

**SNOMED**  
International

Expo 2017 Tutorial

# SNOMED CT Introduction

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SNOMED International*

• INFEKTIÖS LUNGSJUKDOM  
14669001  
• ACUTE RENAL FAILURE  
• SÍNDROME DE INSUFICIENCIA RENAL  
• NYRESVIGTSYNDROM

GUDA



## Introduction to SNOMED CT

- Background
- Benefits
- Features
- Analytics
- Learn more



# Background



# SNOMED Clinical Terms

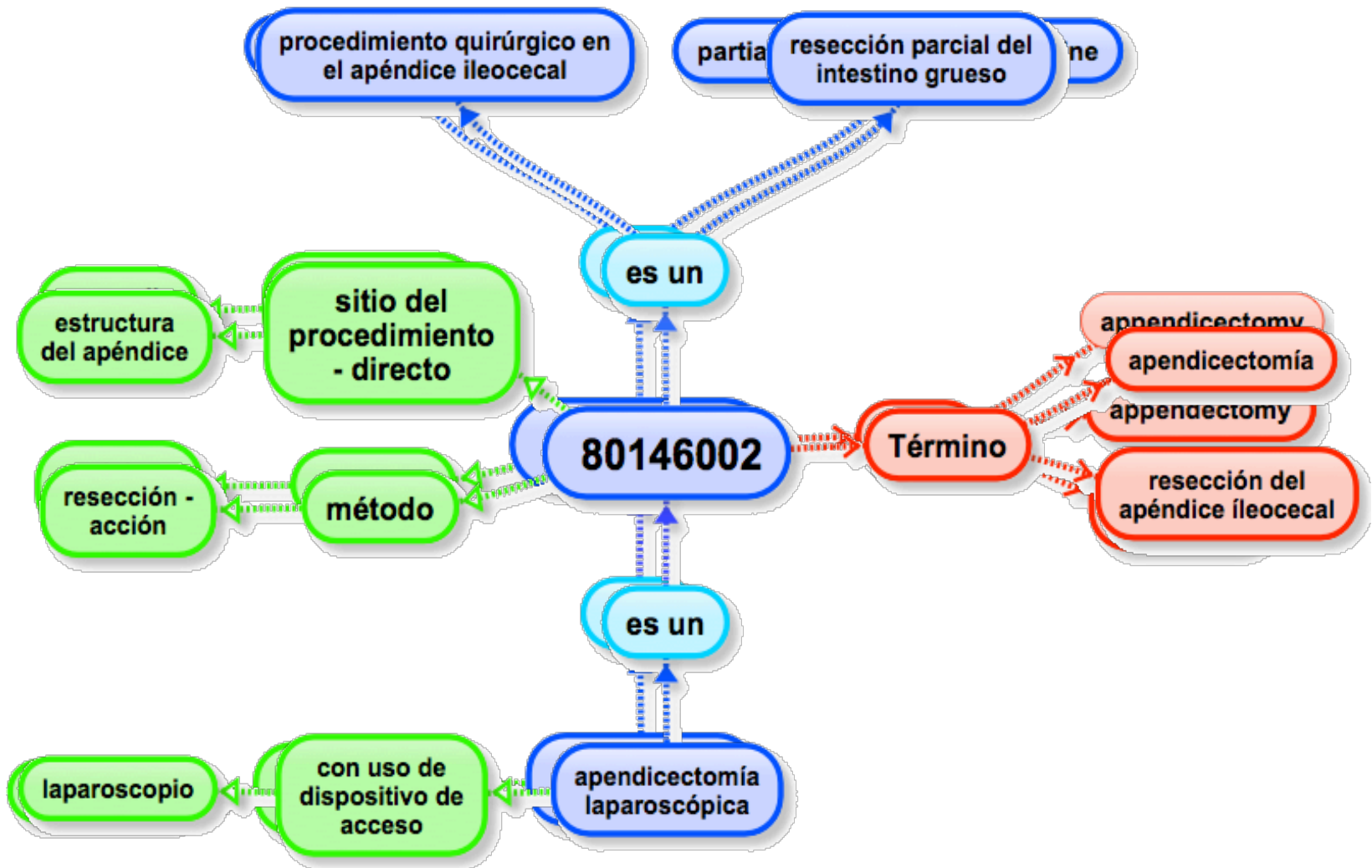
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- Most comprehensive multilingual clinical terminology
- Supports high quality clinical content in health records
- Increasing number of tools and implementations around the world





# SNOMED CT – Not Just a Code System



# SNOMED International

- An international not-for-profit organisation
  - Owned by national Members
  - Governed by General Assembly of its Members
  - Funded by countries based on national wealth
- Maintains and delivers SNOMED CT
  - Free use in Member countries
  - Low cost licenses for institutions in other countries



# SNOMED International Membership Benefits

- Free use of SNOMED CT and related products
- Membership of General Assembly
- Ability to create national extension and translation
  - Financial support provided for translation
  - Ability to request additions to international release
- Access to global community of member countries
  - Forums and networks to learn from and share experiences
- Free new member induction
- Free education and courses
- Free open source tooling



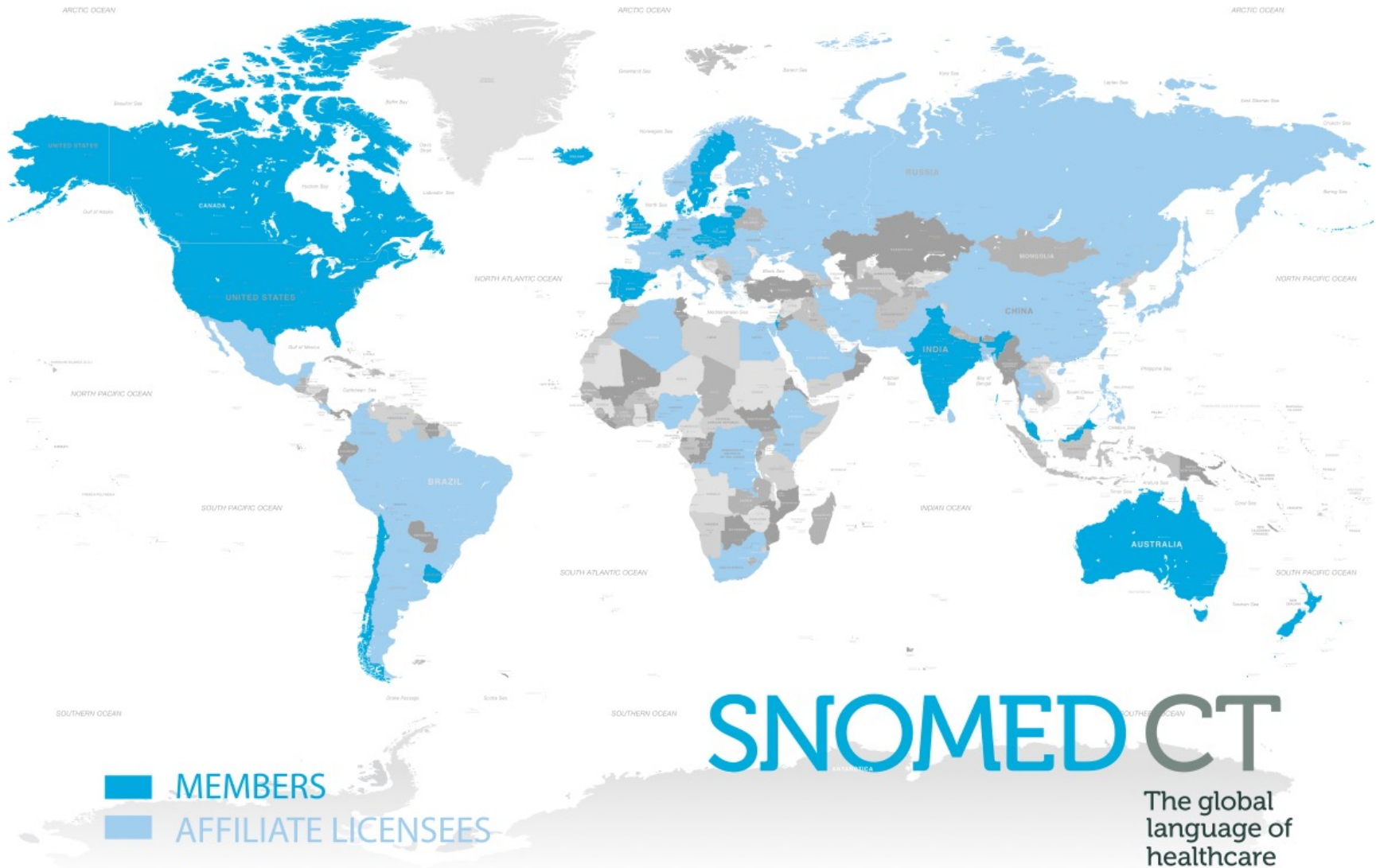


# SNOMED International Current Members

 Australia	 Hong Kong	 Netherlands	 Spain
 Belgium	 Iceland	 Norway	 Sweden
 Brunei	 India	 New Zealand	 Switzerland
 Canada	 Ireland	 Poland	 United Kingdom
 Chile	 Israel	 Portugal	 USA
 Czech Republic	 Lithuania	 Singapore	 Uruguay
 Denmark	 Malaysia	 Slovak Republic	
 Estonia	 Malta	 Slovenia	

# SNOMED Members and Licensees

SNOMED  
International



# Our Vision

By 2020 clinical terminologies will be used globally, which will result in better health, supported by one language of health.



# Benefits

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Making Clinical  
Information  
Meaningful



# Electronic Health Records

- Making health records electronic
  - A significant step forward
  - Improves communication
  - Increases availability of relevant information



*... but this is only a partial solution; the real challenge is ...*

- Making health records meaningful
  - Identifying significant facts in oceans of data
  - Enabling effective meaning-based retrieval
  - Linking the EHR to authoritative clinical knowledge



- **SNOMED CT represents clinical meaning and contributes to meaningful health records**



# Different Health Record Perspectives

## Process View of Records

- A chronological log of events and actions carried out as part of care delivery
- Provides information about
  - Who did what, when, where and to whom
- Valuable for
  - Resource management
  - Billing
  - Statistical reporting
  - Audit of processes

## Meaningful View of Records

- A record that can be processed to present a meaningful view of the current clinical situation
- Provides information about
  - The immediate problems and risks for a patient
  - Outcomes of different types of clinical treatment
- Valuable for
  - Supporting care decisions
  - Enabling research and trials

**An effective EHR needs to provide both views**

# Meaningful Views of a Game of Chess

## Meaningful view of current situation

To start with white moved the queen's pawn to forward two spaces. Black responded by moving a knight in front of the kings bishop's pawn. White advanced the queen's bishops pawn two spaces. Black then moved the king's-knight's pawn two spaces.

