

Representation of Hypersensitivity, Allergy and adverse reactions in SNOMED CT

Bruce Goldberg, MD, PhD




Topics to be covered

- History and current state of hypersensitivity content in SNOMED CT
- Current projects involving adverse reactions and allergy
- Future directions

Allergy content in SNOMED CT

- Until at least 2005, allergy content in SNOMED CT had consisted of three unrelated hierarchies representing allergic disorders, allergic propensities and allergic reactions
- Initial revisions involved an attempt to align allergy content with the WAO/EAAACI nomenclature by incorporating allergy and non-allergic hypersensitivity under a hypersensitivity class
- More Extensive revisions occurred in 2013-2014 involving:
 - Application of the SDP (structure, disposition, process) model to hypersensitivity/allergic disorders, propensities and reactions enabling these hierarchies to be related and distinguished from one another
 - Provision of text definitions for hypersensitivity , allergy and pseudoallergy based on the WAO/EAAACI nomenclature
 - Changes to the concept model by creating new pathological processes in order to fully define the top level nodes of hypersensitivity/allergic/pseudoallergic condition, disposition and reaction
 - Additional change to the concept model for allergic disposition in order to support the SDP model by role grouping the causative agent with after allergic sensitization
 - Retirement of history of allergy to x as maybe A allergy to x (disposition)

Organization of hypersensitivity disorders in SNOMED CT














 **Hypersensitivity condition (disorder)**  

SCTID: 473010000

473010000 | Hypersensitivity condition (disorder) |

Hypersensitivity condition
Hypersensitivity condition (disorder)
The disposition to develop an allergic or pseudoallergic reaction, the reaction itself or its consequences.

Pathological process → Hypersensitivity process

- ▶  Allosensitization (disorder)
- ▶  Contact dermatitis (disorder)
- ▼  Hypersensitivity disposition (disorder)
 - ▶  Allergic disposition (disorder)
 - ▶  Cutaneous hypersensitivity (disorder)
 - ▶  Pseudoallergic disposition (disorder)
- ▼  Hypersensitivity reaction (disorder)
 - ▶  Allergic reaction (disorder)
 - ▶  Contact hypersensitivity reaction (disorder)
 - ▶  Immune hypersensitivity reaction by mechanism (disorder)
 - ▶  Pseudoallergic reaction (disorder)
-  Hypersensitivity to endogenous antigen (disorder)
-  Hypersensitivity to foreign antigen (disorder)

Current projects

- Remediation of allergy to substance
- Allergy implementation guide

Current projects 1

- Allergy to X
 - *There is a need to document modeling and terming guidelines for concept pattern |Allergy to X|, and then to normalize the existing concepts to conform to the modeling and terming guidelines.*
 - *Termining issues*
 - *Inconsistent use of Allergy to X (disorder) and X allergy (disorder)*
 - *The Substance and Product Hierarchies require use of INNs (International Nonproprietary Name) to represent substances in FSNs and Preferred Terms in cases where an INN exists. The same guideline should apply across all hierarchies including Allergy to X*
 - *Modeling issues*
 - *The existing concepts are modeled inconsistently and sometimes incorrectly such as asserting defined rather than proximal primitive parents resulting in the inference of additional causative agent attributes that make the concept unsuitable for use in clinical decision support implementations.*
 - *The current concept model for allergy to X is incongruent with the models for similar domains such as specific infectious diseases*

Allergy to X

Fully defined parent

Parents

- Biguanide allergy (disorder)

Metformin allergy (disorder) ☆

SCTID: 294740006

294740006 | Metformin allergy (disorder) |

- Metformin allergy
- Metformin allergy (disorder)

Pathological process → Allergic process

- After → Allergic sensitization
- Causative agent → Metformin

- After → Allergic sensitization
- Causative agent → Drug or medicament

Additional inferred causative agent

Comparison of models for infectious disease and allergy

Infectious disease

Parents
 > Infectious disease (disorder)

Mycosis (disorder) ☆

SCTID: 3218000
 3218000 | Mycosis (disorder) |

- Mycosis
- Fungal infection
- Disease caused by fungus
- Fungal infectious disease
- Fungus infection
- Mycoses
- Mycosis (disorder)
- Mycotic disease

Pathological process → Infectious process
 Causative agent → Kingdom Fungi

Allergy

Stated Inferred

Parents
 > Allergy to substance (disorder)
 > Propensity to adverse reactions to drug (disorder)

Drug allergy (disorder) ☆

SCTID: 416098002
 416098002 | Drug allergy (disorder) |

- Drug allergy (disorder)
- Drug allergy
- Allergy to drug
- Medication allergy
- Medicine allergy

