

New concept proposal

Exposure

Author	Harald Witte	Date last updated	14.11.2023
Project	General interest	Contact	DCC
Dataset release	2024.1	Consulted expert	Amanda Herbrand

1 Rationale

In the context of healthcare, the contact with (or exposure to) various agents plays a decisive role, for example exposure to toxins, allergens, drugs, radiation, or others. In the current release of the SPHN ontology (2023.2) several exposure properties are part of the concept Allergy Episode (exposure datetime, exposure duration, and exposure route code) yet a separate Exposure concept does not exist. In an effort to revise semantic looseness these attributes will be combined with the benefit of creating a precise reusable concept.

2 Comparison to other standards/data models

2.1 SNOMED CT

SNOMED CT uses the code [418715001](#) (Exposure to potentially harmful entity (event)) to represent an exposure. It is a descendant of code [272379006](#) | Event (event) |. The code has 26 direct children most of which in turn have further descendants to describe contact with or exposure to a variety of agents or substances, e.g. to biological agents ([418307001](#)), drugs ([711455000](#)), toxins ([420239005](#)), or radiation ([218190002](#)).

2.2 NCIT

The NCIT defines “**Exposure**” (Code [C17941](#)) as “The act of subjecting someone or something to an influencing experience.”. The extended CDISC-GLOSS definition describes exposure as “Contact between an agent and a target. A state of contact or close proximity to a medicinal product, chemical, pathogen, radioisotope or other substance. NOTE: Types of exposure may be described by many qualifiers (e.g., local, systemic, acute, chronic, cumulative, environmental, population, individual, gestational, or occupational.)”. An “**Agent**” (Code [C1708](#)) in turn is defined as “An active power or cause (as principle, substance, physical or biological factor, etc.) that produces a specific effect.”.

3 Concept information

Concept or concept compositions or inherited	General concept name	General description	Contextualized concept name	Contextualized description	Type	Standard	Value set or subset	Meaning binding	Cardinality for composedOf
concept	Exposure	contact between a physical, biological, or chemical agent and an individual	Exposure	contact between a physical, biological, or chemical agent and an individual				SNOMED CT:418715001 Exposure to potentially harmful entity (event)	
composedOf	agent code	coded information specifying an active power or cause (as principle, substance, physical or biological factor, etc.) that produces a specific effect	agent	coded information specifying an active power or cause (as principle, substance, physical or biological factor, etc.) that produces a specific effect when exposed to it	SNOMED CT				0:1
composedOf	degree code	coded information specifying the degree of the concept	exposure degree	coded information specifying the qualitative degree of exposure	Code	SNOMED CT			0:1
composedOf	quantity	an amount or a number of the concept	quantitative exposure level	quantitative exposure level	Quantity				0:1
composedOf	route code	coded information specifying the route of the concept	exposure route	coded information specifying the route of the exposure to the agent	Code	SNOMED CT			0:n

composedOf	start datetime	datetime at which the concept started	exposure start	datetime at which the exposure started	temporal				0:1
composedOf	end datetime	datetime at which the concept ended	exposure end	datetime at which the exposure ended	temporal				0:1
composedOf	duration	elapsed time from start to end of the concept	duration	duration of the exposure	Quantity				0:1
composedOf	record datetime	datetime the concept was recorded	record datetime	datetime the exposure was recorded	temporal				0:1

General concept name	Cardinality for concept to Administrative Case	Cardinality for concept to Data Provider	Cardinality for concept to Subject Pseudo Identifier	Cardinality for concept to Source System
Exposure	0:1	1:1	1:1	1:1

4 Impact on the SPHN Dataset

Introduction of the Exposure concept replaces the exposure-attributes of the concept Allergy Episode which has to be adapted accordingly. These changes are done in one go with revising attribute names of this concept.

Moreover, the new concept Tobacco Exposure can directly inherit from Exposure (see [7. Example for inheritance, Figure 1](#)).

5 Discussion

The idea to separate properties describing details of an allergy episode was one driver for creating the Exposure concept. In addition, there has been an attempt to represent data describing Tobacco Smoking Behaviour. The initial proposal of this concept had been revised substantially to represent a broader variety of properties relevant in the context of smoking behaviour, resulting in the concept [Tobacco Exposure](#). After some alignment, Tobacco Exposure shall be able to inherit from Exposure, thereby reusing this concept. The Exposure concept is expandable by additional qualifiers in the future, e.g., representing whether it is local, systemic, acute, chronic, cumulative, environmental, population, individual, gestational, or occupational (compare International Programme on Chemical Safety (IPCS) 2004 WHO).

The composedOf 'agent code' (cardinality 0:1) is not restricted on purpose to avoid limiting concepts potentially inheriting from Exposure, e.g. Tobacco Exposure. In the context of [Allergy Episode](#) it should not be instantiated to avoid conflicts with the 'Allergy Episode'-composedOf 'allergen'.

Semantic Working Group (25.10.2023):

- Discussion of the description of Exposure.