...

*[47 more moves in same style]*

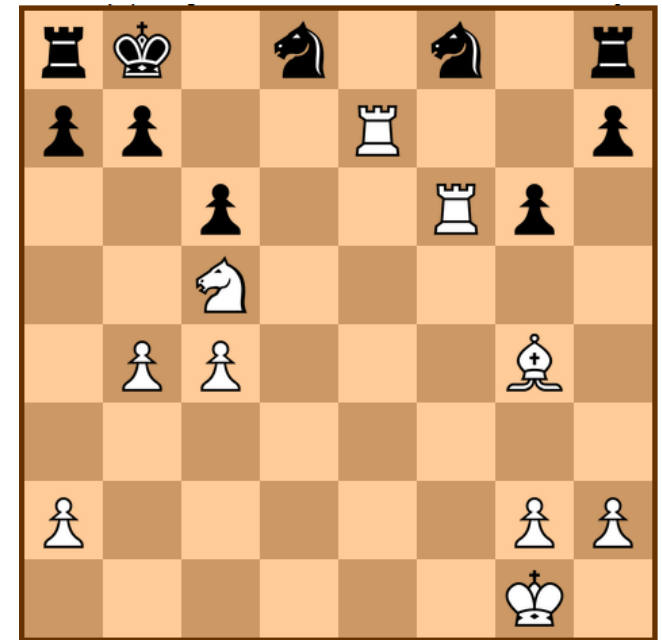
...

Then black moved his king next to his rook.

What should white do next?



To decide I need to understand the current situation



# Meaningful Views of the Current Situation

- Decisions require understanding of the current situation rather than detailed data about every event
  - The significance of past events varies, some are irrelevant others are critically important
- Computing the current situation depends on consistent processable representation of clinical information
- A meaningful record system should be able to make inferences and present a useful view of the current situation as a basis for decision making

## SNOMED CT

- Is designed to support meaning-based processing of clinical information in health records
- The design adopts the peer acclaimed desiderata for clinical vocabularies documented in a paper by Dr James Cimino in 1998



# Benefits

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Clinical  
Knowledge  
Linkage



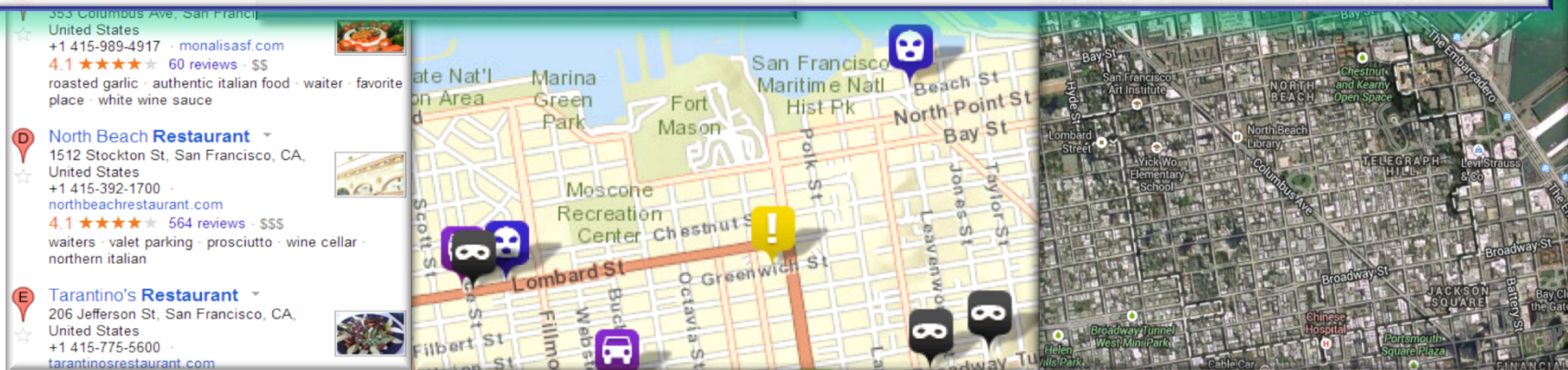
# Geographic Knowledge Linkage

- Geographical coordinates provides access to a wealth of knowledge about an area



## Latitude and Longitude

- Common denominator for interoperable geographic knowledge linkage
- Logically defined, consistent coordinates for all locations on earth
- Non-proprietary and available for use by everyone

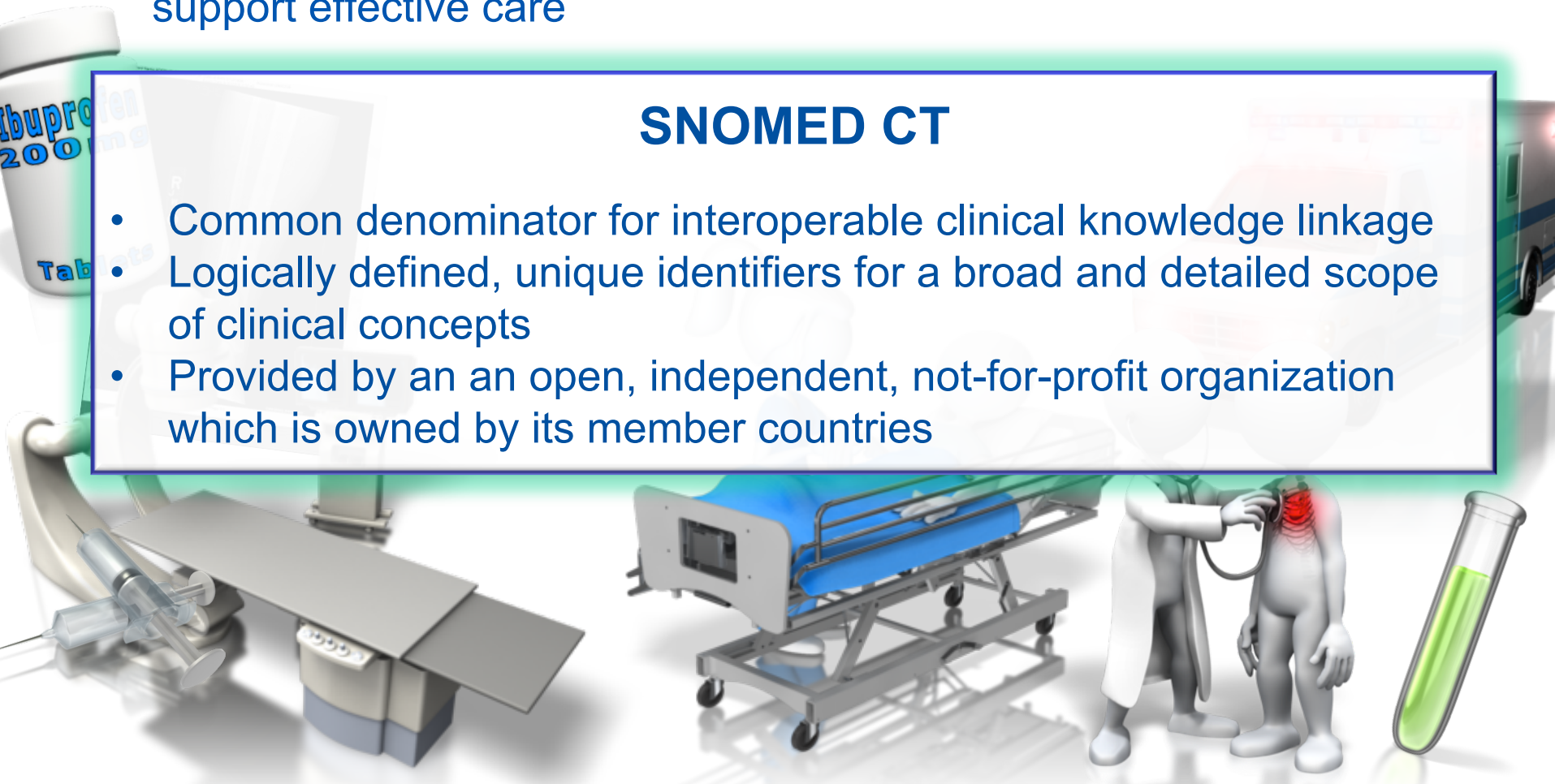


# Clinical Knowledge Linkage

- A common coordinate system for meaningful representation of clinical concepts enables access to evidence based knowledge to support effective care

## SNOMED CT

- Common denominator for interoperable clinical knowledge linkage
- Logically defined, unique identifiers for a broad and detailed scope of clinical concepts
- Provided by an an open, independent, not-for-profit organization which is owned by its member countries



