SNOMED International

Delivering SNOMED CT

SNOMED CT Global Trends and Developments

16th June 2022

Dr Linda Bird

Implementation Support Lead

DR LINDA BIRD

Implementation Support Lead

SNOMED International

Background

- Information Technology (BIT PhD)

Work History

- Tech companies (AU, US)
- National E-Health (AU)
- MoHH (Singapore)
- SNOMED Int (2014+)

Areas of Interest

- Clinical terminology
- Drug dictionaries
- EHR implementation
- Information modelling
- Data analytics
- ECL, ETL and SCG
- HL7 FHIR

Overview

- Introduction
- Past trends
- Focus areas
- Discover more

Introduction

snomed.org @snomedct linkedin.com/company/ihtsdo/

SNOMED International

SNOMED International: Delivering SNOMED CT

What is SNOMED CT?

The world's most comprehensive multilingual clinical terminology

Comprehensive Scope

SNOMED International

- Not-for-profit based in the UK
- Delivers international edition of SNOMED CT
- Owned and funded by our Members
- Governed by our GA and MB

Canada Health Infoway

- Delivers Canadian Edition of SNOMED CT and other supporting services

42 SNOMED Members (June 2022)

Argentina	Czech Republic	Israel	Norway	Switzerland
Armenia	Denmark	Jordan	Portugal	Thailand
Australia	Estonia	Kazakhstan	Saudi Arabia	United Arab Emirates
Austria	Finland	Lithuania	Singapore	United Kingdom
Belgium	Germany	Luxembourg	Slovakia	United States
Brunei	Hong Kong, China	Malaysia	Slovenia	Uruguay
Canada	Iceland	Malta	Republic of Korea	
Chile	India	Netherlands	Spain	
Cyprus	Ireland	New Zealand	Sweden	

SNOMED CT
Concept

A clinical idea with a

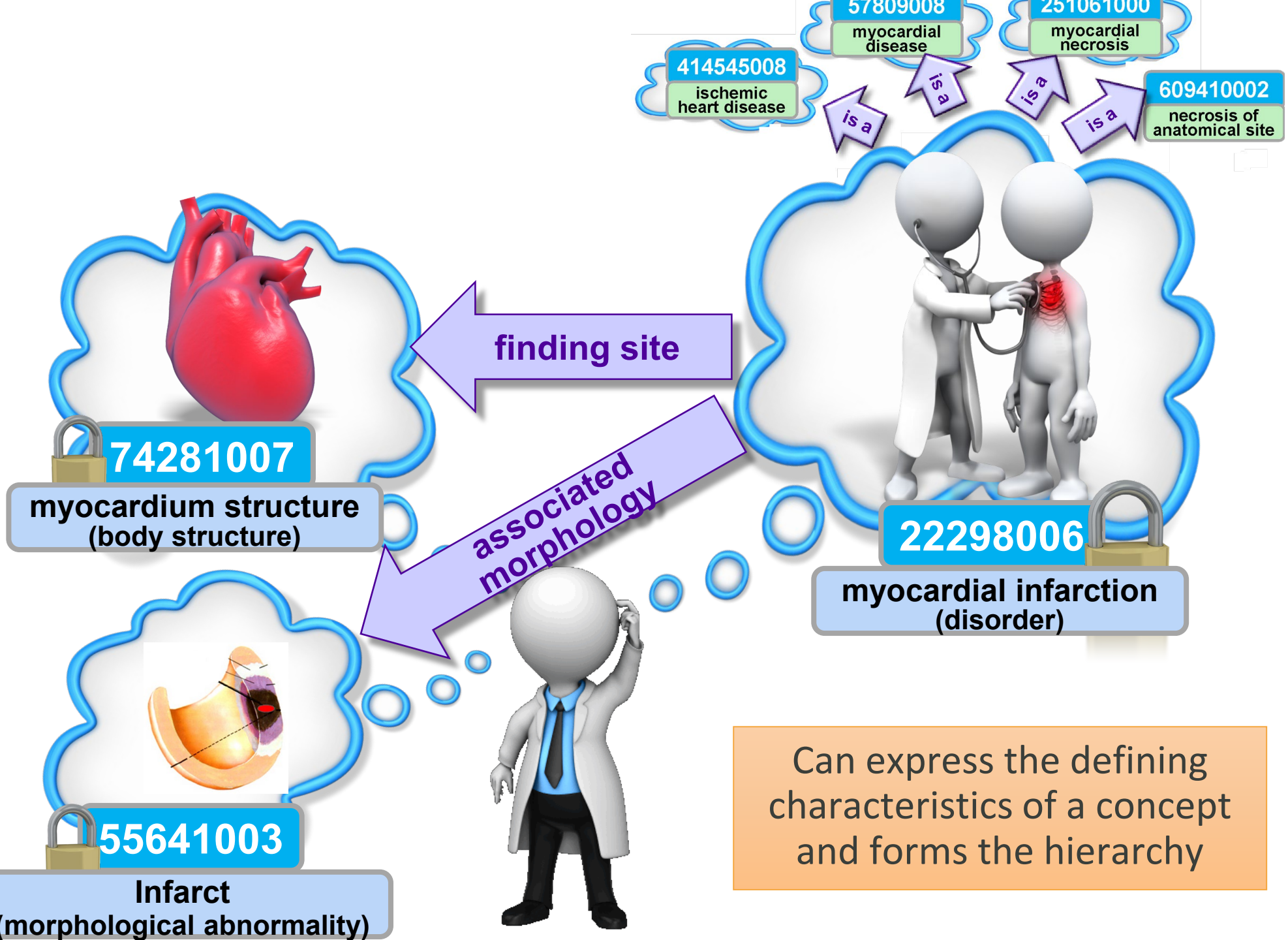
unique identifier

SNOMED CT Description

FSN	myocardial infarction (disorder)	751689013
SYN	myocardial infarction	37436014
SYN	cardiac infarction	37442013
SYN	heart attack	37333015
FR		
SYN	infarctus du myocarde	5861000077119
SYN	infarctus cardiaque	50011331000188114