Proposed variant: "an interaction between entities that provides opportunity for transmission of a physical, chemical, or biological agent from a source entity to a target entity, e.g., an individual"

Alternatives:

1. contact between a physical, biological, or chemical agent and a target, e.g., an individual
2. contact between a physical, biological, or chemical agent and an individual
3. contact between a physical, biological, or chemical agent and an individual or another target

Alternative 2 has been chosen as being concise and most appropriate to the current requirements of the concept.

- Non-physical exposures, e.g., psychological ones like encounters or harassment, are not intended to be included for the moment.
- The attribute "degree" is changed to type Code to represent coded qualitative degree levels.
- The attribute "quantity" has been added:
 - avoids the potentially misleading need to represent the composedOf degree as type Result
 - allows the representation of quantitative exposures, e.g., radiation
 - The option to create a new concept Degree was considered but ruled out until actual need arises. [One possibility for the design of the Degree concept was three attributes of type Code, Quantity, and qualitative.]

6 Example

6.1 Example 1

Exposure to radiation during computertomography

Exposure

agent code:
 identifier: 52250000
 name: X-ray electromagnetic radiation (physical force)
 coding system and version: SNOMED-CT-2023-07-31
 quantity:
 value: 1.2
 unit:
 identifier: mJperkg
 name: mJ/kg
 coding system and version: UCUM
 route code:
 identifier: 45890007
 name: Transdermal route (qualifier value)
 coding system and version: SNOMED-CT-2023-07-31
 start datetime: 2022-11-05 15:45:21
 end datetime: 2022-11-05 16:12:35
 duration: -
 record datetime: 2022-11-07 10:05:12

6.2 Example 2

Exposure to allergen (inhaled pollen)

Exposure

agent code:
 identifier: 698724007
 name: Ambrosia psilostachya pollen (substance)
 coding system and version: SNOMED-CT-2023-07-31
 degree code:
 identifier: 62482003
 name: Low (qualifier value)
 coding system and version: SNOMED-CT-2023-07-31
 route code:
 identifier: 284009009
 name: Respiratory tract route (qualifier value)
 coding system and version: SNOMED-CT-2023-07-31
 start datetime: -
 end datetime: -
 duration:
 quantity:
 value: 6

unit:

identifier: **h**

name: **h**

coding system and version: **UCUM**

record datetime: **2022-11-07 10:05:12**

7 Example for inheritance ([Tobacco Exposure](#), adapted from proposal (09/2023))

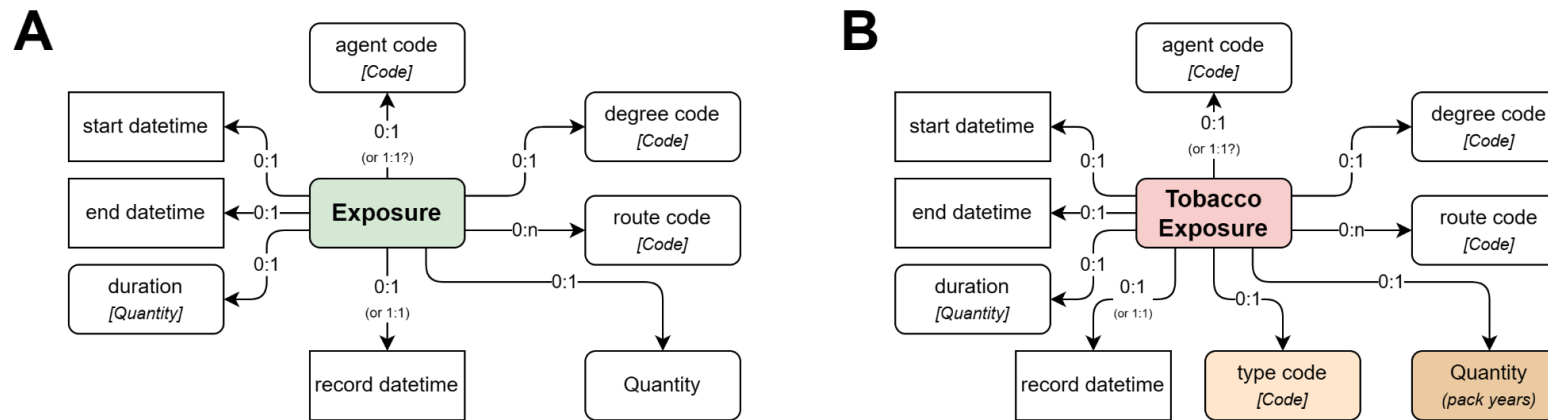


Figure 1: Exposure vs. Tobacco Exposure

(A) Exposure concept, (B) Tobacco Exposure concept, inheriting from Exposure

7.1 Original proposal Tobacco Exposure

Concept or concept compositions or inherited	General concept name	General description	Contextualized concept name	Contextualized description	Type	Standard	Value set or subset	Meaning binding	Cardinality for composedOf
concept	Tobacco Exposure	episode of exposure of an individual to tobacco in various forms	Tobacco Exposure	episode of exposure of an individual to tobacco in various forms				229819007 Tobacco use and exposure (observable entity)	