# Summary of Benefits

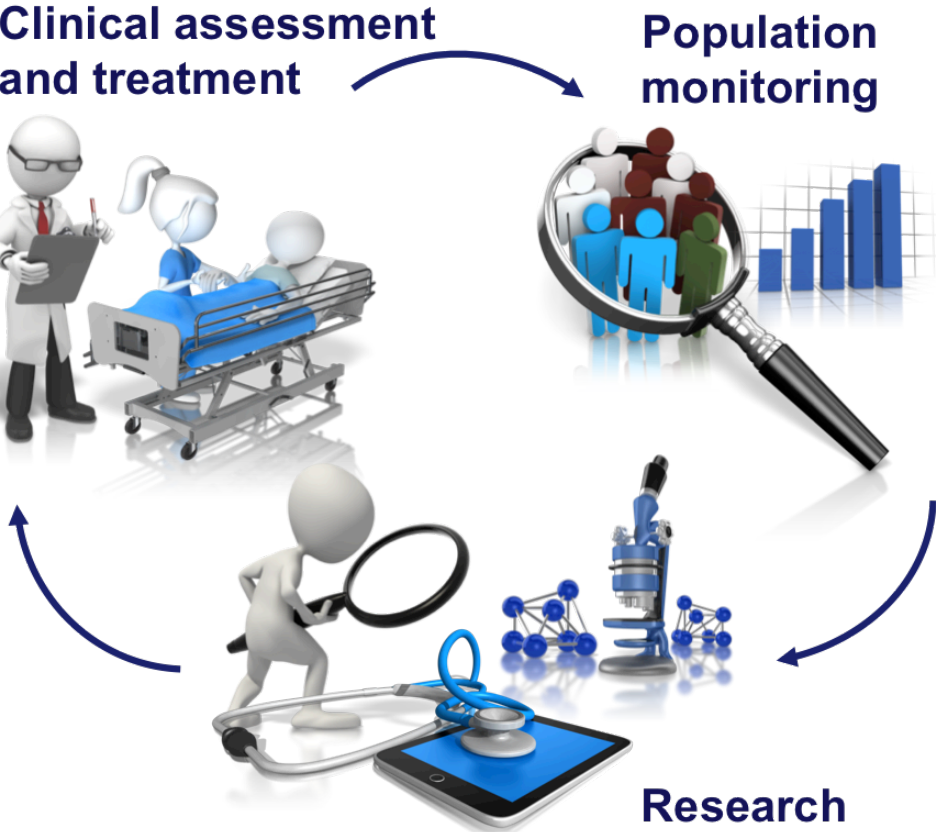
**Clinical assessment and treatment**



**Population monitoring**



**Research**

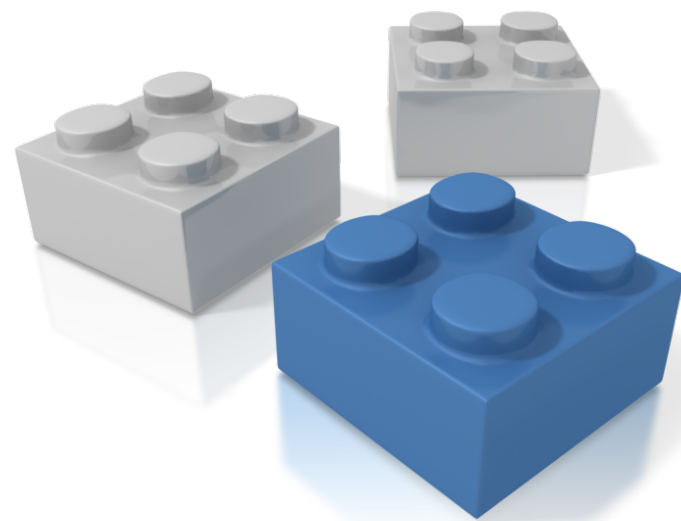


# Benefits of SNOMED CT in EHRs

- Enhancing the care of individuals
  - Display appropriate information
  - Guideline & decision support integration
  - Communicating & sharing relevant information
  - Retrospective searches for patterns requiring follow-up
- Enhancing the care of populations
  - Epidemiology monitoring & reporting
  - Research into the causes & management of diseases
- Supporting cost-effective delivery of care
  - Guidelines to minimize risk of costly errors
  - Reducing duplication of investigations & interventions
  - Auditing the delivery of clinical services
  - Planning service delivery based on emerging health trends



# SNOMED CT Features



# Concept

SNOMED  
International

A clinical idea with a unique  
identifier



# Description

SNOMED  
International

**FSN** myocardial infarction (disorder) 751689013

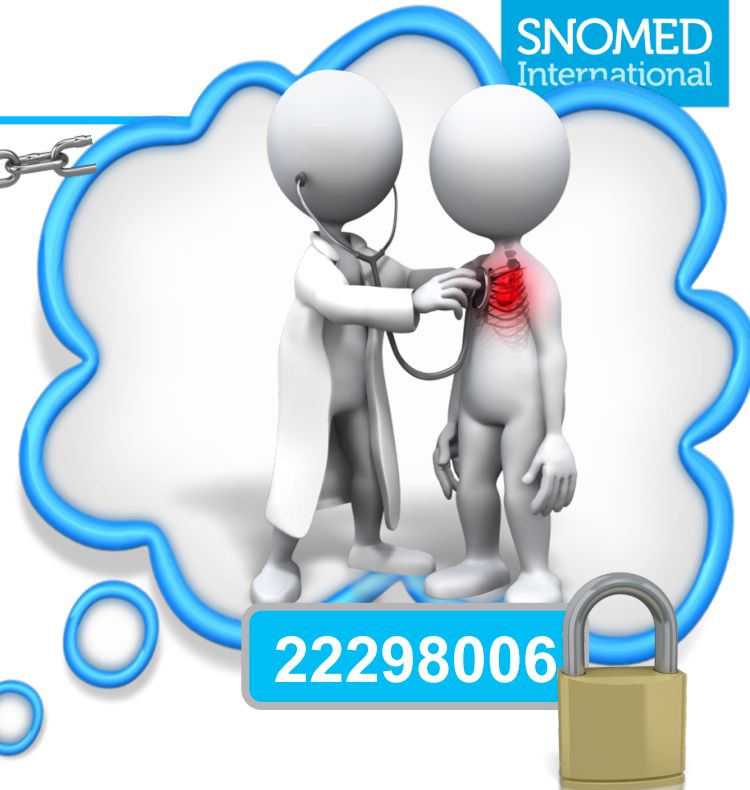
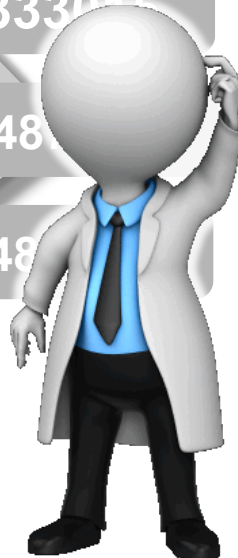
**SYN** myocardial infarction 37436014