Pathological process → Allergic process
 After → Allergic sensitization
 Causative agent → Drug or medicament

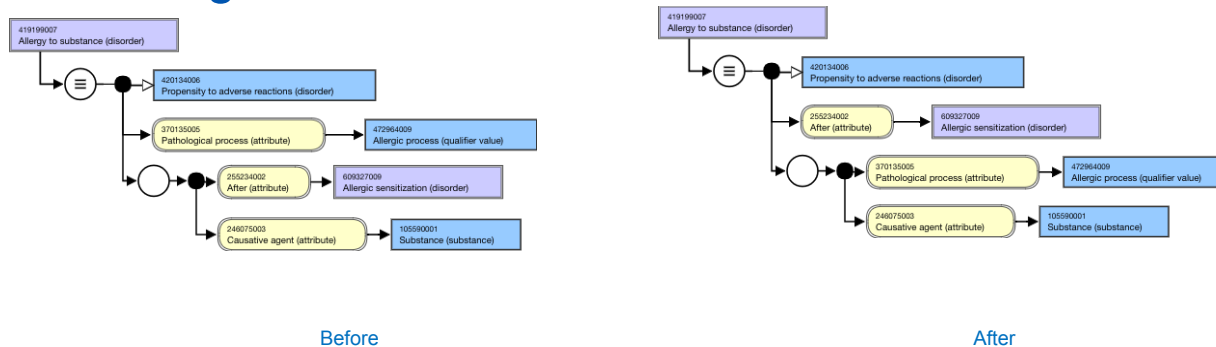
Stated Inferred

Allergy to X

- Scope
 - ~1,700 concepts
- Workplan
 - Proposed deployment for July 2017 release

Allergy to X remediation process 1

- Naming convention will be allergy to X (disorder) and will use INNs to represent substances in FSNs and Preferred Terms in cases where an INN exists.
- Model will be revised to move after=allergic sensitization (disorder) from role group 1 to role group 0 and add pathological process=allergic process (qualifier value) to role group 1 with causative agent=X



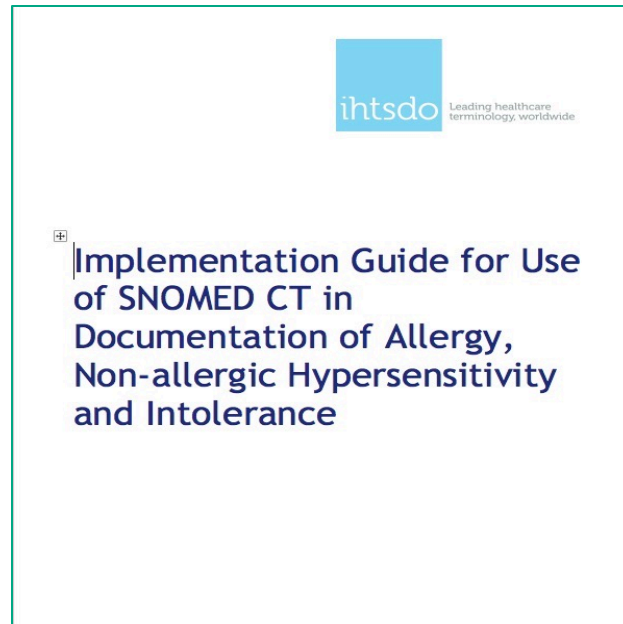
- Testing has shown both models infer the same parents

Allergy to X remediation process 2

- All concepts will be asserted under a proximal primitive ancestor
- Underlying issues in the substance hierarchy (e.g. missing concepts, duplicate concepts, concepts modeled incorrectly) will be addressed.
- Current requests in CRS will be modeled individually while a batch process is being developed in order to remediate the existing content
- Editorial guide to be updated with above policies.