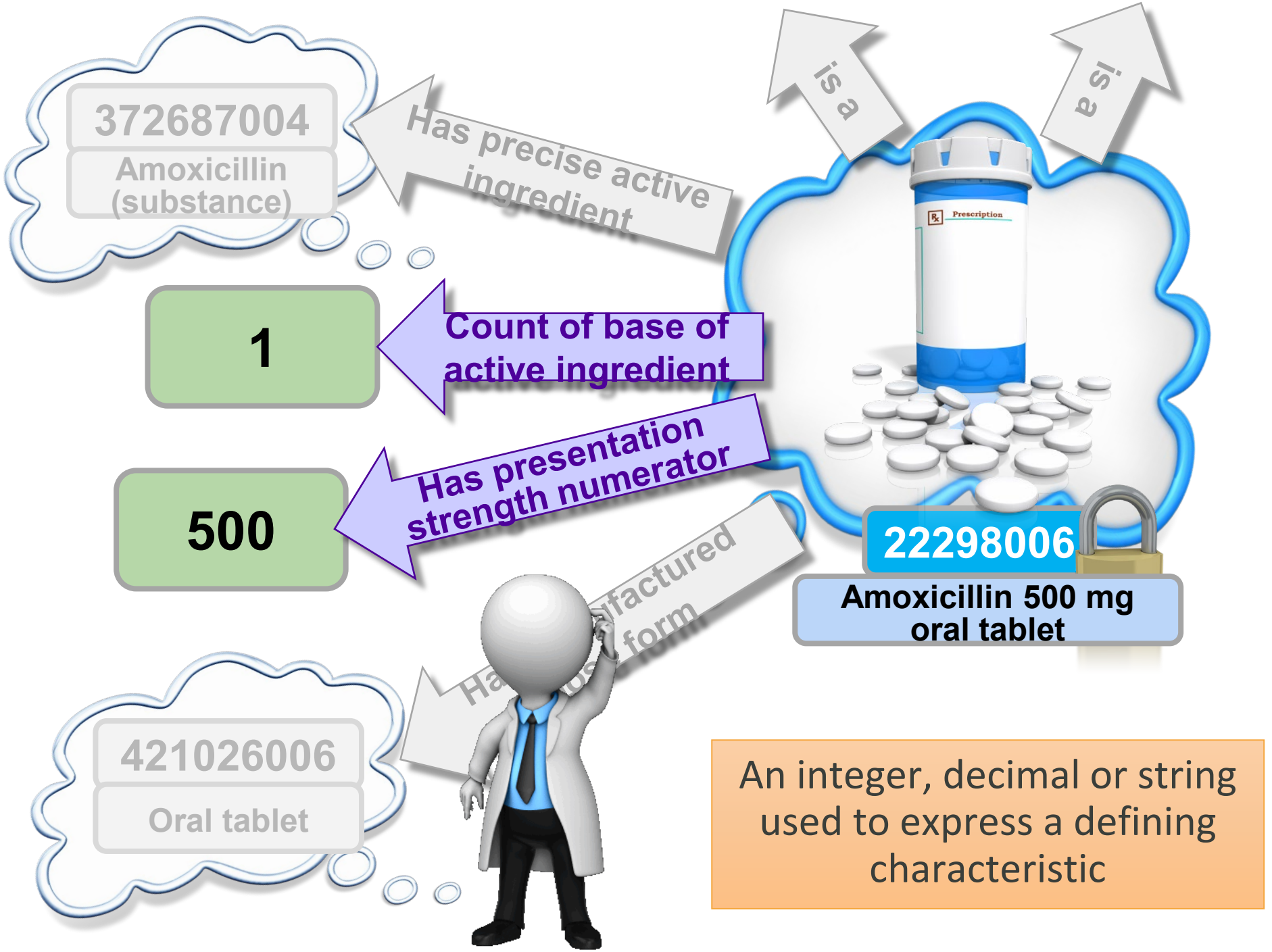
SNOMED International

Attribute Relationships



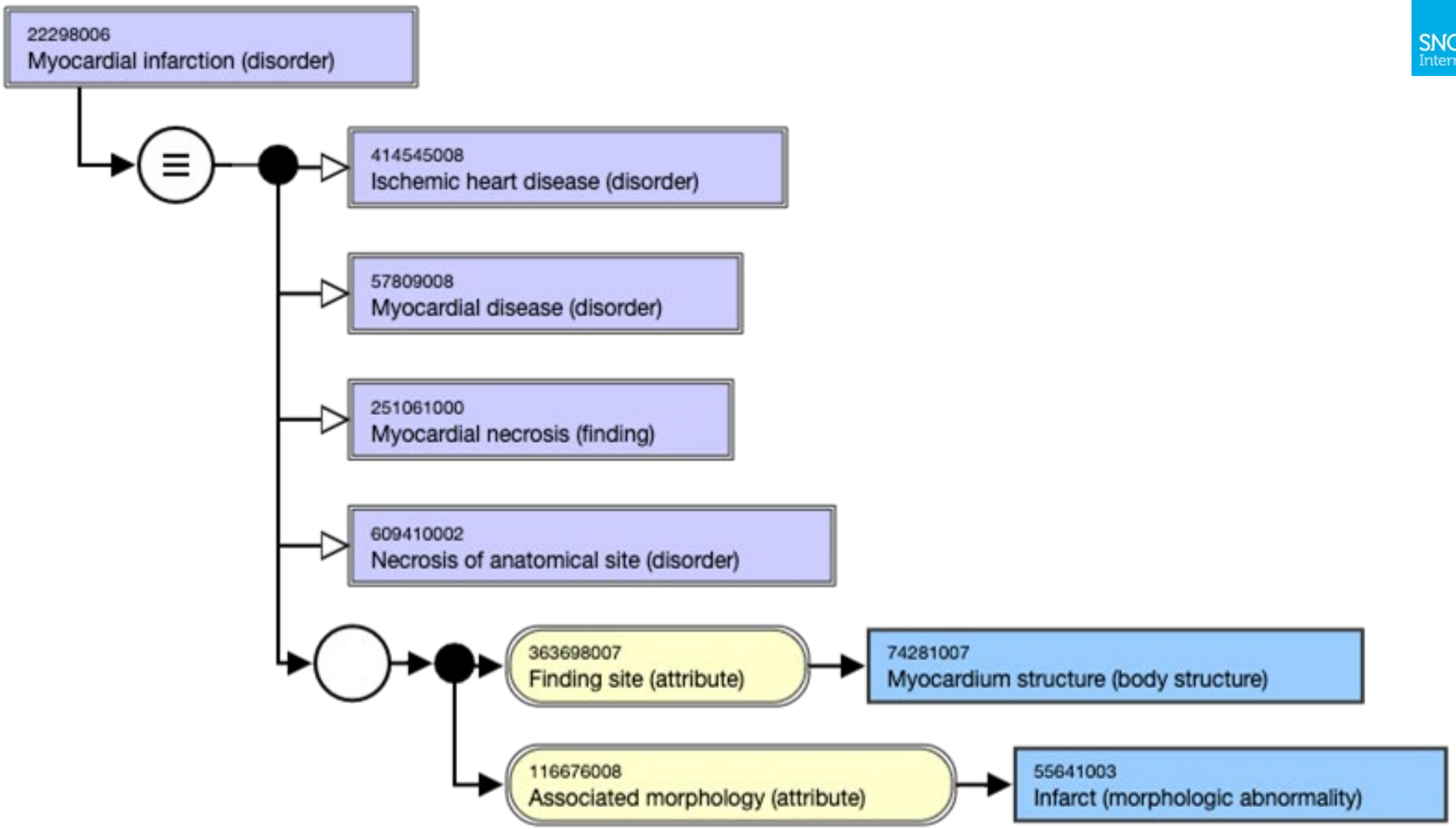
Can express the defining characteristics of a concept and forms the hierarchy

Concrete Value Relationships

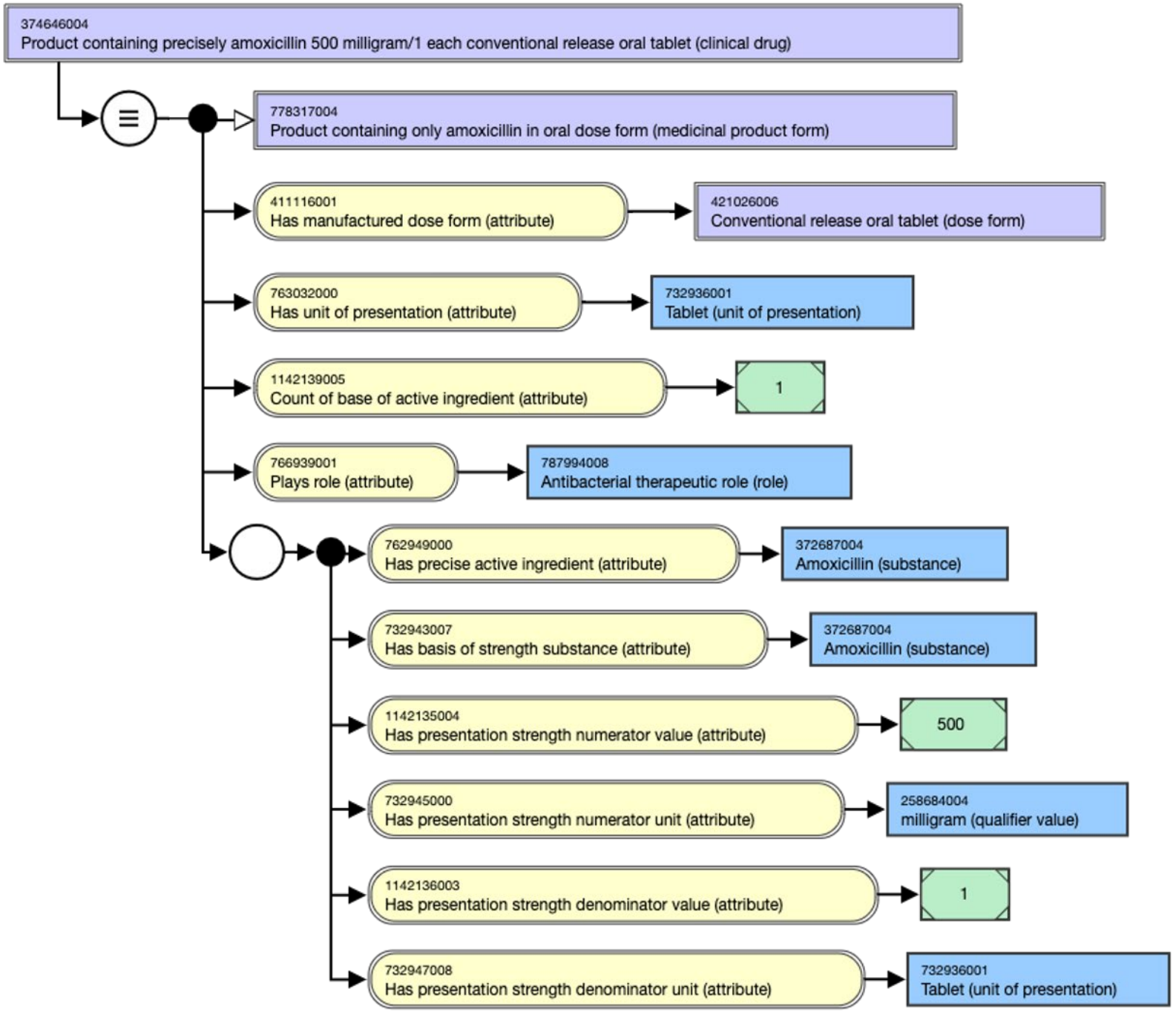


An integer, decimal or string used to express a defining characteristic

Myocardial infarction

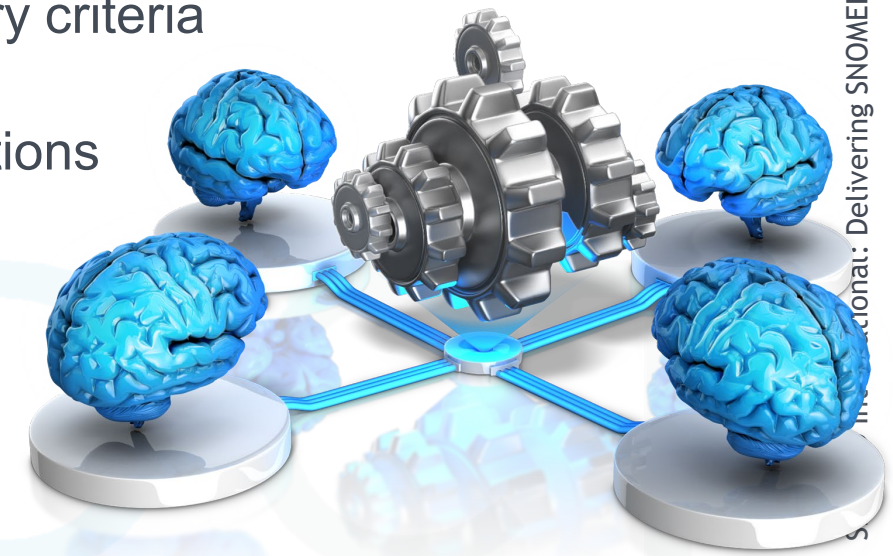


Amoxicillin 500 mg oral tablet



SNOMED CT Additional Features

- Machine Readable Concept Model
  - Provides rules for processing clinical meaning
- Computable Languages
  - Expressions, expression constraints, expression templates
  - Enable meaning-based queries over more than just concepts
- Reference Sets
  - Represent subsets of concepts to help define query criteria
  - Define maps to/from SNOMED CT
  - Define sets of language or dialect specific descriptions
- Description Logic
  - Computational reasoning and powerful queries



SNOMED CT Additional Features

- Broad Domain Coverage
  - Enables queries across disciplines, specialties and clinical areas
- Robust Versioning
  - Helps to manage queries over longitudinal health records
- International
  - Enables sharing of coded data, queries, subsets and maps between countries
- Localization Mechanisms
  - Allows queries to be applied to data from different countries, dialects, regions & applications