**SYN** cardiac infarction 37442013

**SYN** heart attack 37333015

**SYN** MI – Myocardial infarction 17848

**SYN** myocardial infarct 17848



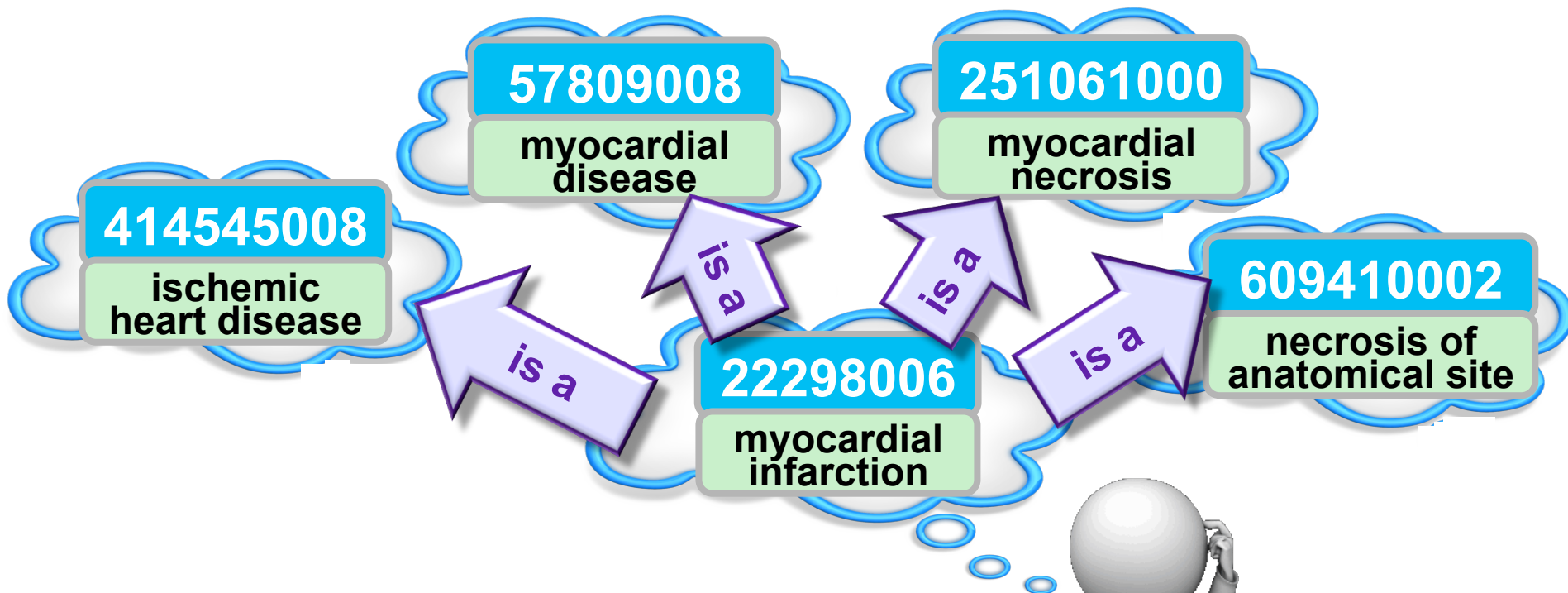
22298006



Human-readable term  
linked to a concept



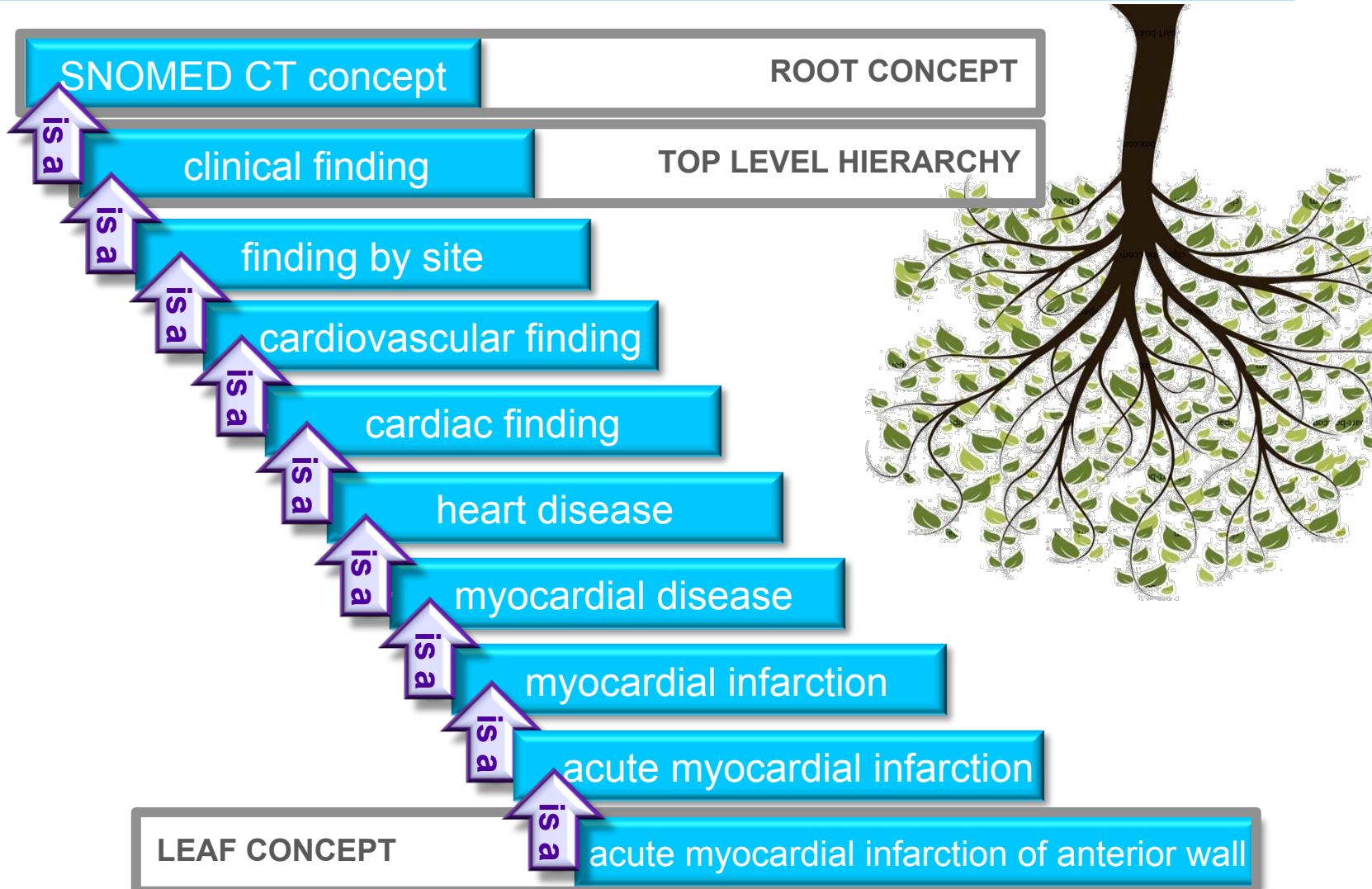
# Relationship



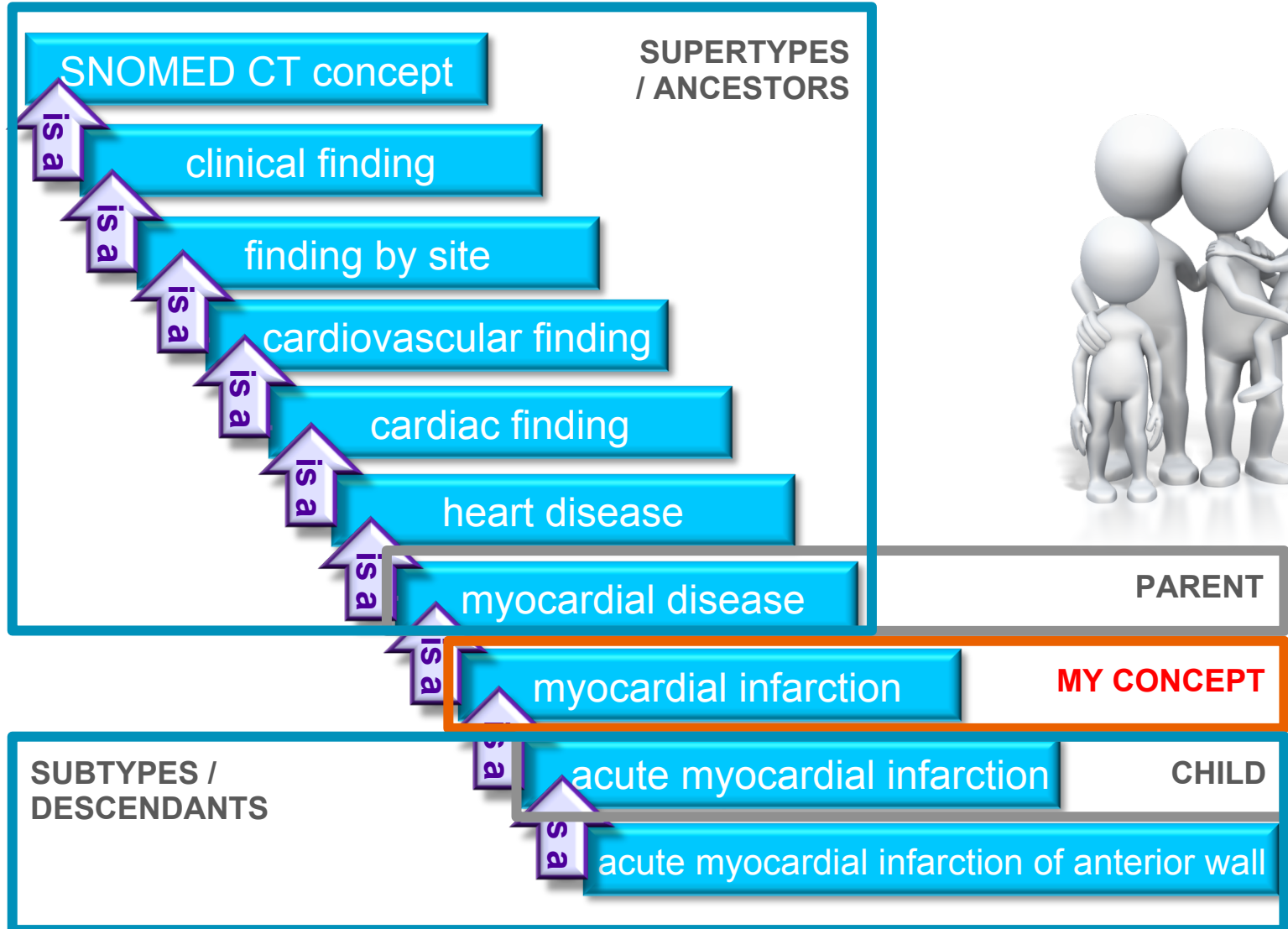
'is a' relationships form a subtype 'polyhierarchy'



# Subtype Relationships



# Subtype Relationships

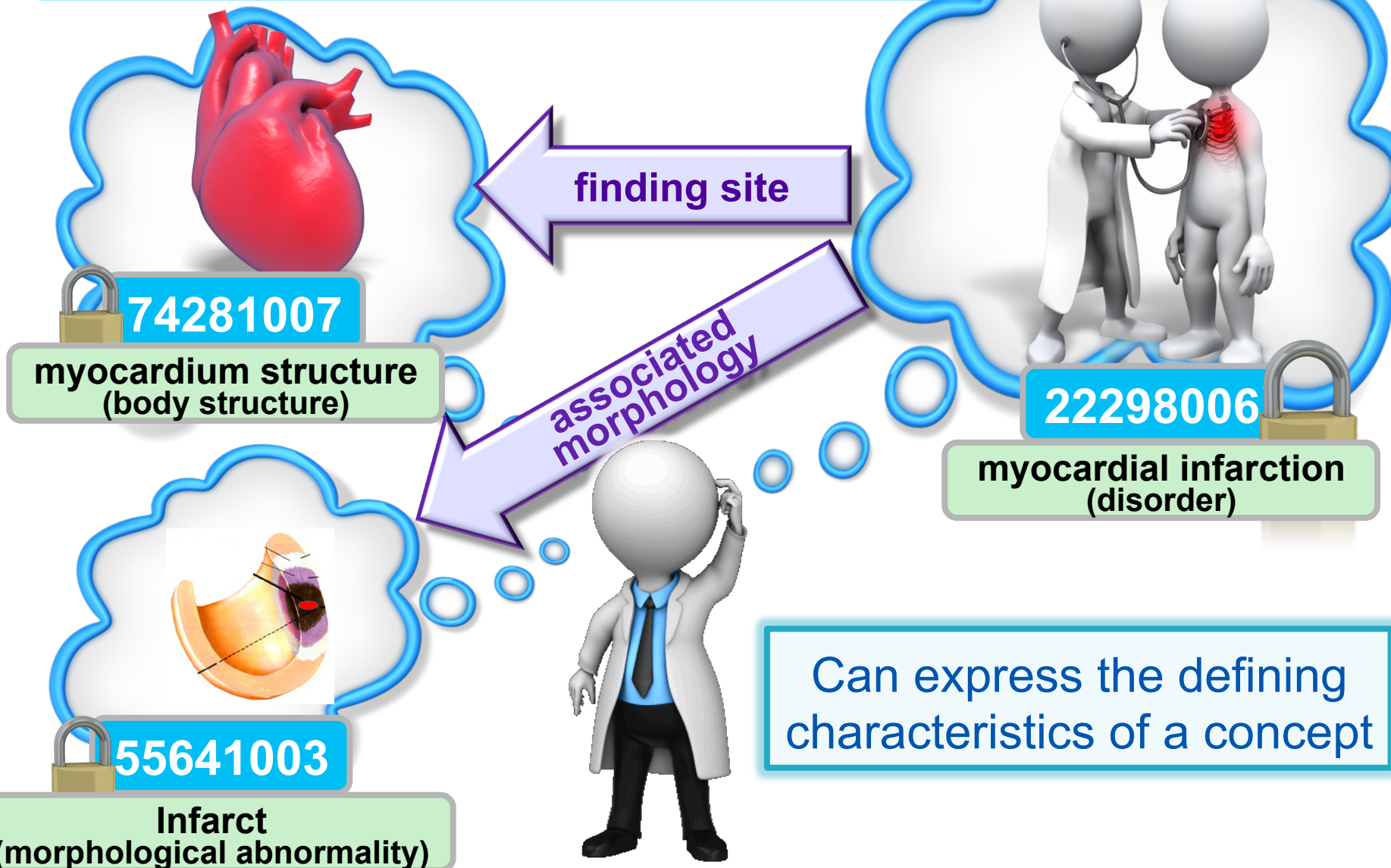


# SNOMED CT Content Hierarchies



- ▼ ● SNOMED CT Concept
  - ● Body structure (body structure)
  - ● Clinical finding (finding)
  - ● Environment or geographical location
  - ● Event (event)
  - ● Observable entity (observable entity)
  - ● Organism (organism)
  - ● Pharmaceutical / biologic product (product)
  - ● Physical force (physical force)
  - ● Physical object (physical object)
  - ● Procedure (procedure)
  - ● Qualifier value (qualifier value)
  - ● Record artifact (record artifact)
  - ● Situation with explicit context (situation)
  - ● SNOMED CT Model Component (metadata)
  - ● Social context (social concept)
  - ● Special concept (special concept)
  - ● Specimen (specimen)
  - ● Stages and scales (staging scale)
  - ● Substance (substance)

