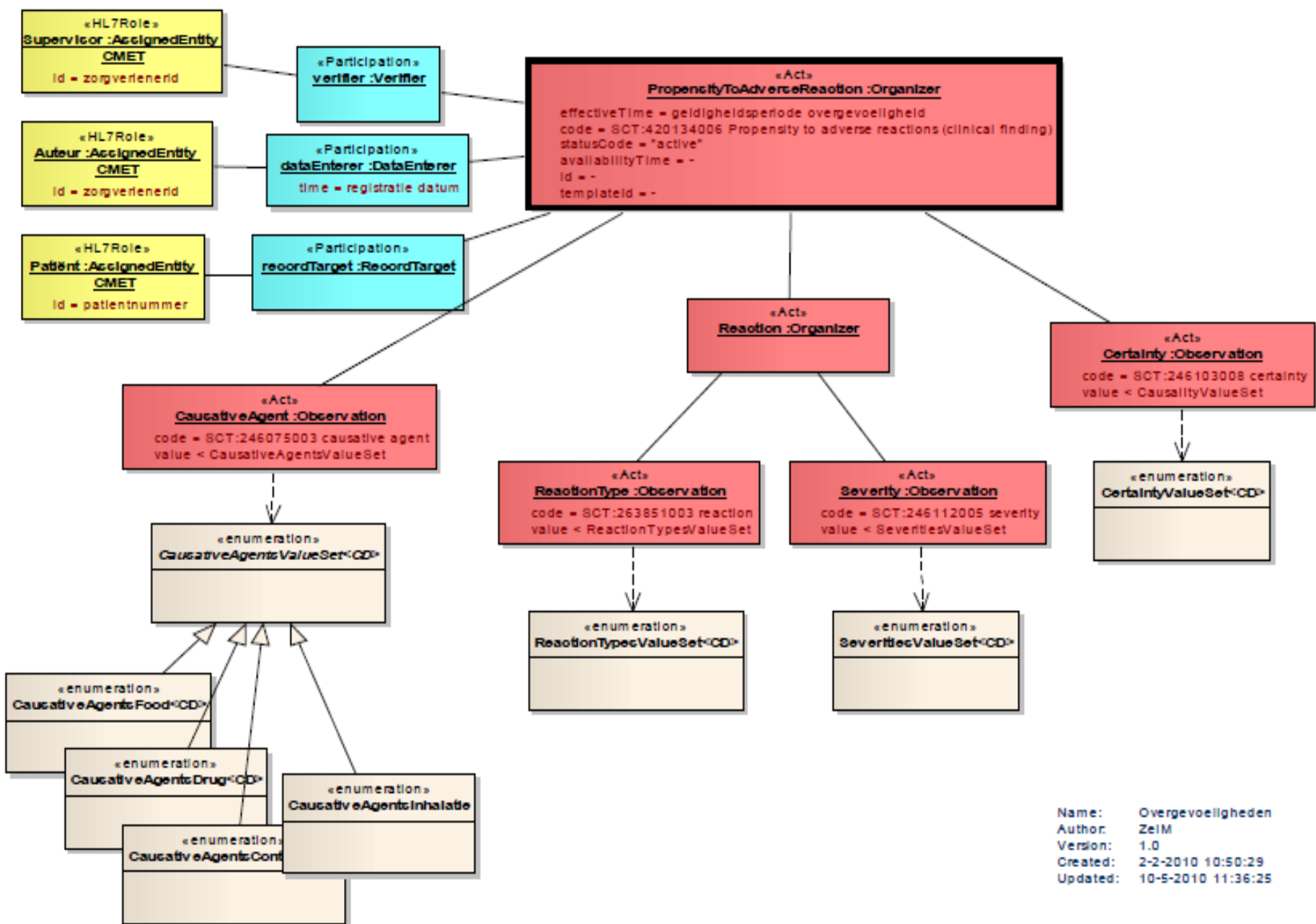
General | Details | Require | Constraints | Links | Scenario | Files | **Tagged Values**

**ReactionType (Enumeration)**

DefinitionCode	SCT:263851003 reaction
ValueSet	SCT:116223007 complication   281647001 adverse reaction