Past Trends

snomed.org @snomedct linkedin.com/company/ihtsdo/

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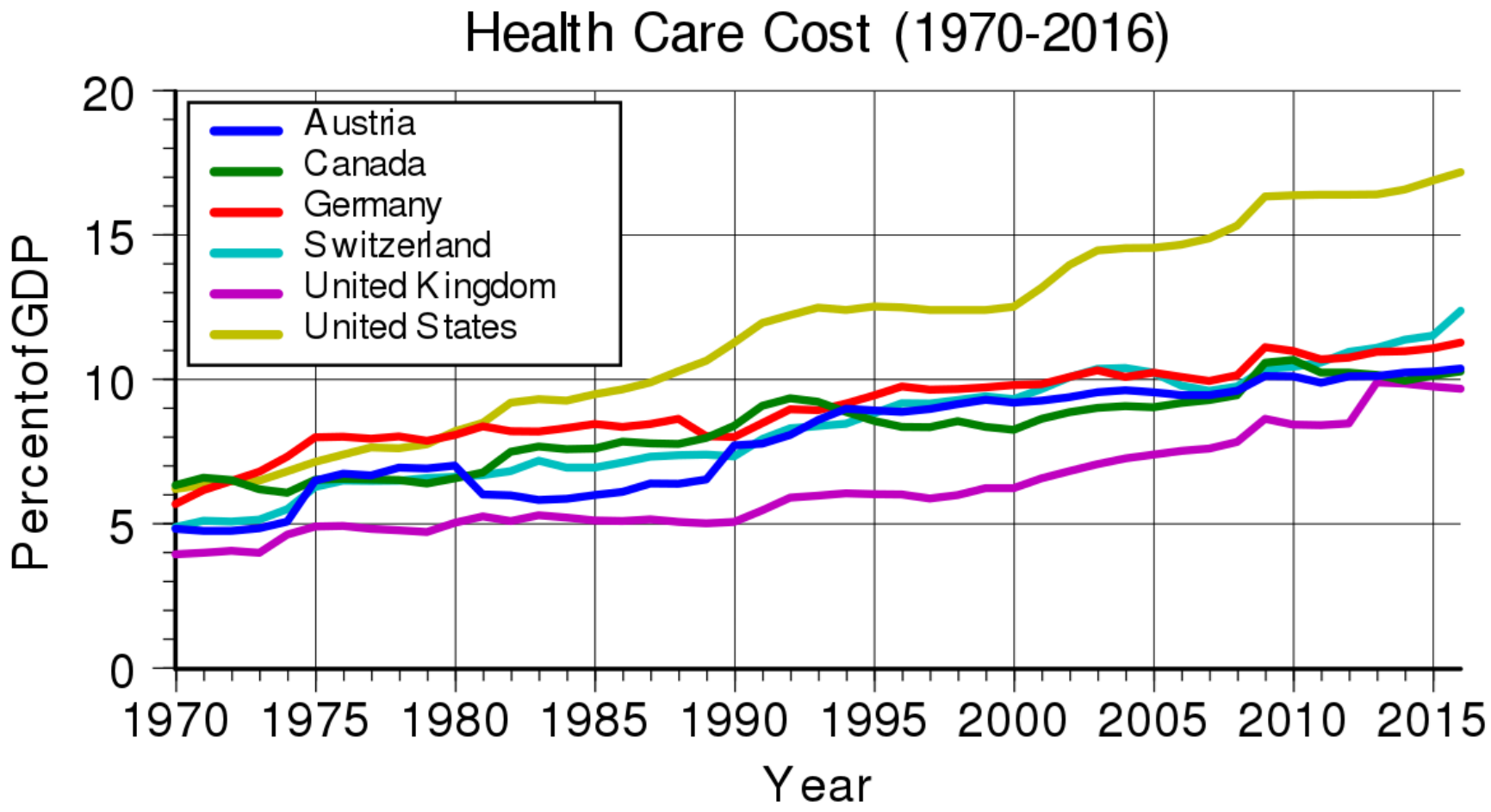
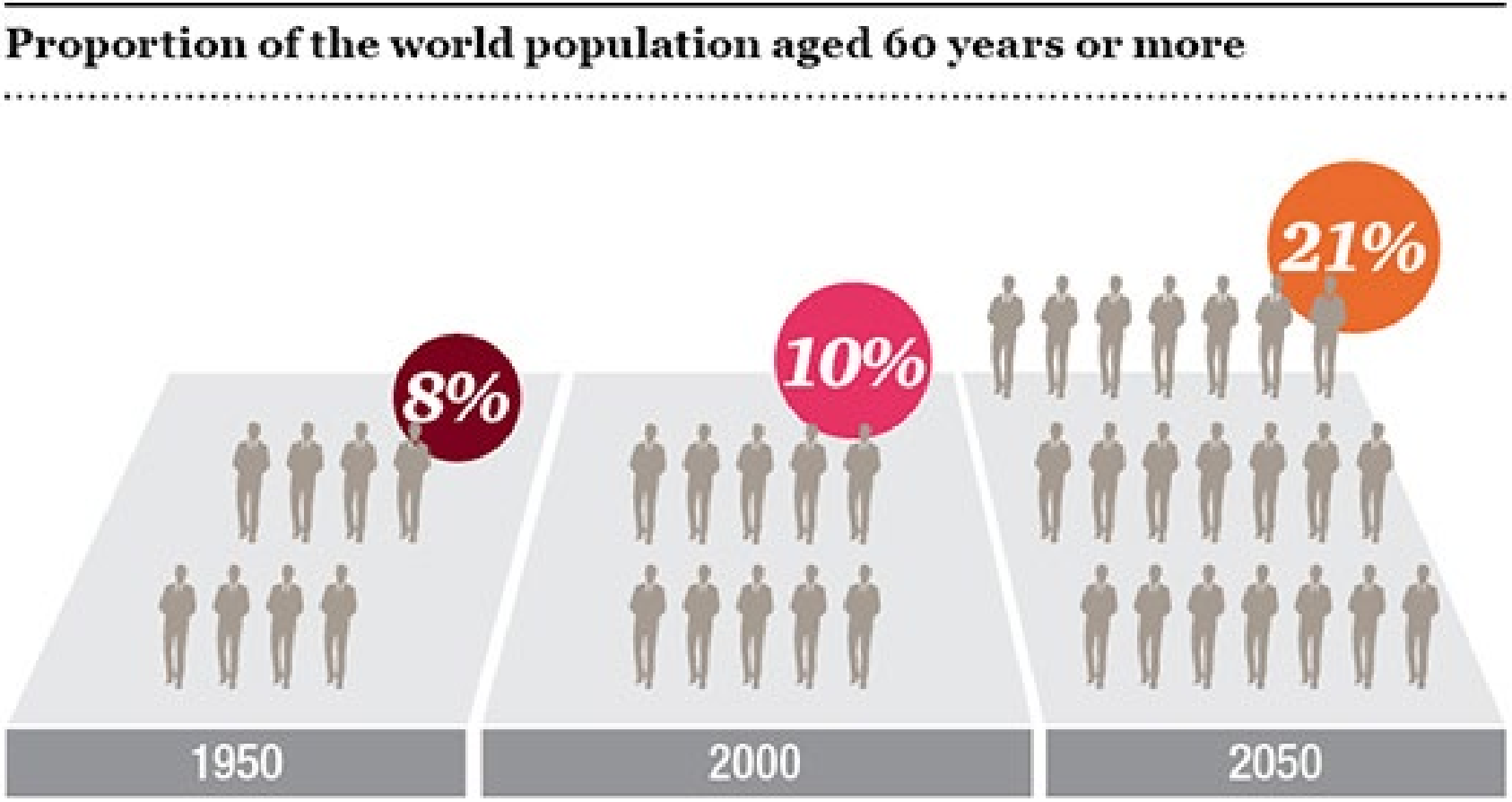
SNOMED International: Delivering SNOMED CT