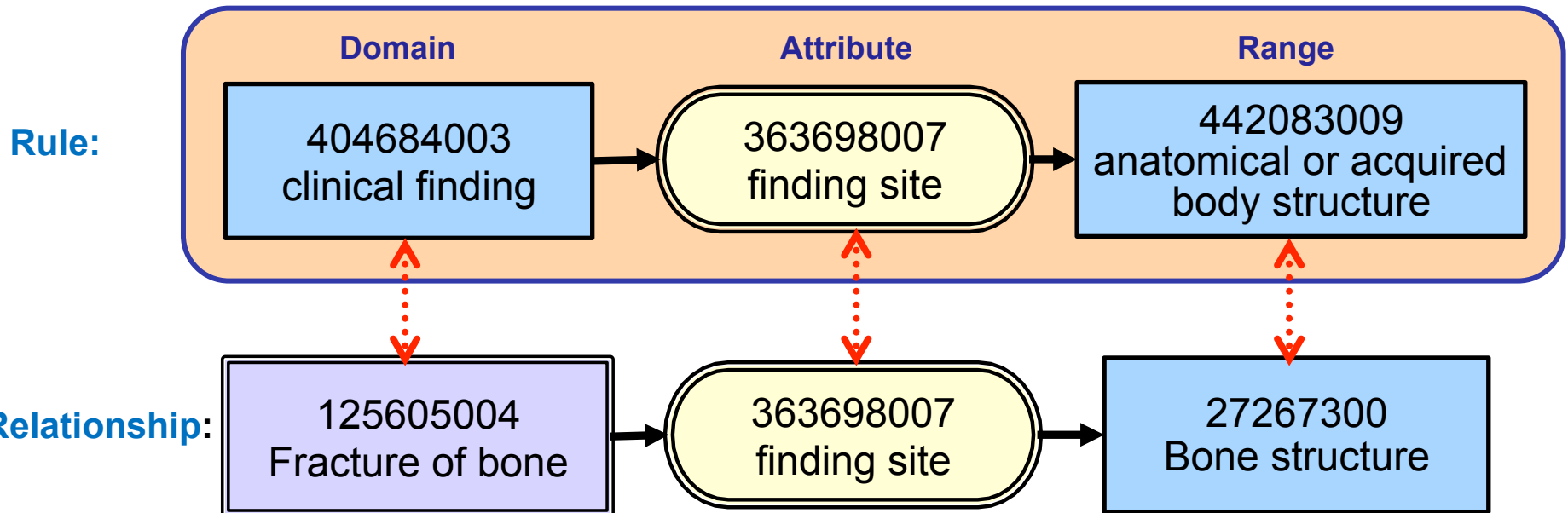
# Relationship



Can express the defining characteristics of a concept

# SNOMED CT Concept Model

- Rules for how SNOMED CT concepts are defined
  - Constrains the domain and range of each attribute
  - Defines some additional constraints (e.g. cardinality)
- Machine Readable Concept Model
  - Defines concept model rules in a computer processable way
  - Distributed with the international release of SNOMED CT



# SNOMED CT Languages

## 1. Compositional Grammar (<http://snomed.org/scg>)

To define a SNOMED CT expression

```
182201002 |Hip joint|: 272741003 |Laterality| = 24028007 |Right|
```

## 2. Expression Constraint Language (<http://snomed.org/ecl>)

To constrain the set of possible concepts or expressions

```
< 19829001 |Disorder of lung|:  
116676008 |Associated morphology| = << 79654002 |Edema|
```

## 3. Expression Template Language (<http://snomed.org/etl>)

To define incomplete expressions with slots that are filled later

```
< 404684003 |Clinical finding|:  
363698007 |Finding site| = [[ +id ]]
```

## 4. Expression Query Language

To query over SNOMED CT RF2 content



# Reference Set

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- A mechanism for representing references to SNOMED CT components to support many requirements including:
  - Subset – Limited search list or message data validation
  - Language – Preferred and acceptable descriptions in a dialect
  - Order – Prioritized display order in a search list
  - Alternative hierarchy – Navigational or aggregation
  - Annotation – Additional information about referenced component
  - Map – Maps to or from another code system





# Subset

A collection of components  
for a particular purpose

otic route

nasal route

gastrostomy route

oral route

subcutaneous route

## Route of administration subset

Id	Term
10547007	Otic route
46713006	Nasal route
127490009	Gastrostomy route
26643006	Oral route
34206005	Subcutaneous route

# Subset

A collection of components for a particular purpose

## Subset

Id	Term
82272006	Common cold
6142004	Influenza
55604004	Avian influenza

## Reference Set

id	effective Time	active	moduleId	refsetId	referenced ComponentId
0000d6608041-005b-5108-b608-07891b210365	20140731	1	19999999103	49999999102	82272006
00008774f374-5f54-5234-8af1-8aca6e73b5c2	20140731	1	19999999103	49999999102	6142004
00006ac9-2f97-5ed4-b37e-84cb158c388d	20140731	1	19999999103	49999999102	55604004

# Language Preferences

SNOMED  
International

## EN-AU language reference set

**FSN** myocardial infarction  
(disorder) 

**SYN** myocardial infarction 

**SYN** cardiac infarction

**SYN** heart attack

**SYN** MI – Myocardial  
infarction

**SYN** myocardial infarct



**22298006** 



# Language Preferences

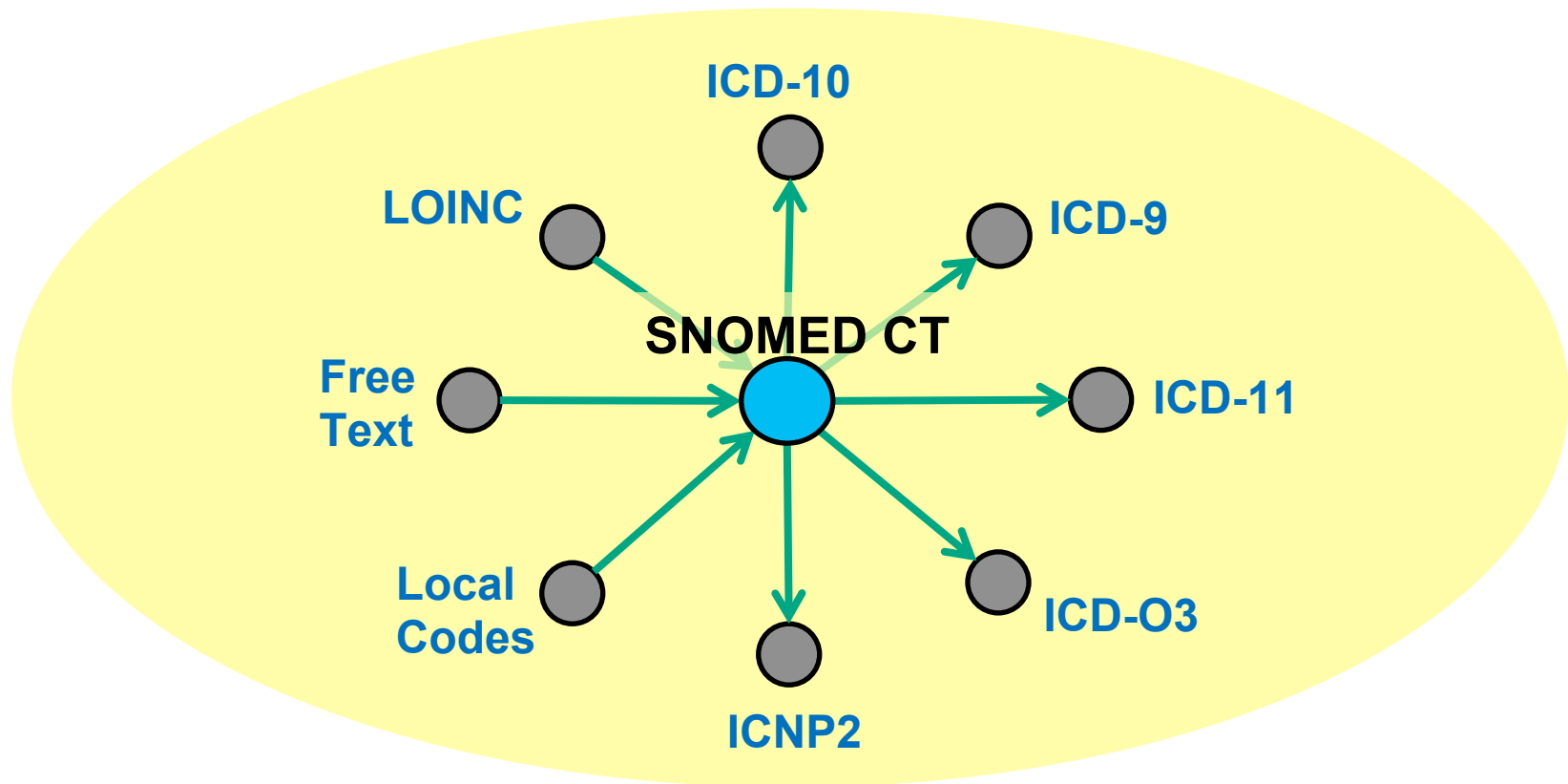


## EN-AU language reference set

SNOMED CT description		Acceptability	
751689013	myocardial infarction (disorder)	9000000000000548007	preferred
37436014	myocardial infarction	9000000000000548007	preferred
37442013	cardiac infarction	9000000000000549004	acceptable
37443015	heart attack	9000000000000549004	acceptable

# Maps SNOMED CT and Other Coding Systems

SNOMED CT acts as bridge between other code systems



Enables cross-domain queries and analysis

# Map Example

Between SNOMED CT and an external code system

## ICD-O simple map reference set

SNOMED CT concept		ICD-O code	
243930007	entire spine	C41.2	Vertebral column
372177002	entire nail plate	C44.9	Skin, NOS
61685007	lower limb structure	C76.5	lower limb, NOS
447643008	lipoma	8155/1	lipoma, NOS
127573000	neuroendocrine carcinoma, grade 2	8249/3	Neuroendocrine tumor, grade 2
447644002	benign stromal tumour	8935/0	stromal tumor, benign