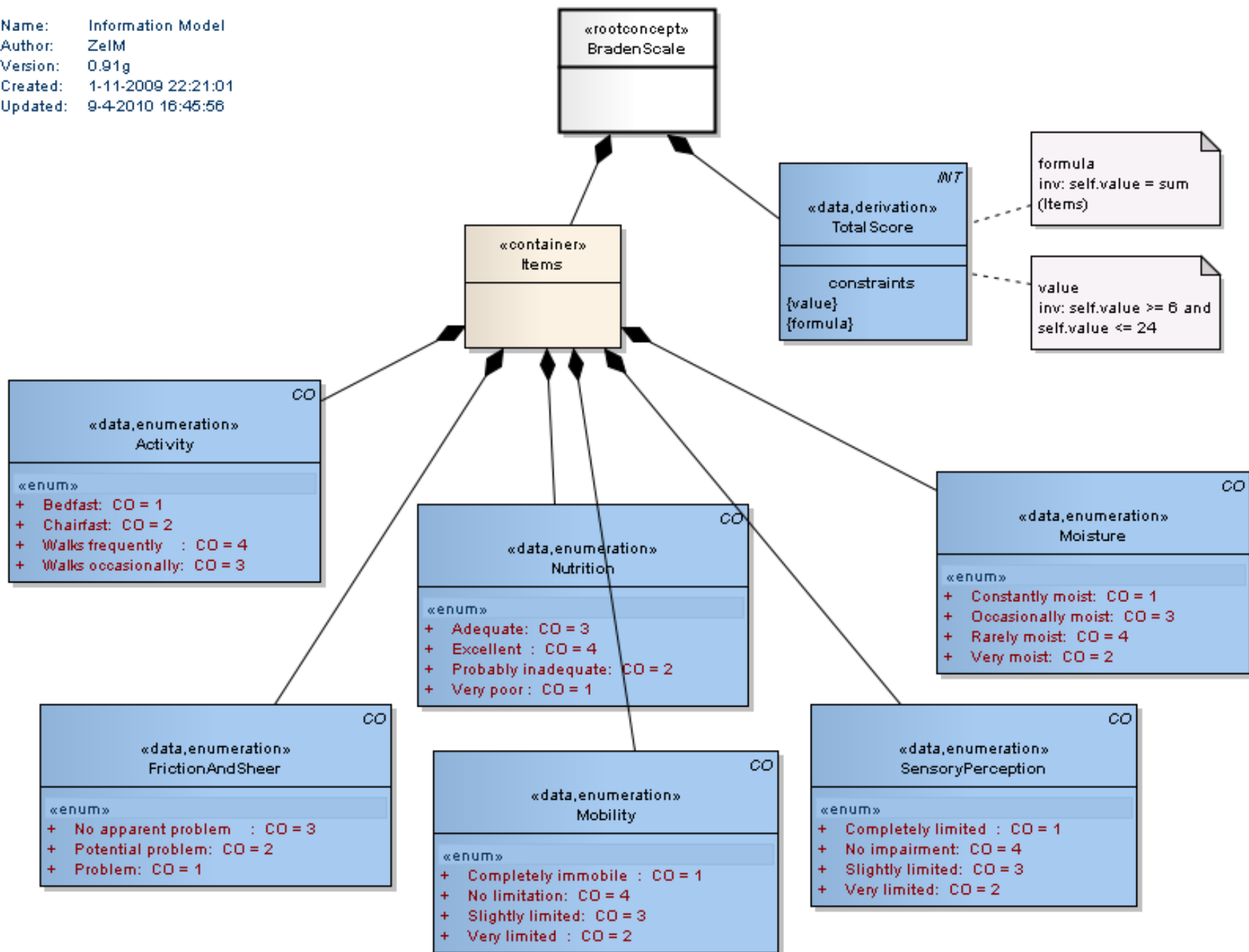


Attribute	Notes	Constraints and tags
<b>Anafylaxie</b> Public «enum»		<i>Default:</i> [DCM::DefinitionCode = SCT:39579001 Anaphylaxis ]
<b>Anafylaxie met            angio oedeem +            urticaria</b> Public «enum»		<i>Default:</i> [DCM::DefinitionCode = SCT:39579001   anaphylaxis   : 47429007   associated with   = 402392000   allergic urticaria and/or angio-oedema   ]
<b>Anafylaxie met            tensie daling</b> Public «enum»		<i>Default:</i> [DCM::DefinitionCode = SCT:39579001   anaphylaxis   : 47429007   associated with   = 45007003   low blood pressure   ]
<b>Andere            huidafwijkingen</b> Public «enum»		<i>Default:</i> [DCM::DefinitionCode = SCT:127334004 Acute skin disorder (disorder) ]