Healthcare Costs

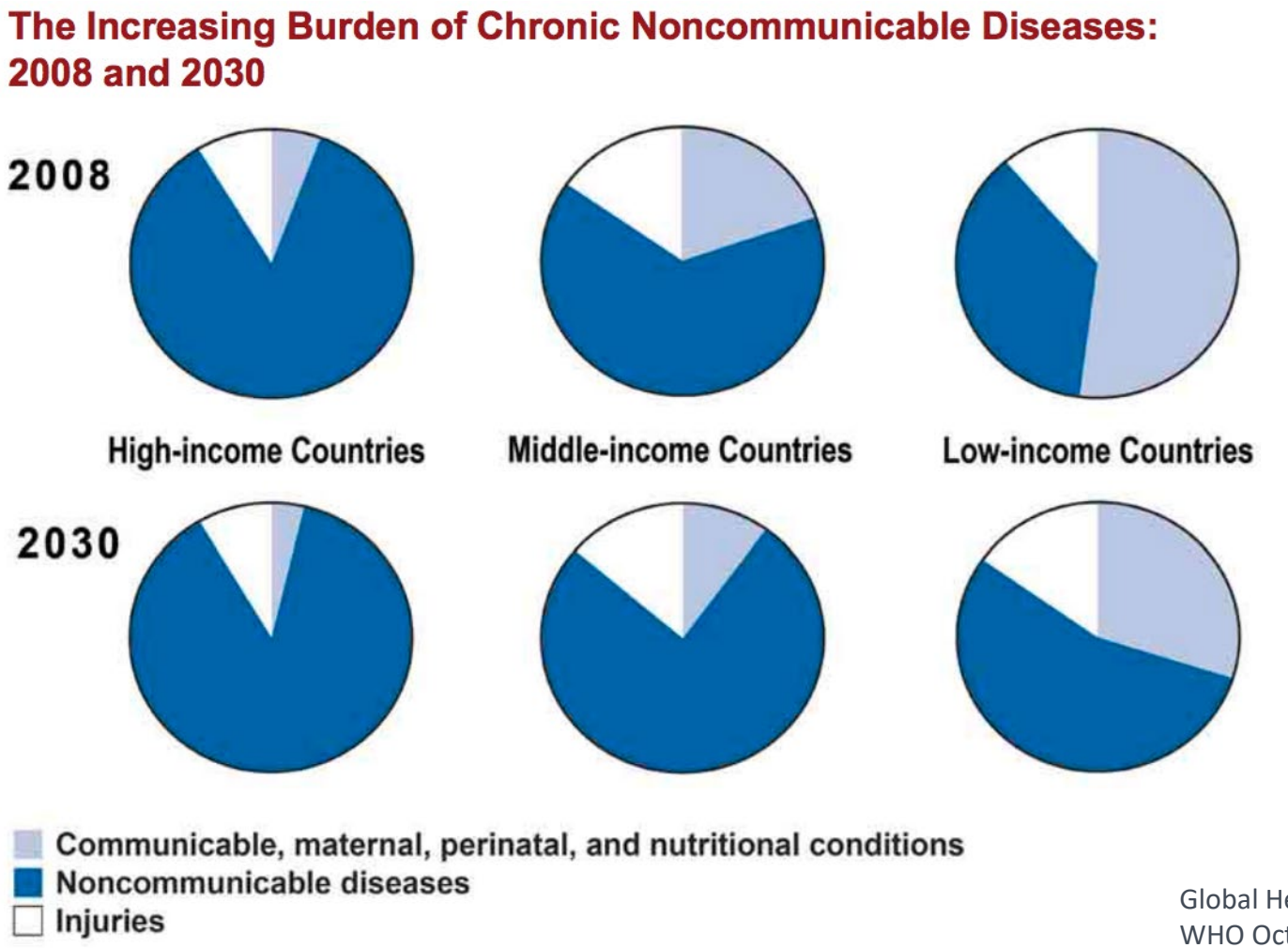


Ageing Population



Source: UN report World Population Ageing 1950-2050

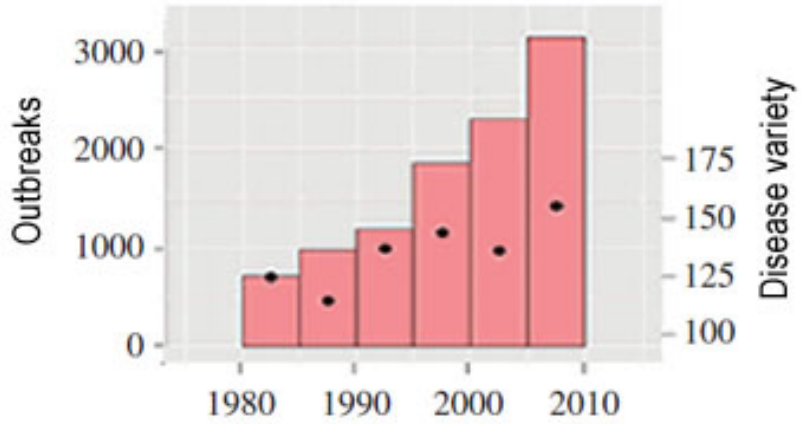
Chronic Diseases



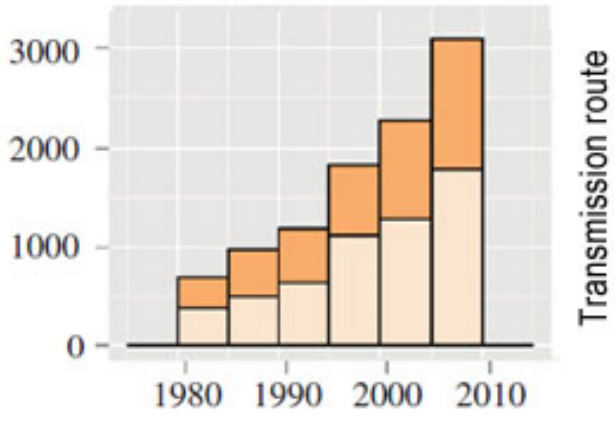
Global Health and Ageing
WHO Oct 2011

Infectious Diseases

Outbreaks rise and change, while per-outbreak cases fall

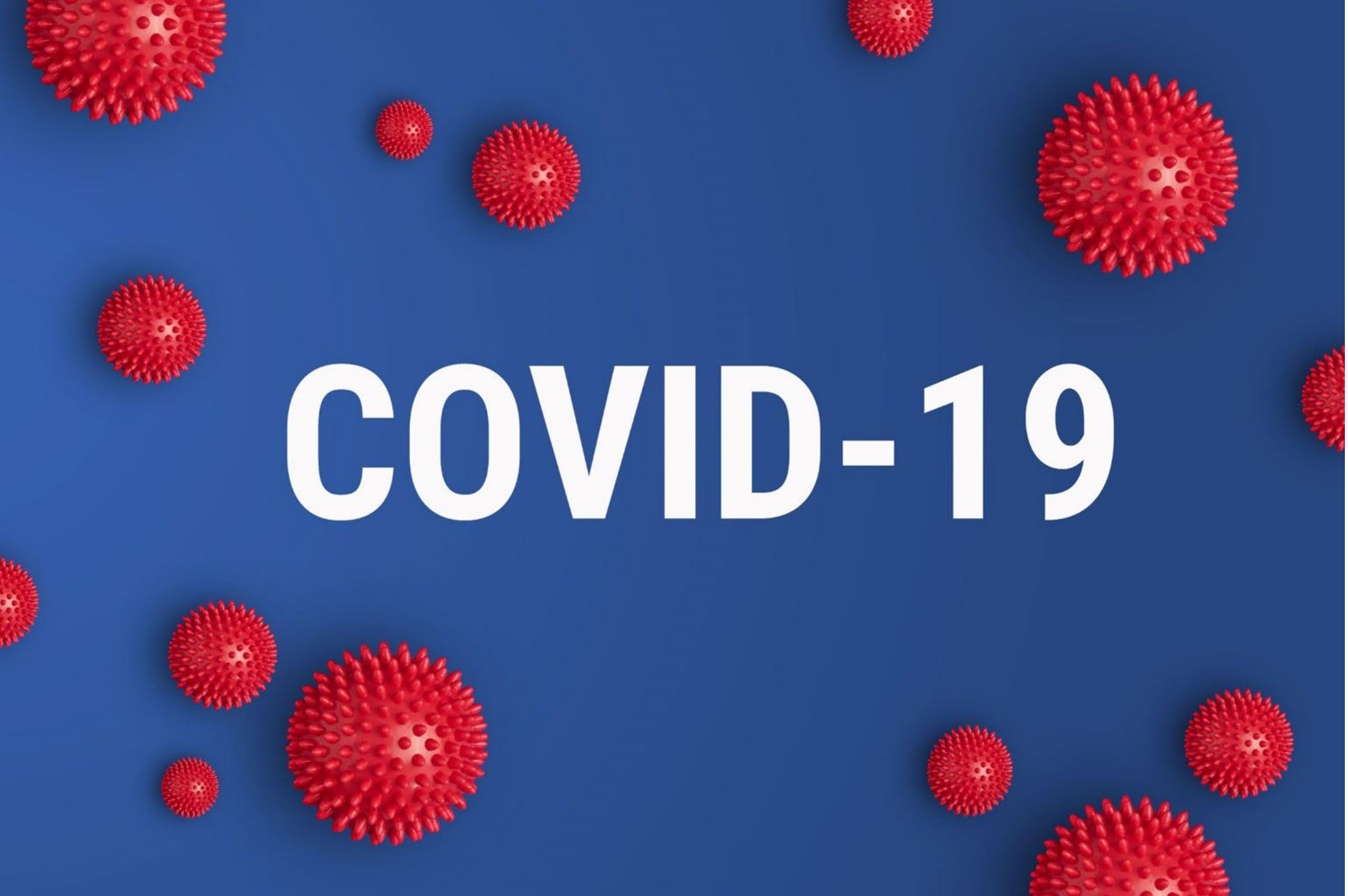


Since 1980 the global number of disease outbreaks has risen (pink bars, left axis) while the variety of diseases (dots, right axis) has also increased.



The proportion of diseases transmitted by animals and other vectors (in tan) has also risen relative to those that are human-specific (in brown).

"Global Rise in Human Infectious Disease Outbreaks," *Journal of the Royal Society Interface*, 2014