# SNOMED International Collaboration

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- **WHO**
  - Maps to ICD-0, ICD-9 and ICD-10
  - US National Library of Medicine provides map to ICD-10-CM
  - SNOMED International and WHO cooperating on ICD-11
- **LOINC**
  - Links between SNOMED CT and LOINC minimize duplication and benefit users of both code systems
- **HL7**
  - Collaboration agreement to encourage use of SNOMED CT in HL7 messages, documents and resources
- **GMDN (Global Medical Device Nomenclature)**
  - Medical device terminology linked to SNOMED CT
- **ICN (International Council of Nursing)**
  - Joint work linking SNOMED CT and ICNP

# Extension

- Additional content for local use
  - To meet the needs of countries, specialties and realms
  - To meet vendor needs
  - To meet local business needs
- May include local
  - Concepts, relationships, descriptions
  - Subsets, Language, Maps
- Must have one or more authorized namespaces
  - Ensures global uniqueness of identifiers



21782 1000132 10 5



# Analytics with SNOMED CT



# Analytics with SNOMED CT

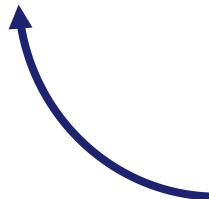
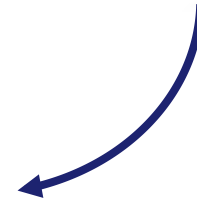
## Clinical assessment and treatment



## Population monitoring



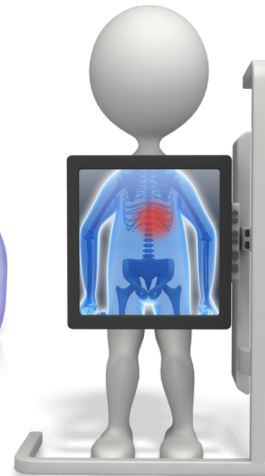
## Research



**PATIENT: 1961-06-21 Harry Smith**

**Diagnosis (SNOMED CT)**

75570004 | Viral  
pneumonia (disorder) |



# Parents

- ☰ Infective pneumonia (disorder)
- ☰ Viral lower respiratory infection (disorder)

☰ Viral pneumonia (disorder)

SCTID: 75570004

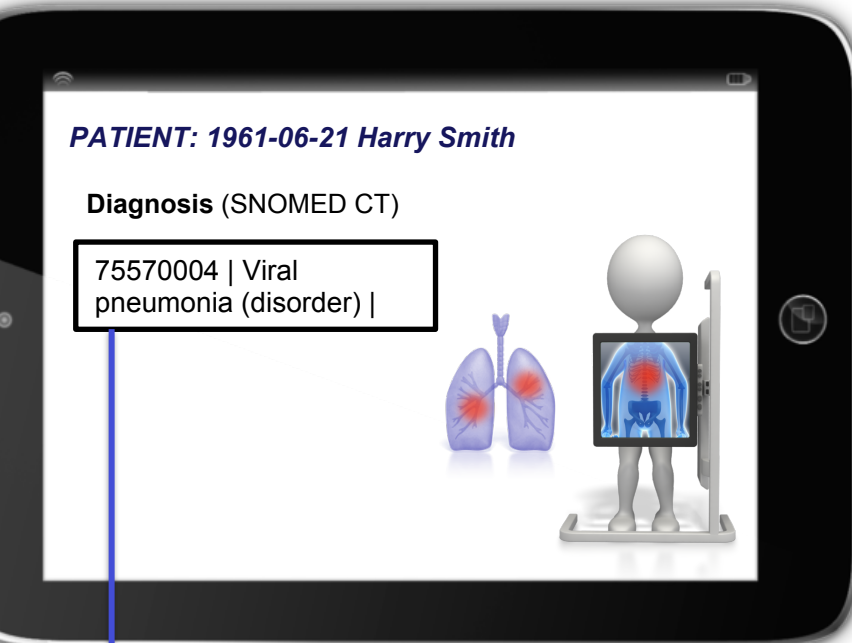
75570004 | Viral pneumonia (disorder) |



Pathological process → Infectious process  
Associated morphology → Inflammation and consolidation  
Finding site → Lung structure  
Causative agent → Virus

Pathological process → Infectious process  
Associated morphology → Inflammation and consolidation  
Finding site → Lung structure  
Causative agent → Virus

# SNOMED CT Supports Meaningful Health Records



Does patient have respiratory disorder?

**Yes:** subtype of respiratory disorder

Does patient have an infection?

**Yes:** subtype of infectious disease

Does the disorder affect the lung?

**Yes:** finding site is lung structure

Is the disorder caused by a virus?