Name: Overgevoeligheden  
 Author: ZeIM  
 Version: 1.0  
 Created: 2-2-2010 10:50:29  
 Updated: 10-5-2010 11:36:25

Name: Information Model  
 Author: Zelm  
 Version: 0.91g  
 Created: 1-11-2009 22:21:01  
 Updated: 9-4-2010 16:45:56





### Class : BradenScale

General Details Require Constraints Links Scenario Files Tagged Values

BradenScale (Class)

DCM::DefinitionCode1	SCT: 413139004  braden assessment scale
DCM::DefinitionCode2	LOINC: 38228-3 Braden Scale Skin Assessment Pnl

### Enumeration : Activity

General Details Require Constraints Links Scenario Files Tagged Values

Activity (Enumeration)

DCM::DefinitionCode	LOINC:38223-4 Physical activity
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### Activity Attributes: Bedfast

General Detail Constraints Tagged Values

Bedfast (Attribute)

DCM::DefinitionCode	LOINC:LA6742 Bedfast
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# Assessment tool concept model

## Scale elements

- Name of the scale
- 'Topic' of the assessment
- Scale score
- Scale result interpretation
- Scale sub item score
- Scale sub item finding

## Example

- Braden scale
- Pressure sore risk assessment
- Braden score
- High risk of pressure sore etc
- Mobility etc
- No limitation (in mobility) etc

# Assigning codes from appropriate SNOMED CT hierarchies



<b><i>Component</i></b>	<b><i>Example Term</i></b>	<b><i>Hierarchy</i></b>
Name of scale	Braden scale	Staging and Scales
Procedure (assessment of X using Y instrument)	Assessment of pressure sore risk [using Braden scale]	Procedure ( <b>is this using = means?</b> )
Scale score	Braden score	Observable entity
Scale score interpretation	High risk of pressure sore	Clinical finding
Scale sub item score	Mobility, Nutrition etc	Observable entity (' <b>authority dependent concepts'</b> issue e.g. <b>Braden mobility</b> )
Scale sub item finding	no limitation of mobility, at risk of pressure sore etc	Clinical finding



# Representing values as findings



- Example A – an instrument item ‘neurological deficit’ with values of:
  - 1 (none)
  - 2 (mild)
  - 3 (moderate)
  - 4 (severe)
- We can say that the score 3 in the context of this instrument represents the concept ‘moderate neurological deficit’.



# Representing values as findings

- Example B – an instrument item ‘mobility’ with values of:
  - none
  - partial
  - full
- In the context of this scale the term ‘full’ represents the concept ‘fully mobile’.

# Representing values as findings



- SNOMED CT<sup>®</sup> policy regarding inclusion of enumerated instrument values is as follows:
  - *A decision about whether to model complete value sets should be made on a case by case basis depending on user need (clinical utility) and common sense e.g. it would not be sensible to model contextualized values for a ten point pain assessment scale.*