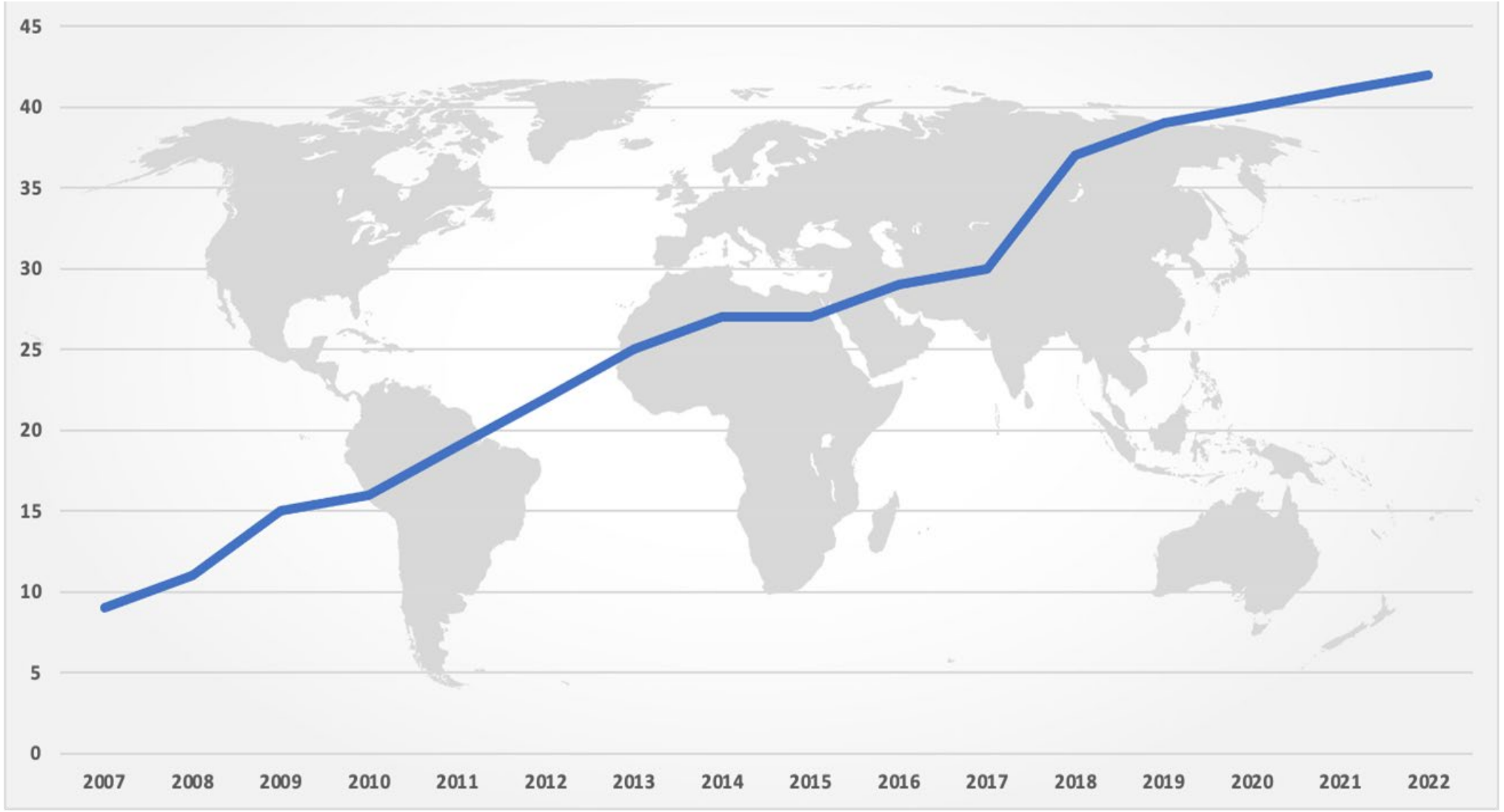


SNOMED International

SNOMED International: Delivering SNOMED CT

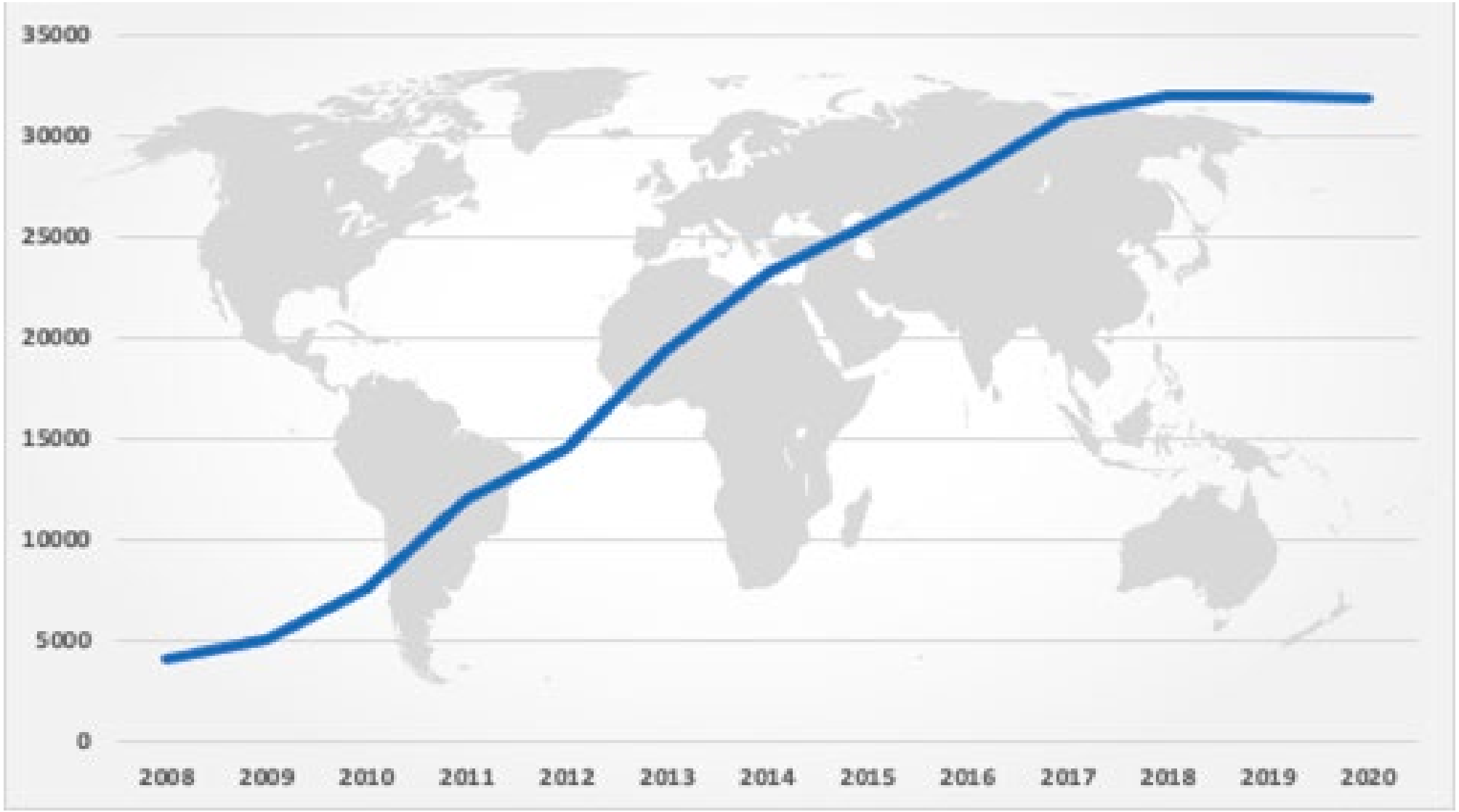
SNOMED International Membership Growth

2007 - 2022

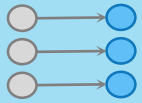
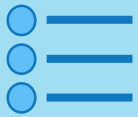
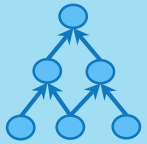
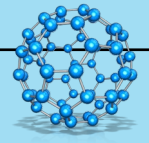
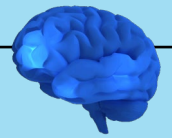


SNOMED International Affiliate Growth

2008 - 2021



SNOMED CT Implementation Maturity

	**Level 0: PLANS TO USE SNOMED CT**
	Not yet used, but there are plans to do so. Current text and other codes.
	**Level 1: MAPPING TO SNOMED CT**
	SNOMED CT not directly recorded in record. Mapping is required.
	**Level 2: SIMPLE CODE SYSTEM**
	SNOMED CT is directly recorded in record. Used as a flat list of codes.
	**Level 3: HIERARCHY**
	Level 2 + used as hierarchy of codes to support various system functions.
	**Level 4: SEMANTIC NETWORK**
	Level 3 + used as a semantic network of relationships and simple ECL
	**Level 5: ADVANCED USE**
	Level 4 + used as an ontology using DL, MRCM, ECL etc

SNOMED CT Focus Areas

SNOMED CT Focus Areas

1. Improving the quality and responsiveness
2. Need for standardized international data sharing
3. Implementation, implementation, implementation

SNOMED CT Focus Areas

1. **Improving the quality and responsiveness**
2. Need for standardized international data sharing
3. Implementation, implementation, implementation

Quality and Responsiveness

- Increasing semantic expressivity
- Quality improvement initiative
- More frequent international releases
- Flexible delta generation

Quality and Responsiveness

Increasing Semantic Expressivity

- In July 2019 stated relationships were replaced with Description Logic axioms to increase the expressive power of SNOMED CT
- Enables sufficient conditions (GCIs), multiple alternative definitions, property chains etc
- In July 2021 concrete values were added

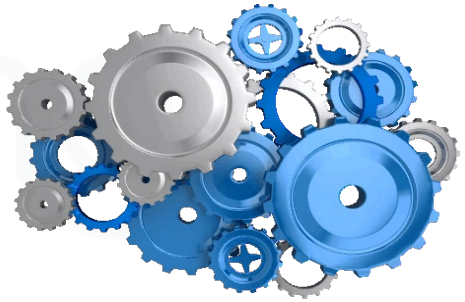
Quality and Responsiveness

Increasing Semantic Expressivity

Authoring
(old process)

Stated Relationship File

Convert to OWL
and classify



Concept File

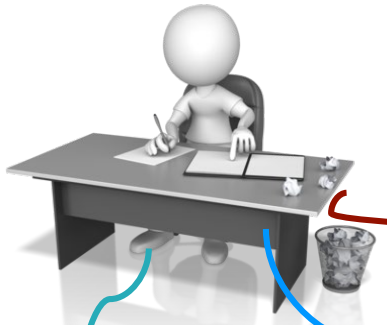
Description File

Relationship File
(inferred)

SNOMED International

Quality and Responsiveness

Increasing Semantic Expressivity



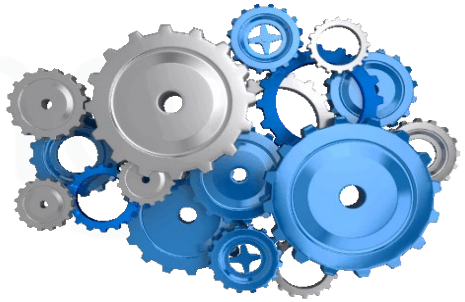
Authoring
(old process)

Stated Relationship File

Convert to OWL
and classify

Concept File

Description File



Relationship File
(inferred)

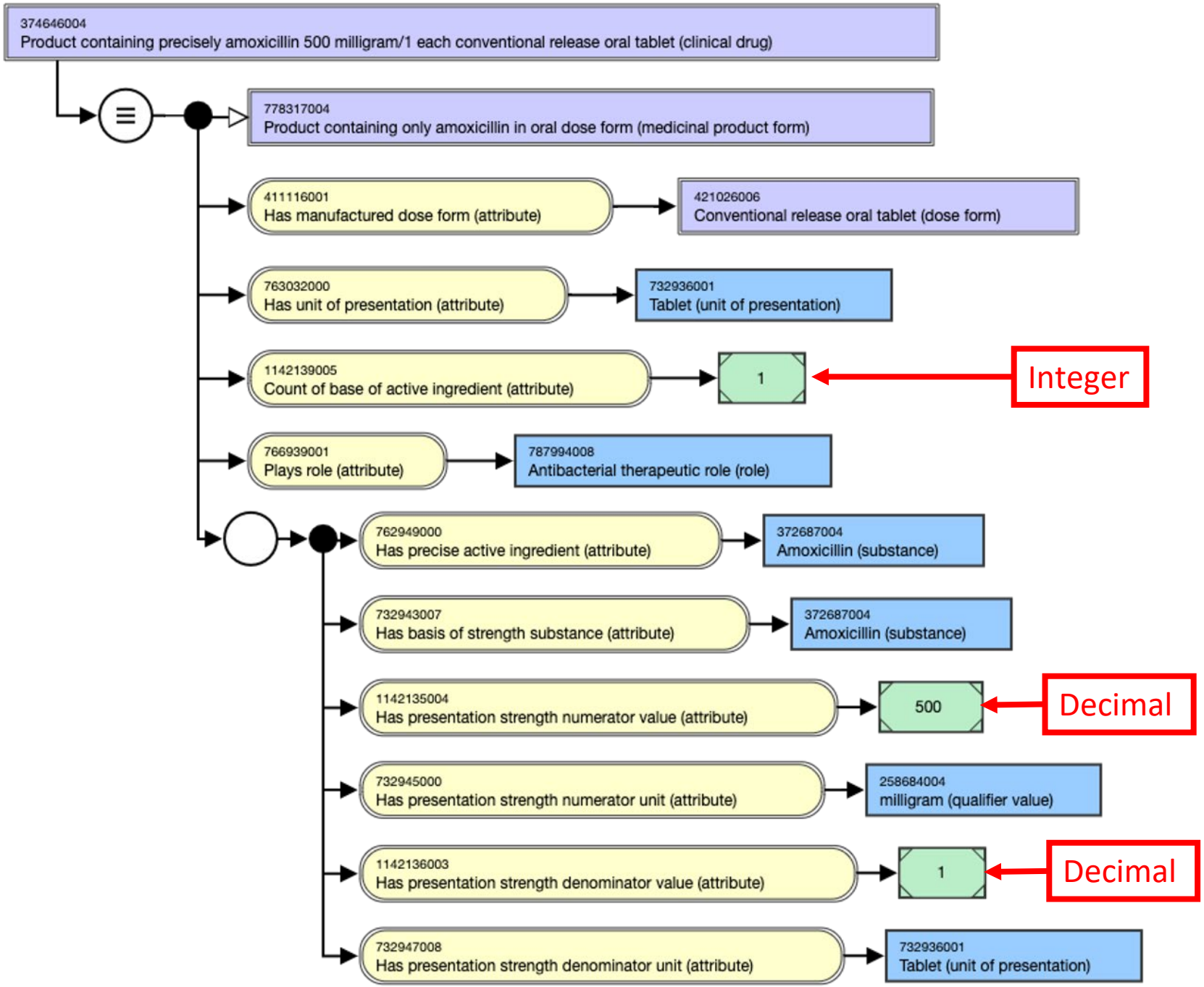
Concrete Value File
(inferred)

OWL Axiom Refset File

Combine OWL
and classify

Authoring
(new process)

Amoxicillin 500 mg oral tablet



Quality and Responsiveness

Quality Improvement Initiative

- Multi-year project began in 2018
- Automated expression templates and manual reviews to identify and fix any modelling and naming inconsistencies
- Original focus was on Clinical findings
- New focus on Procedures
- Also working on Medication and Substances