**Yes:** causative agent is virus

75570004  
| Viral pneumonia  
(disorder) |

# Analytics with SNOMED CT

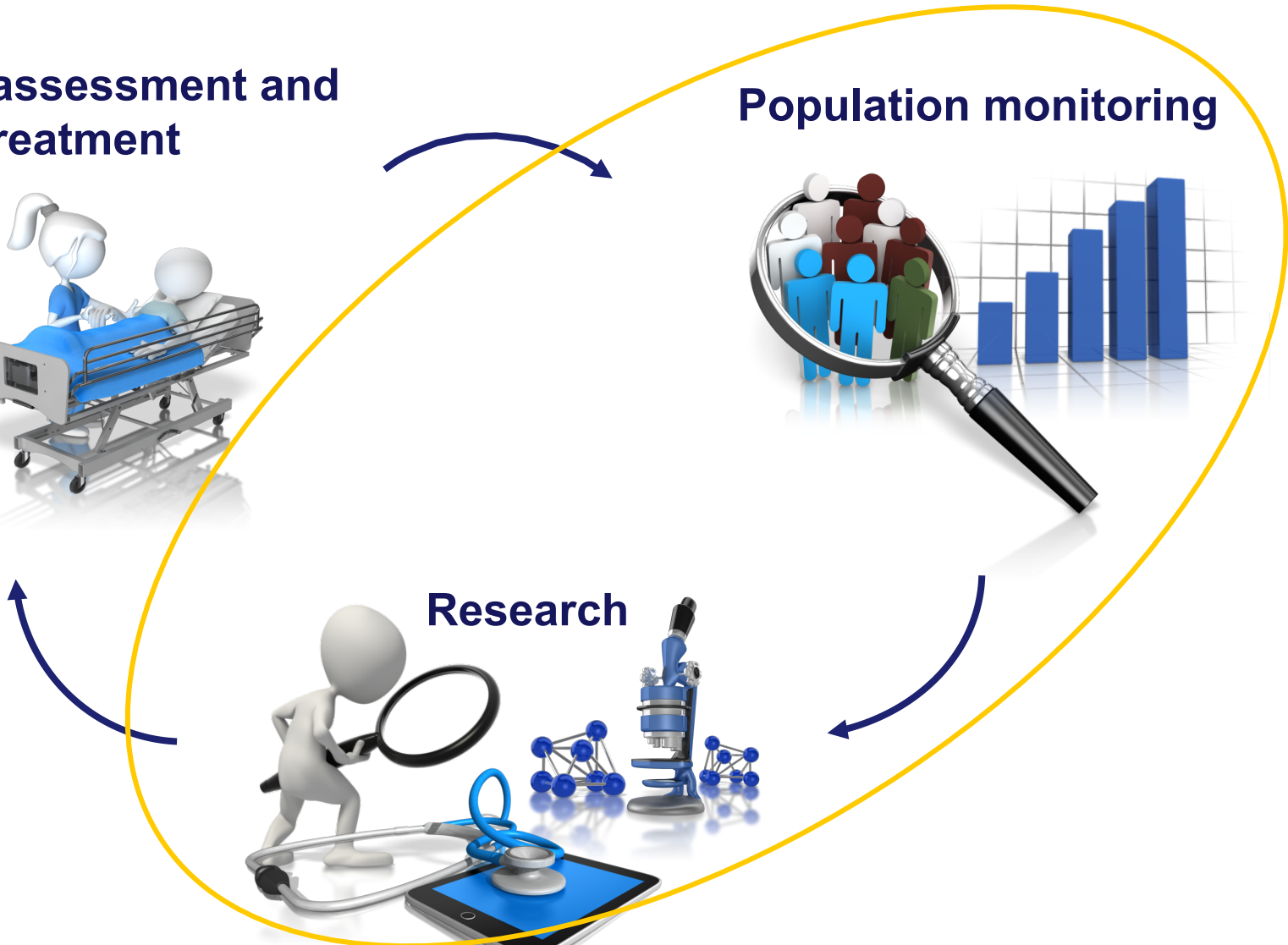
## Clinical assessment and treatment

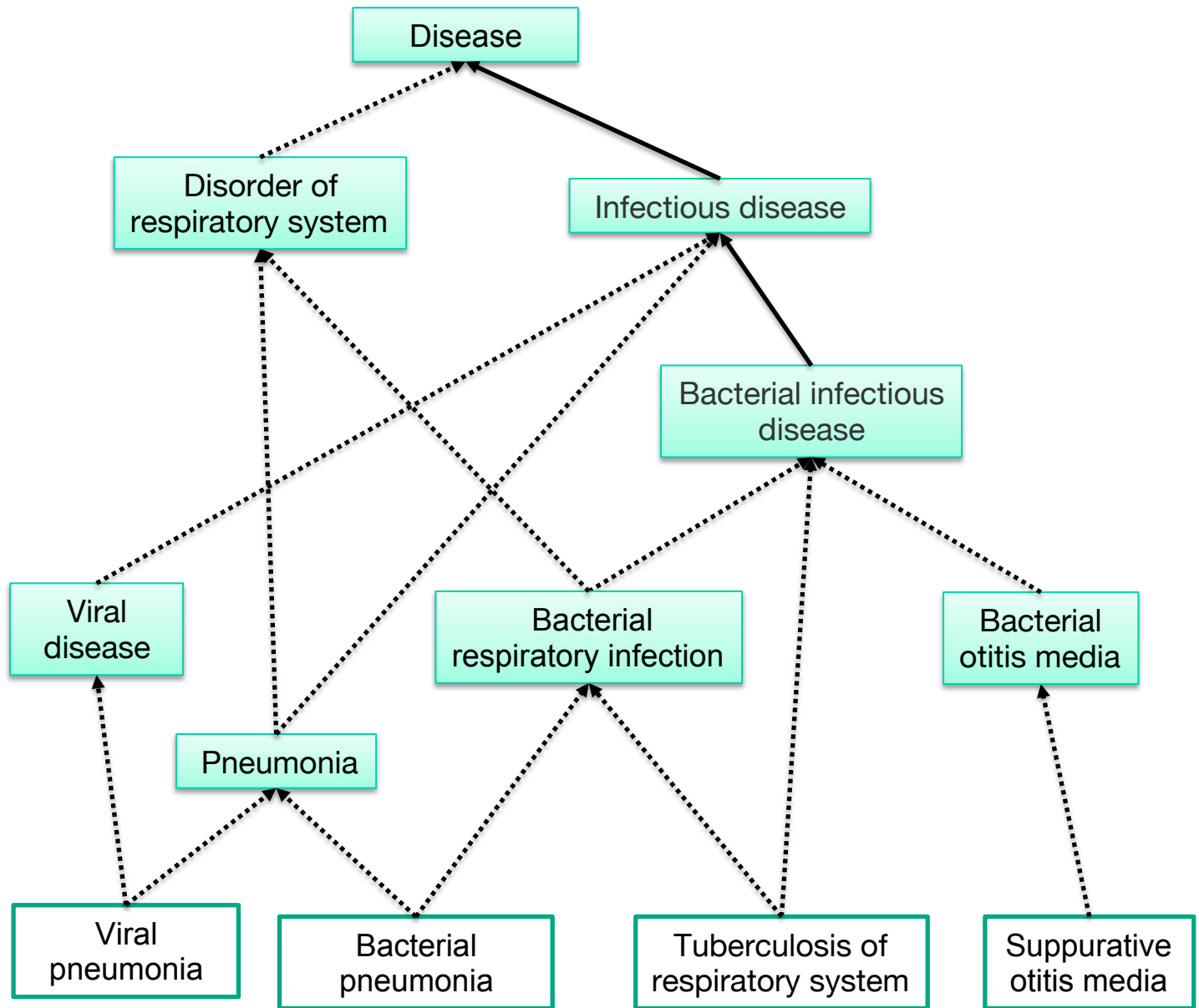
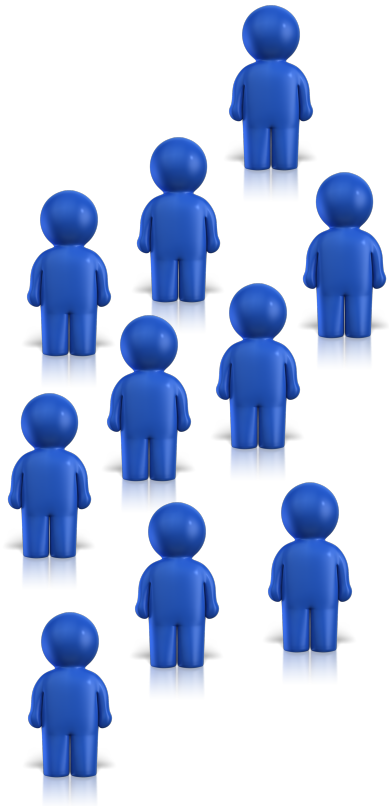