Current projects 2

- Allergy Implementation guide

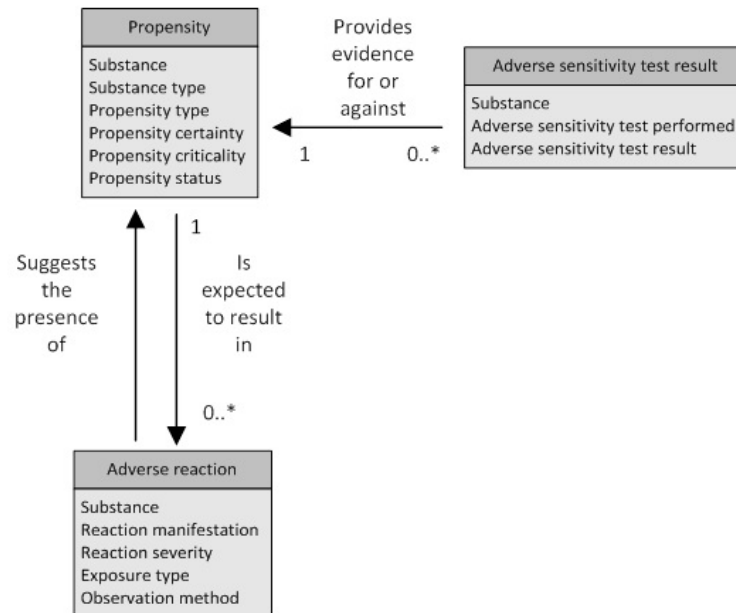


Purpose

- Extend previous (and current) IHTSDO work on definitions of adverse sensitivity events,
- Survey and summarize the relevant interoperability standards and use this information to develop an inclusive information model
- Advise the IHTSDO community regarding best practice deployment of allergy data within the EHR
- Identify the SNOMED CT refsets (value sets) that would constitute best practice for use in electronic health records.

Inclusive information model

- After considering reference information models from various standards development organizations and other national or regional sources, an inclusive information model is proposed.
- This simplified model aligns the essential elements of different information models into a coherent and comprehensive model.
- Classes and data elements in the inclusive information model can be mapped to individual models for compatibility.



Current work – Identifying the gaps between SNOMED CT and standards value sets

- Initial project has compared FHIR with SNOMED CT
- Future directions will also examine HL7 CCDA, HL7 Patient Care Domain Analysis Model, epSOS, FHIM, 1.7.7 United Kingdom NHS Connecting for Health Information Model, openEHR.

Identifying gaps between FHIR value set for adverse reactions and SNOMED CT

FHIR Element	Element type	FHIR values	Value exists in SNOMED?	Existing SNOMED concept	SNOMED concept needed
Allergy/intolerance	DomainResource	Risk of adverse reaction to a substance	Yes	418038007 Propensity to adverse reactions to substance (disorder)	
Identifier	Identifier	N/A	N/A	Free text	
Status	Code	Active	Yes	55561003 Active (qualifier value)	
		Unconfirmed	N/A		
		Active confirmed	Yes	410605003 Confirmed present (qualifier value)	
		Inactive	Yes	73425007 Inactive (qualifier value)	
		Resolved	No		Resolved (qualifier value)
		Refuted	No		Refuted (qualifier value)
		Entered in Error	No		Entered in error (qualifier value)
Type	Code	Allergy	Yes	609328004 Allergic disposition (disorder)	
		Intolerance	No		Intolerance to substance (disorder)
Category	Code	Food	Yes	255620007 Foods (substance)	
		Medication	Yes	410942007 Drug or medicament (substance)	
		Biologics	Yes	115668003 Biological substance (substance)	
		Environment	Yes		Environmental allergen (substance)
Criticality	Code	Low Risk	No		Low risk (qualifier value)
		High Risk	No		High risk (qualifier value)
		Unable to assess	No		Unable to determine risk (qualifier value)
Code	CodeableConcept	Specific substances/pharmaceutical products, allergy or intolerance conditions, and negation/exclusion codes to specify the absence of specific types of allergies or intolerances.	Yes	420881009 Allergic disorder by allergen type (disorder) 238575004 Allergic contact dermatitis (disorder) 418634005 Allergic reaction caused by substance (disorder) 417516000 Anaphylaxis caused by substance (disorder) 609406000 Pseudoallergic reaction (disorder) 400195000 Contact hypersensitivity reaction (disorder) 282100009 Adverse reaction caused by substance (disorder) 420134006 Propensity to adverse reactions (disorder)	The hierarchies displayed in column E capture adverse sensitivity specifically related to substances. If there is a need for a broader specification, then then descendants of 473010000 Hypersensitivity condition (disorder) , 420134006 Propensity to adverse reactions (disorder) and 281647001 Adverse reaction (disorder) would cover everything.

Additional Issues – Future Directions

- Reorganization of structure for allergy related content
 - Apply previously discussed editorial principles for Allergy to X to other allergy/hypersensitivity hierarchies including development of new concept models in order to bring a consistent modeling approach to this domain
 - Allergic condition - Allergic disorder caused by X
 - Allergic reaction to X
 - Pseudoallergy to X
 - Pseudoallergic reaction to X
- Addition of a new Intolerance to substance class and possibly Adverse sensitivity (to subsume 281647001 |Adverse reaction (disorder)| and 420134006 |Propensity to adverse reactions (disorder)|)
- Mapping of SNOMED CT allergy content with ICD-11
- Modeling allergy to combined drugs