Quality and Responsiveness

More Frequent International Releases

- **January 31st and July 31st since 2002** – Publications every 6 months

…

- **March 9th 2020** – First out-of-cycle release to update COVID-19 content

…

- **January 31st 2022** – Monthly releases began on last day of each month
- **February 28th 2022** – International release
- **March 31st 2022** – International release
- **April 30th 2022** – International release
- **May 31st 2022** – International release

Quality and Responsiveness

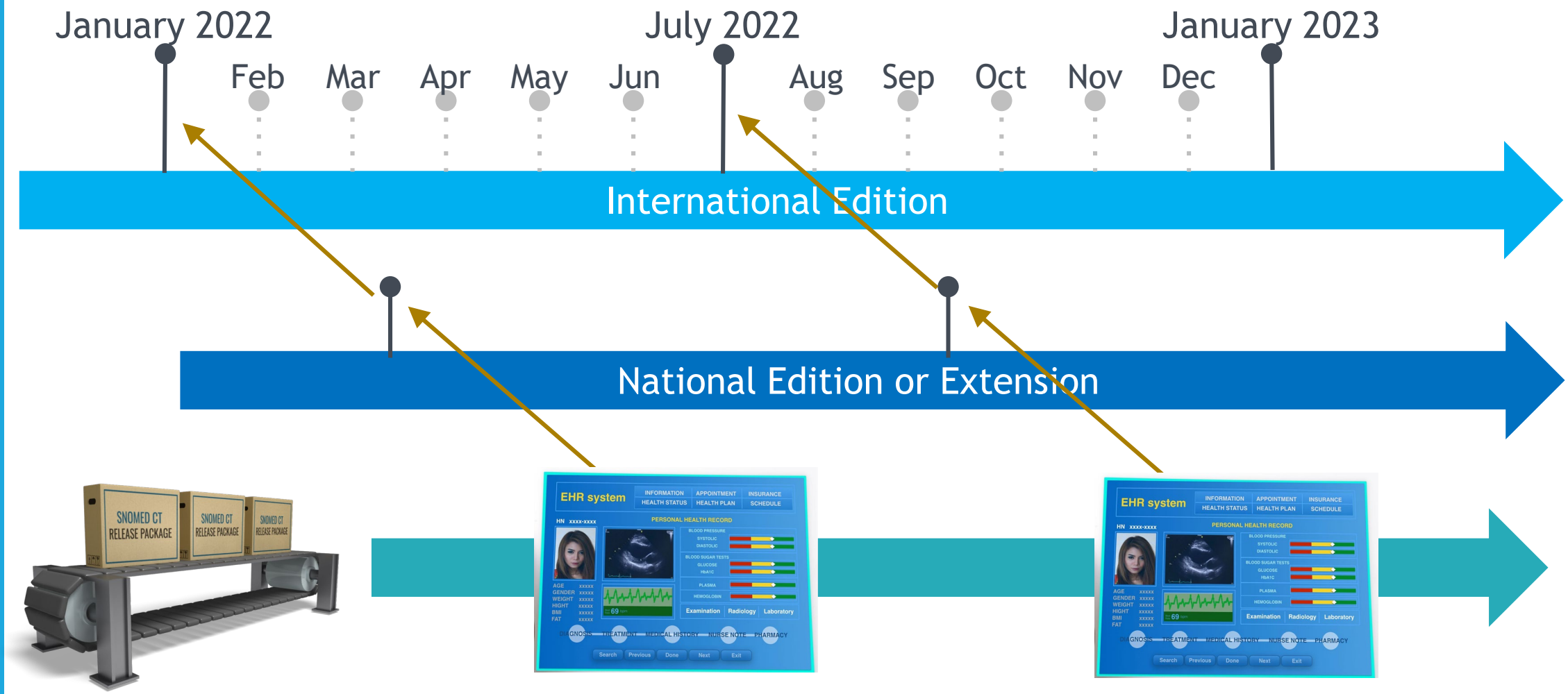
More Frequent International Releases

- Faster responsiveness to important and necessary changes (eg COVID)
- Earlier availability of submitted content
- More flexibility for users and member releases (with no extra obligation)

SNOMED CT Editions

Versioned Releases

Versioned Releases



Quality and Responsiveness

Flexible Delta Generation

- Users are not expected to upgrade to each monthly release
- Fixed deltas in the RF2 package are not useful for all users
- The International release does not include delta files from January 2022
  - Other editions are eliminating deltas as well
- SNOMED International has made a Delta Generation tool available (opensource)

github.com/IHTSDO/delta-generator-tool

SNOMED CT Focus Areas

1. Improving the quality and responsiveness
2. **Need for standardized international data sharing**
3. Implementation, implementation, implementation

International Data Sharing

- Global patient set (GPS)
- International patient summary terminology (IPST)
- Common drug model for interoperability
- Community content platform

International Data Sharing

Global Patient Set

- A managed collection of existing SNOMED CT reference sets available to any user at no cost
- Includes content for dentistry, renal, general practice, nursing, IHE, DICOM, International Patient Summary, COVID-19 and SDoH
- Can be used to share health information across all care settings, systems, organizations and national borders
  - http://gps.snomed.org

Global Patient Set
Delivered By SNOMED International

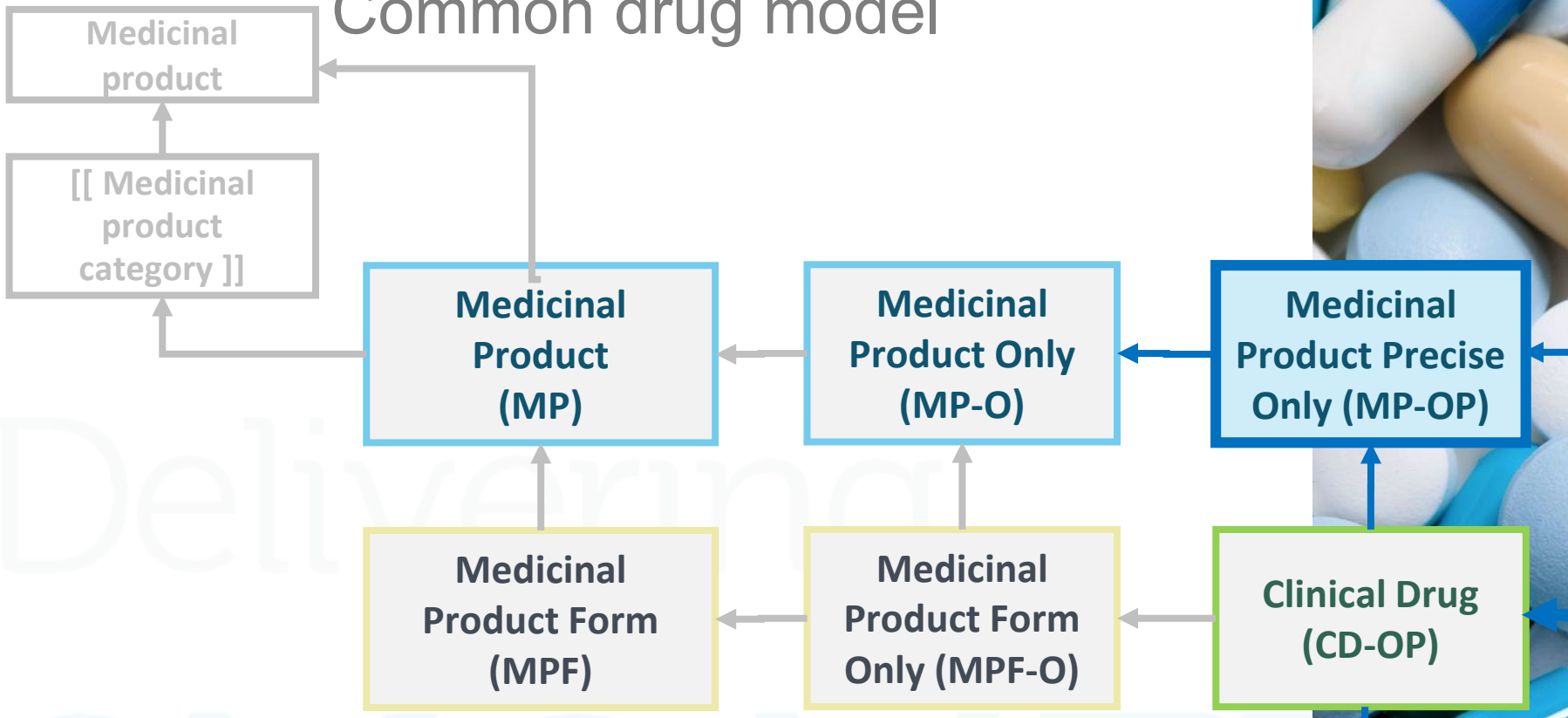
International Data Sharing

IPS Terminology

- **International Patient Summary** - a minimal set of basic clinical data about a patient, used to support cross-border/system patient care
- **International Patient Summary Terminology** - For non-affiliates to use in IPS implementations
  - Includes hierarchy & defining relationships of concepts from IPS free set
  - Can be used in a terminology server (RF2)
  - In Beta for stakeholder testing & feedback
- Browser: https://ips-browser.snomedtools.org/
- User guide: http://snomed.org/ipstug
- Contact releases@snomed.org for more info