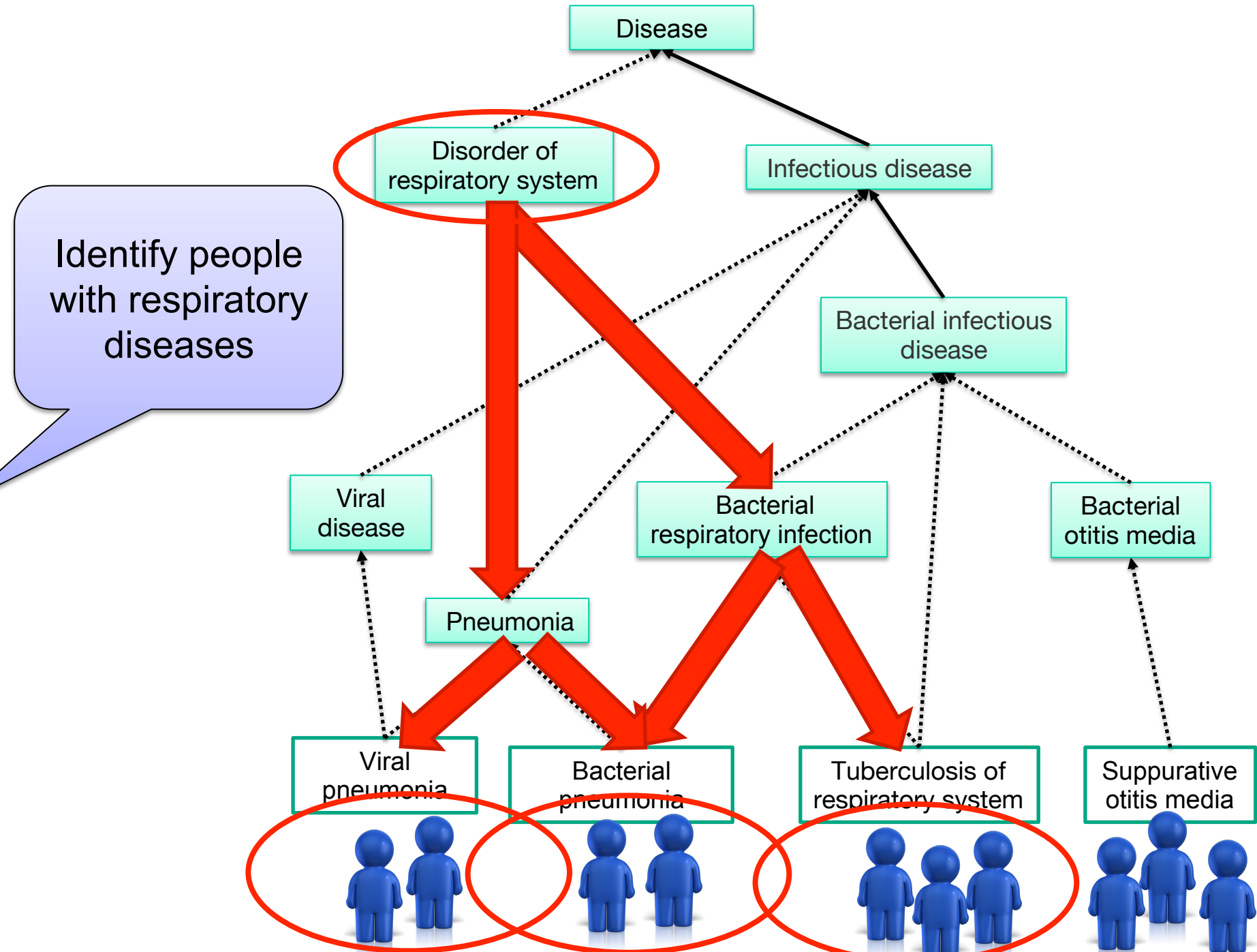
## Population monitoring



## Research







Identify people with respiratory diseases

Disease

Disorder of respiratory system

Infectious disease

Bacterial infectious disease

Viral disease

Bacterial respiratory infection

Bacterial otitis media

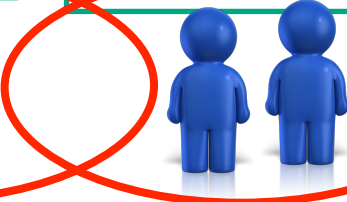
Pneumonia

Viral pneumonia

Bacterial pneumonia

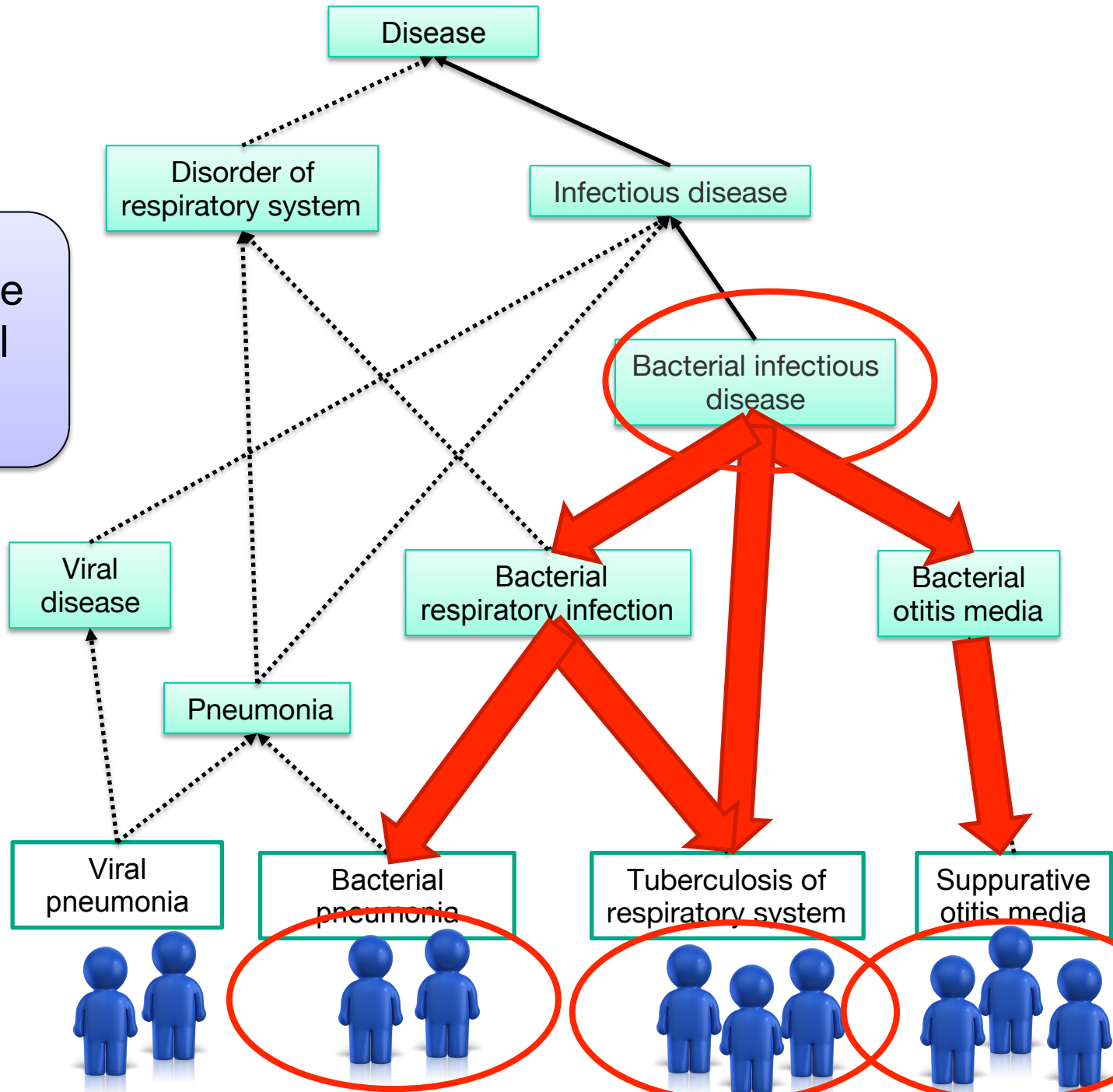
Tuberculosis of respiratory system

Suppurative otitis media



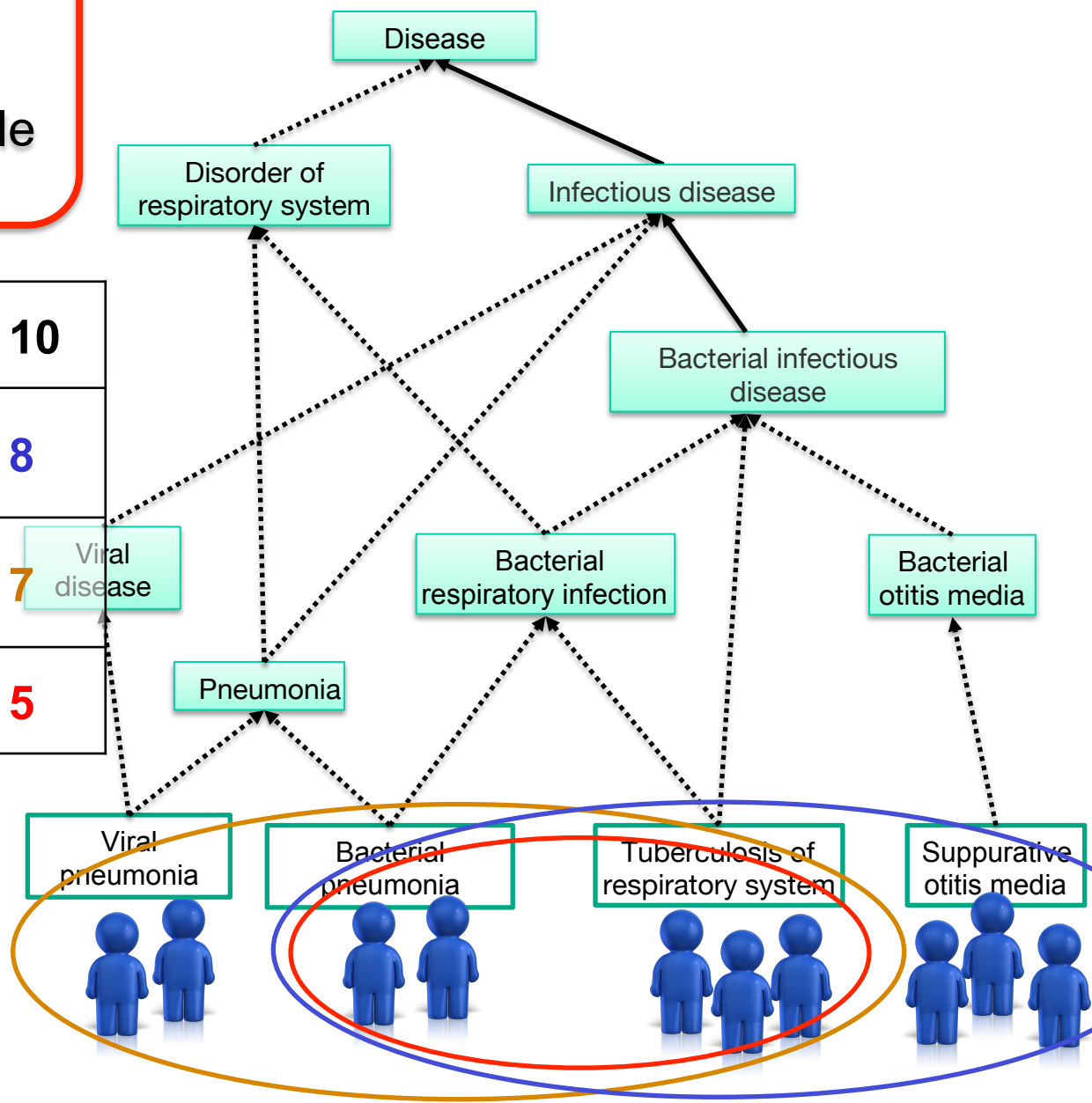


Identify people with bacterial infections



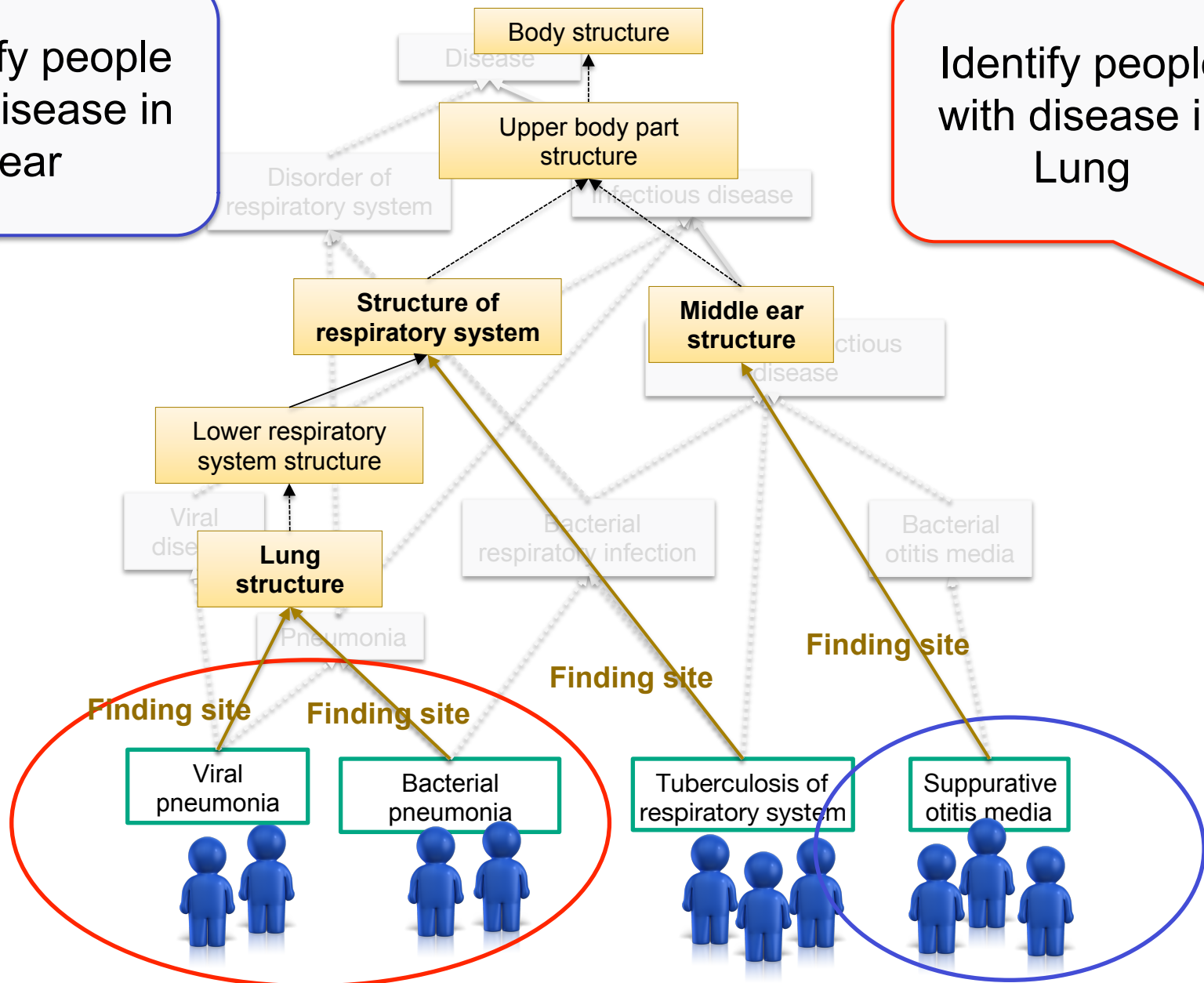
**Note:** When using SNOMED CT for querying, strategies exist to prevent double counting

<b>Patient count</b>	<b>10</b>
<b>Bacterial infectious diseases</b>	<b>8</b>
<b>Disorder of respiratory system</b>	<b>7</b>
<b>Double counts</b>	<b>5</b>



Identify people with disease in ear

Identify people with disease in Lung



**Learn More  
About  
SNOMED CT**



# Learning More E-Learning Presentations and Courses

- SNOMED E-Learning: <http://snomed.org/elearning>
  - Create a free account
  - Enroll on a course or browse our learning materials
- SNOMED E-Learning
  - Formal Courses with Assessments
    - Foundation
    - Implementation
    - Content Development
  - Self Guided Learning Pathways
    - Data Analysts
    - Developers
  - Open Access
    - All account holders have access to ~100 presentations



# Learning More SNOMED CT Document Library

<http://snomed.org/doc>

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International

- **Introductory Guides**
  - Starter Guide <http://snomed.org/sg>
  - Vendor Introduction <http://snomed.org/vendorintro>
  - Member (NRC) Guide <http://snomed.org/nrcguide>
- **Specifications and Technical Guidance**
  - Release file specifications
  - Computable language specifications
  - Terminology and record services
- **Practical Guides**
  - Search      Decision Support
  - Data Entry   Reference Sets
  - Analytics    Extensions\*
- **Explore SNOMED CT Content**
  - <http://snomed.org/browser>



# Additional Information

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- SNOMED International website  
<http://snomed.org>
- SNOMED CT Browser  
<http://snomed.org/browser>
- SNOMED CT Document Library  
<http://snomed.org/doc>
- SNOMED CT Starter Guide  
<http://snomed.org/sg>
- SNOMED CT E-Learning server  
<http://snomed.org/elearning>
- SNOMED CT Tools  
<http://snomed.org/tools>



# Questions and Discussion

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Contact: [info@snomed.org](mailto:info@snomed.org)  
Website: [www.snomed.org](http://www.snomed.org)