composedOf	type code	coded information specifying the type of the concept	exposure type code	code describing the exposure of the individual to tobacco and related substances	Code		702979003 Never used tobacco (finding); 43381005 Passive smoker (finding); 77176002 Smoker (finding); 8517006 Ex-smoker (finding); 228494002 Snuff user (finding); 228493008 Ex-snuff user (finding); 81703003 Chews tobacco (finding); 228513009 Ex-tobacco chewer (finding); 722499006 Electronic cigarette user (finding); 35361000087100 Ex-electronic cigarette user (finding)		0:1
composedOf	consumed substance code	code for the substance consumed by the individual	consumed substance code	code for the tobacco derived substance consumed by the individual	Code		descendant: 39953003 Tobacco (substance)		0:1
composedOf	exposure degree code	code, name, coding system and version describing the concept	exposure degree code	Code for the degree of exposure to the substance. For cigarettes: 1-9 cigs/day = low, 10-20 cigs/ day = moderate, 20+ cigs/day = high	Code		62482003 Low (qualifier value) , 1255665007 Moderate (qualifier value) , 75540009 High (qualifier value)		0:1
composedOf	duration	duration of the concept	duration of exposure	duration of exposure to tobacco in years	Quantity		UCUM Code: a		0:1
composedOf	pack years	calculated number of years that the individual consumed one pack of cigarettes per day for	pack years	calculated number of years that the individual consumed one pack of cigarettes per day for	Quantity		UCUM Code: a		0:1

composedOf	end datetime	datetime at which the concept ended	cessation datetime	datetime the individual stopped being exposed to tobacco related products	temporal				0:1
composedOf	record datetime	datetime the concept was recorded	record datetime	datetime the tobacco exposure was recorded	temporal				0:1

7.2 Adapted proposal inheriting from Exposure

Concept or concept compositions or inherited	General concept name	General description	Contextualized concept name	Contextualized description	Type	Standard	Value set or subset	Meaning binding	Cardinality for composedOf
concept	Tobacco Exposure	episode of exposure of an individual to tobacco in various forms	Tobacco Exposure	episode of exposure of an individual to tobacco in various forms	Exposure			229819007 Tobacco use and exposure (observable entity)	
composedOf	type code	coded information specifying the type of the concept	exposure type code	code describing the exposure of the individual to tobacco and related substances	Code	SNOMED CT	702979003 Never used tobacco (finding); 43381005 Passive smoker (finding); 77176002 Smoker (finding); 8517006 Ex-smoker (finding); 228494002 Snuff user (finding); 228493008 Ex-snuff user (finding); 81703003 Chews tobacco (finding); 228513009 Ex-tobacco chewer (finding); 722499006 Electronic cigarette user (finding); 35361000087100 Ex-electronic cigarette user (finding)		0:1
inherited	agent code	coded information specifying an active power or cause	consumed substance code	code for the tobacco derived substance	Code	SNOMED CT	descendant of: 39953003 Tobacco (substance)		0:1

		that produces a specific effect		consumed by the individual					
inherited	degree code	degree of the concept	exposure degree code	Code for the degree of exposure to the substance. For cigarettes: 1-9 cigs/day = low, 10-20 cigs/day = moderate, 20+ cigs/day = high	Code	SNOMED CT	restricted to: 62482003 Low (qualifier value) ; 1255665007 Moderate (qualifier value) ; 75540009 High (qualifier value)		0:1
inherited	duration	elapsed time from start to end of the concept	duration	duration of the exposure to tobacco in years	Quantity	UCUM	unit -> code restricted to: a		0:1
inherited	quantity	an amount or a number of the concept	pack years	calculated number of years that the individual consumed one pack of cigarettes per day for	Quantity	UCUM	unit -> code restricted to: a		0:1
inherited	route code	coded information specifying the route of the concept	route code	coded information specifying the route of the exposure to the agent	Code	SNOMED CT			0:n
inherited	start datetime	datetime at which the concept started	exposure start	datetime at which the exposure started	temporal				0:1
inherited	end datetime	datetime at which the concept ended	cessation datetime	datetime the individual stopped being exposed to tobacco related products	temporal				0:1
inherited	record datetime	datetime the concept was recorded	record datetime	datetime the tobacco exposure was recorded	temporal				0:1

7.2.1 Example: Tobacco Exposure (inheriting from Exposure)

Tobacco Exposure

```

type code
  identifier 77176002
  name Smoker (finding)
  coding system and version SNOMED-CT-2023-07-31
agent code
  identifier 66562002
  name Cigarette smoking tobacco (substance)
  coding system and version SNOMED-CT-2023-07-31
degree code
  identifier 1255665007
  name Moderate (qualifier value)
  coding system and version SNOMED-CT-2023-07-31
duration
  quantity
    value 5
    unit
      identifier a
      name a
      coding system and version UCUM
  quantity
    value 3.5
    unit
      identifier a
      name a
      coding system and version UCUM
route code
  identifier 284009009
  name Respiratory tract route (qualifier value)
  coding system and version SNOMED-CT-2023-07-31
start datetime -
end datetime -
record datetime 2023-08-04 10:22:15

```