Allergy representation in ICD-11

ICD-11 Beta Draft (Foundation)
[Register] | [Log In]
Last Update: Oct 1

[Advanced Search]
Foundation
Linearizations
Contributions
Info

- ▼ Allergic or hypersensitivity conditions
 - ▼ Allergic or hypersensitivity disorders involving the respiratory tract
 - ▼ Vasomotor or allergic rhinitis
 - ▼ Allergic rhinitis
 - Allergic rhinitis due to pollen
 - Allergic rhinitis due to other seasonal allergens
 - Allergic rhinitis due to specified allergens
 - Allergic rhinitis due to house dust mite
 - Other allergic rhinitis
 - ▼ Non-allergic rhinitis
 - Gustatory rhinitis
 - ▼ Hormonally-mediated rhinitis
 - Rhinitis related to pregnancy
 - Rhinitis related to hypothyroidism
 - Drug-induced rhinitis
 - Non-allergic rhinitis with eosinophils
 - ▼ Irritant Induced-rhinitis
 - Reactive upper airways dysfunction syndrome
 - Mixed rhinitis
 - Vasomotor rhinitis
 - ▼ Aspergillus-induced allergic or hypersensitivity conditions
 - Allergic Aspergillus rhinosinusitis
 - Maltworker lung
 - Allergic bronchopulmonary aspergillosis
 - ▼ Chronic rhinosinusitis
 - Chronic maxillary sinusitis
 - Chronic frontal sinusitis
 - Chronic ethmoidal sinusitis
 - Chronic sphenoidal sinusitis

Foundation Id : <http://id.who.int/icd/entity/1531458929>

Allergic or hypersensitivity disorders involving the respiratory tract

Parent(s)

- Allergic or hypersensitivity conditions

Definition

Allergic or hypersensitivity disorders involving the respiratory tract includes several clinically different conditions that can be considered as hypersensitivity disorders of the upper and lower respiratory tract. The classification of these conditions is complex.

ICD-11 is the first version of ICD in which allergy and hypersensitivity disorders have their own chapter under diseases of the immune system

In ICD-9 and 10, allergy and hypersensitivity disorders are scattered among different chapters such as diseases of the respiratory system and diseases of the skin and subcutaneous tissue

Issues with allergy/hypersensitivity content in ICD-11

- In ICD-11, Allergy is grouped together with hypersensitivity by disjunction.
 - Allergy is a kind of hypersensitivity and there is also non-allergic hypersensitivity (pseudoallergy) and thus some disorders which are clearly non-allergic and therefore non-immune are classified under diseases of the immune system (e.g. vasomotor rhinitis) in the ICD-11 foundation.

- ▼ Diseases of the immune system
 - ▶ Primary immunodeficiencies
 - ▶ Acquired immunodeficiencies
 - ▶ Non-organ specific systemic autoimmune disorders
 - ▶ Organ specific autoimmune disorders
 - ▶ Autoinflammatory disorders
 - ▼ Allergic or hypersensitivity conditions
 - ▼ Allergic or hypersensitivity disorders involving the respiratory tract
 - ▼ Vasomotor or allergic rhinitis
 - ▶ Allergic rhinitis
 - ▼ Non-allergic rhinitis
 - Gustatory rhinitis
 - ▶ Hormonally-mediated rhinitis
 - Drug-induced rhinitis
 - Non-allergic rhinitis with eosinophils
 - ▶ Irritant Induced-rhinitis
 - Mixed rhinitis
 - Vasomotor rhinitis

- Some incorrect inheritances removed in the linearizations but these are sparsely populated at present
- Allergic or hypersensitivity conditions is still a descendant of Diseases of the immune system in the joint linearization for mortality and morbidity statistics

Issues with allergy/hypersensitivity content in SNOMED CT

- 473011001 |Allergic condition (disorder)|is not related to 414029004 |Disorder of immune function (disorder)|(synonym= Immune system disorder)

Allergy to combined drugs

Allergy to combination drugs is to one or the other active ingredients and not to both
 Currently modeled as allergy to both constituent substances
 Interim solution is to remove both causative agents

Parents

▶ ● Propensity to adverse reactions (disorder)

Stated Inferred

☰
Amoxicillin + clavulanate potassium allergy (disorder)
☆

SCTID: 294523000

294523000 | Amoxicillin + clavulanate potassium allergy (disorder) |

Co-amoxiclav allergy
 Amoxicillin + clavulanate potassium allergy (disorder)
 Amoxicillin + clavulanate potassium allergy

Pathological process → Allergic process
 After → Allergic sensitization
 Causative agent → Amoxicillin

Pathological process → Allergic process
 After → Allergic sensitization
 Causative agent → Clavulanate potassium

Two causative agents

Children (0)

No children