# Representing values as findings

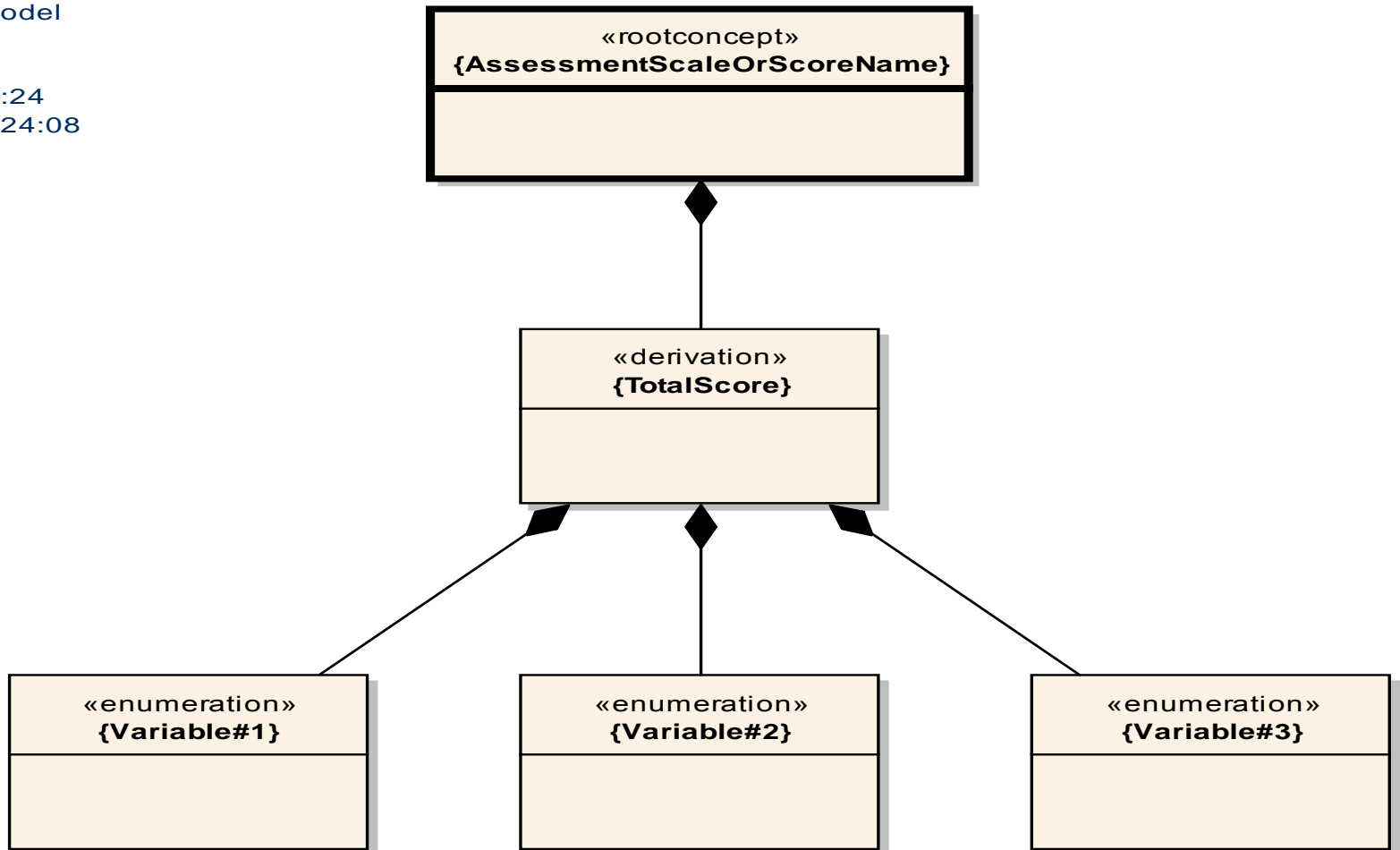
- System developers who are setting up assessment screens will need to decide whether they have a use case for assigning SNOMED CT codes to the values, for example, a code is required as it represents a clinically useful concept required in other parts of the application, for analysis or messaging.
- **discussion needs more input**



# DCM Assessment Pattern

## Information Model

Information Model  
ZelM  
1.0  
5-3-2010 9:50:24  
: 13-8-2010 14:24:08





# DCM Assessment Pattern

- Rootconcept = Name of the scale -> Staging and Scales
- Derivation = Scale score -> Observable entity
- Enumeration = Scale sub item score -> Observable entity (^ authority dependent concepts' issue e.g. Braden mobility')
- Valueset in Enumeration = Scale sub item finding -> Clinical finding



## Issues in DCM work

- HL7 v3: vocabulary
- 5.1.3.2 Unique Meaning Rule
- HL7 International recommends that, whenever possible, a *Value Set be drawn from a single Code System.*

# HL7 v3: 5.1.3.4 Value Set Versioning



- A Value Set Definition can change over time. New codes may be added to or removed from an Extensional Value Set definition, and/or the rules used to construct an intensionally defined Value Set may be changed.
- When a Value Set Definition changes, it should be done in a way that ensures both the old and new versions are available for comparison, and for the use of models that explicitly reference the old version.





# Conclusions

- For semantic interoperability EHR / HIT systems need to be able to handle terminology.
- Hence, terminology must be bound to information models.
- Terminology binding has rules and issues
- Terminology binding is essential part of DCM



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- [www.results4care.nl](http://www.results4care.nl)

# References



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