International Data Sharing

Common drug model

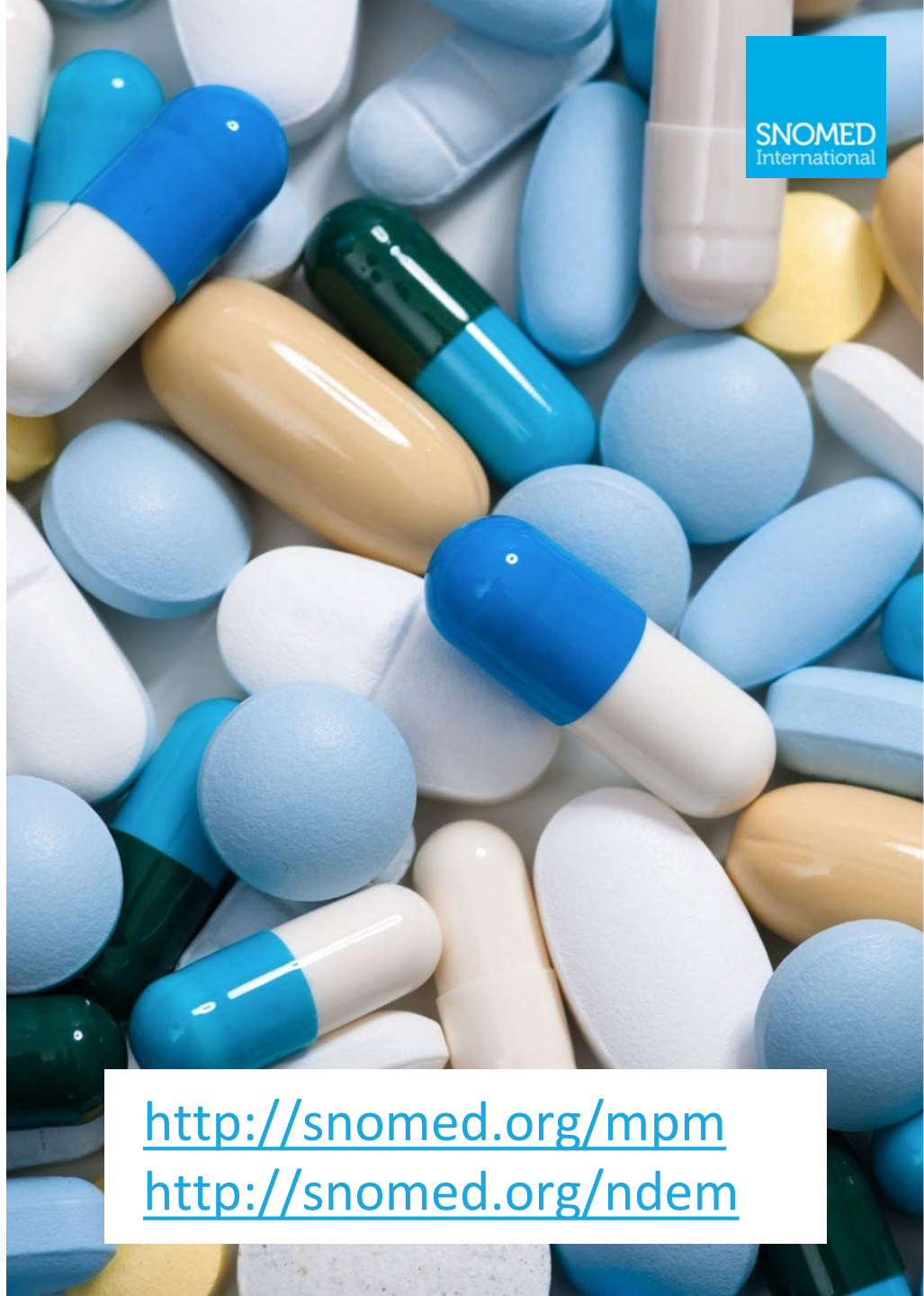


- Common national drug extension model
  - Allows nationally-defined drug concepts to be compared and queried

International Data Sharing

Common drug model

- Defined using common building blocks (int. attributes, values, and concept model)
  - **Attributes**: Has precise active ingredient, Has manufactured dose form, Has product name, Has pack size, Has pack size units, etc
  - **Values**: Substances, Dose Forms, Units, etc
- Use cases include
  - Person's medication list being computer processable in another country
  - Knowledge vendors and semantic search engines working in different countries



http://snomed.org/mpm
http://snomed.org/ndem

International Data Sharing

Community Content Platform

https://confluence.ihtsdotools.org/display/CC/SNOMED+CT+Community+Content+Home

- Collaborative platform for global content outside the current scope of the Int. Edition
- Enables rapid sharing of quality SNOMED CT content without waiting for SNOMED Int
- Contains community extensions viewable in a browser and (in future) downloadable
  - Cancer synoptic reporting
  - Common french translation
  - COVID-19 vaccines
  - Genomics
  - Traditional medicine

SNOMED CT Focus Areas

1. Improving the quality and responsiveness
2. Need for standardized international data sharing
3. **Implementation, implementation, implementation**

Implementation[3]

- SNOMED CT value platform
- Implementation support team & portal
- Free tool for mapping to SNOMED CT
- Querying codes in patient records
- Simplifying terminology server deployment

Implementation[3]

SNOMED CT Value Platform

- The SNOMED CT value platform presents stakeholder value propositions along with evidence that SNOMED CT adds measurable value to a broad range of primary and secondary health processes leveraging SNOMED CT encoded data to deliver improved patient outcomes
  - Stakeholder value propositions
  - A qualitative and quantified case for investment
  - A set of exemplar case studies

https://www.value.snomed.org/

Research

Data Entry and Integration

Clinical Information Sharing

Where is SNOMED CT used?

Point-of-Care Analytics

Population Analytics

Management Analytics

https://www.value.snomed.org/

SNOMED International's Implementation Support Team

To provide assistance to implementations of SNOMED CT for a range of stakeholders including NRCs, healthcare providers, research organizations and vendors

Linda BIrd
Implementation Support Lead

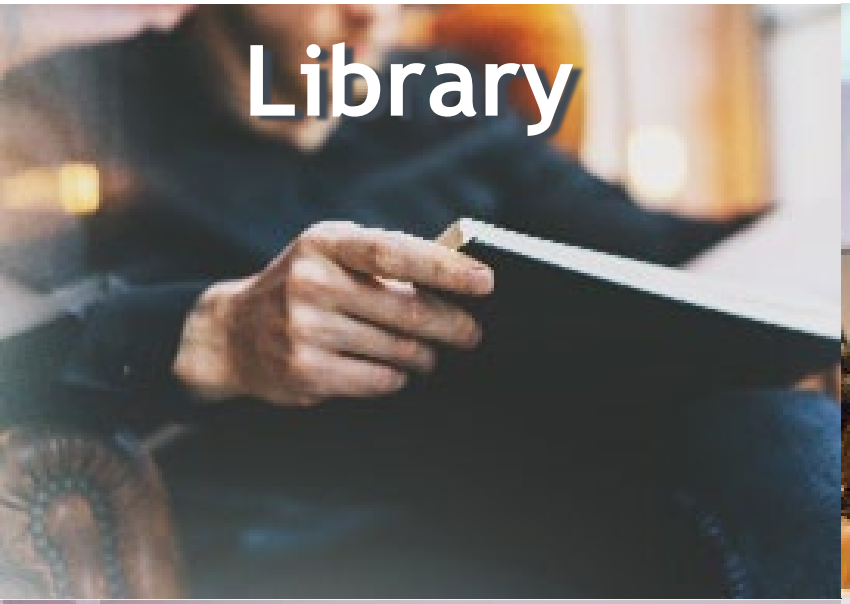
Alejandro Lopez Osornio
Senior Implementation Support Specialist

Kai Kewley
Technical Support Specialist

Anne Højen
Implementation Support Specialist

http://snomed.org/support

SNOMED CT Implementation Support Portal



http://snomed.org/support

Implementation[3]

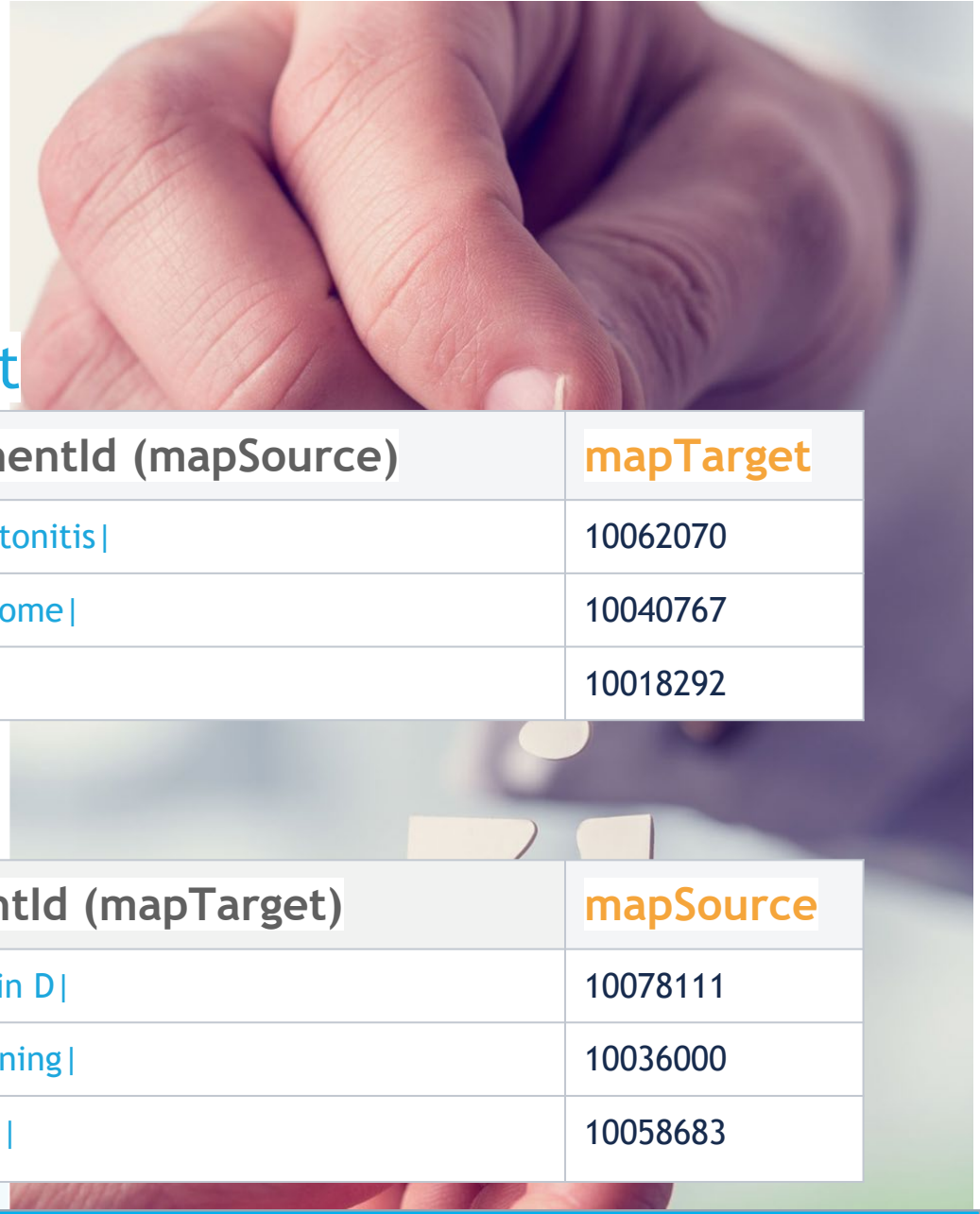
Mapping to SNOMED CT

- Many implementations require existing codes to be mapped to SNOMED CT
- To support these implementers, SNOMED International commissioned CSIRO to develop a tool for mapping to SNOMED CT
- Snap2Snomed
  - An online tool that supports the collaborative authoring, review and maintenance of simple maps to SNOMED CT
  - User guide: http://snomed.org/s2sug

https://snap.snomedtools.org/

Implementation[3]

Mapping to SNOMED CT



Simple map **FROM** SNOMED CT type reference set

refsetId	referencedComponentId (mapSource)	mapTarget
816210007 |SNOMED CT to MedDRA simple map reference set|	197171003 |Bacterial peritonitis|	10062070
816210007 |SNOMED CT to MedDRA simple map reference set|	83901003 |Sjögren's syndrome|	10040767
816210007 |SNOMED CT to MedDRA simple map reference set|	66383009 |Gingivitis|	10018292

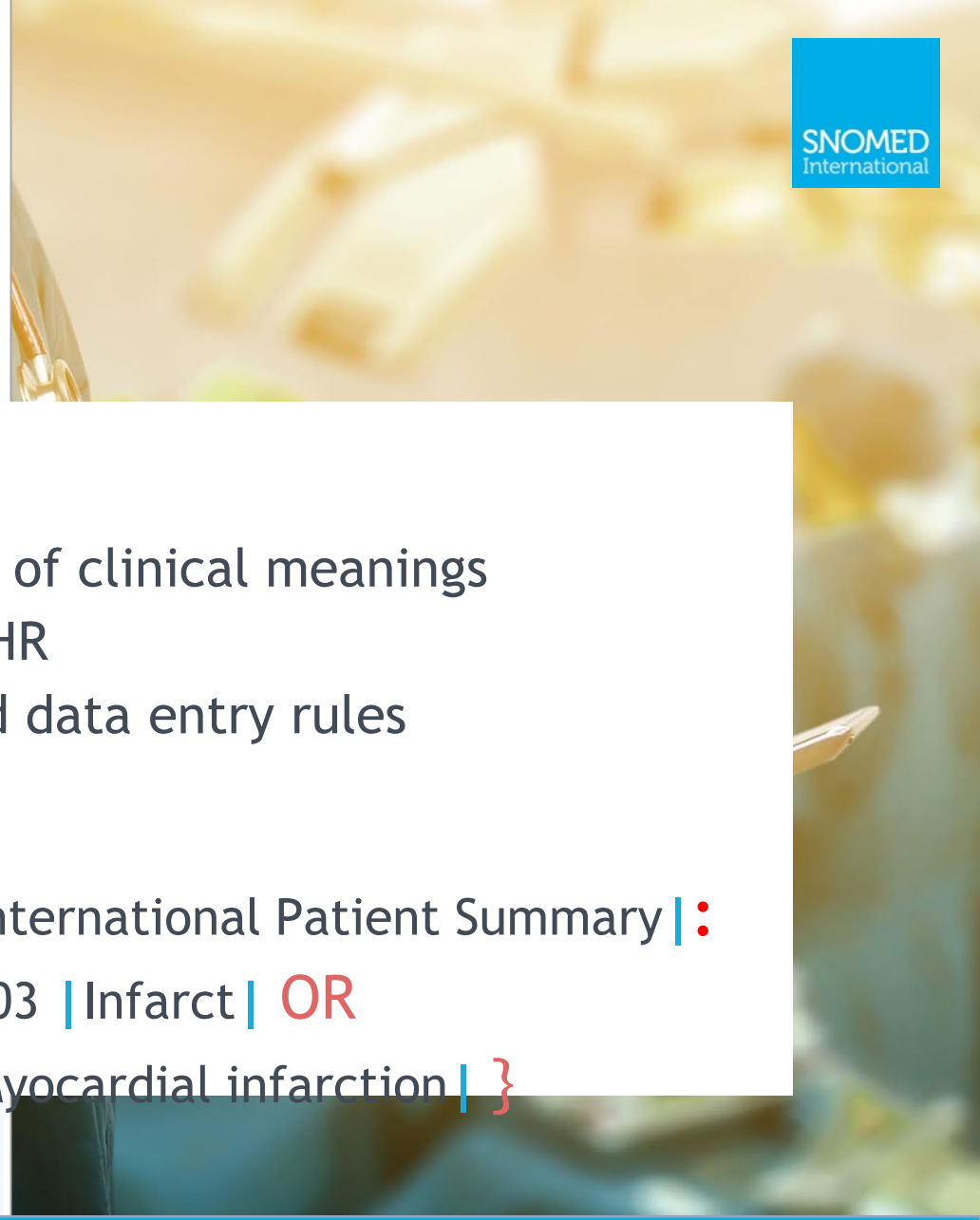
Simple map **TO** SNOMED CT type reference set

refsetId	referencedComponentId (mapTarget)	mapSource
1193497006 |MedDRA to SNOMED CT simple map reference set|	131114008 |Decreased vitamin D|	10078111
1193497006 |MedDRA to SNOMED CT simple map reference set|	410061008 |Intentional poisoning|	10036000
1193497006 |MedDRA to SNOMED CT simple map reference set|	95388000 |Injection site pain|	10058683

http://snomed.org/rfs

Implementation[3]

Querying Codes in Patient Records



SNOMED CT Expression Constraint

- A computable rule that can be used to define a set of clinical meanings
- Can be used to query SNOMED codes in a patient EHR
- Can be used in CDS triggers, knowledge linkage and data entry rules

Example

- < 404684003 |Clinical finding| AND ^816080008 |International Patient Summary|:
  { 116676008 |Associated morphology| = << 55641003 |Infarct| OR
  << 47429007 |Associated with| = << 22298006 |Myocardial infarction| }

http://snomed.org/ecl

Implementation[3]

Querying Codes in Patient Records

Implementation challenge

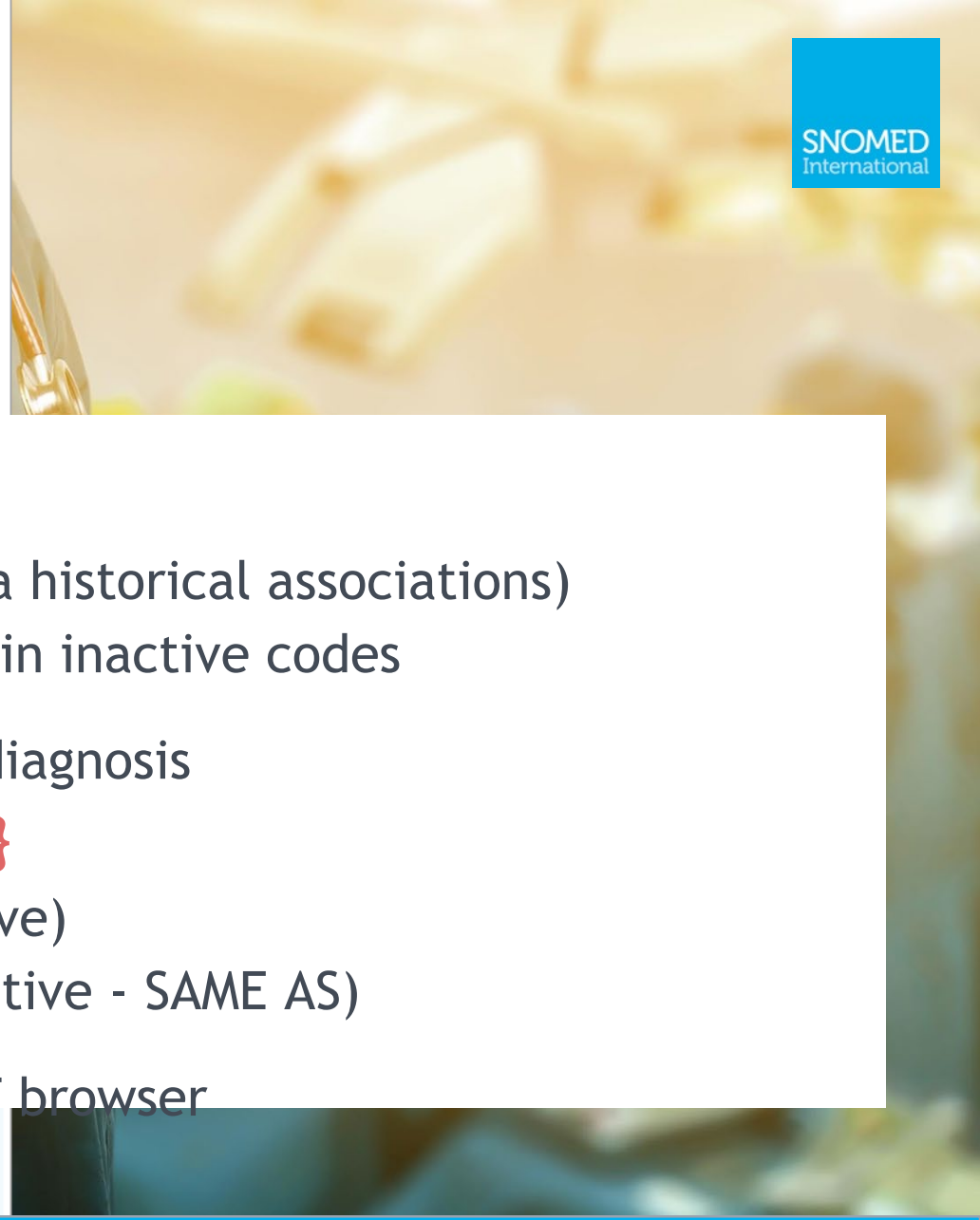
- New clinical data in an EHR should use only active SNOMED CT codes
- However, SNOMED CT is an evolving terminology
- As a result, concepts previously recorded in the EHR may subsequently be inactivated
- SNOMED CT queries typically return only active concepts, so it may not be possible to retrieve health records containing inactive identifiers
- A solution was needed to retrieve these codes

SNOMED International

http://snomed.org/ecl

Implementation[3]

Querying Codes in Patient Records



History Supplements (ECL v2.0)

- Augment results with relevant inactive concepts (via historical associations)
- Used when retrieving health records that may contain inactive codes

- - Find the patients who have ever had an Asthma diagnosis

  << 195967001 |Asthma| {{+HISTORY-MIN}}

  Results include: 304527002 |Acute asthma| (active)

  Results include: 304527002 |Acute asthma| (inactive - SAME AS)

- ECL 2.0 Demo - SNOMED International's SNOMED CT browser

https://ihtsdotools.org/browser

Implementation[3]

Querying Codes in Patient Records

Member Filters (ECL v2.0)

- Filter results on refset member's field values, module, effective time & active status
- ^ [referencedComponentId, mapTarget] 447562003 |ICD-10 complex map refset| {{M mapGroup=#1, mapTarget="J45.9"}}

Concept Filters (ECL v1.6)

- Filter results on concept's definition status, module, effective time & active status
- < 56265001 |Heart disease| {{C definitionStatus=primitive, effectiveTime>="20210131"}}

Description Filters (ECL v1.5) (ECL v2.1)

- Filter results on description's term, type, language, dialect, acceptability, module, effective time, active status & id (v2.1)

Implementation[3]

Simplifying Terminology Services

Terminology Services

- Rapid and effective way of deploying SNOMED CT
- Functions include
  - Search SNOMED CT content using term matching, hierarchy, defining relationships and ECL queries
  - Retrieve data about a selected concept
    - Descriptions
    - Supertypes and subtypes
    - Defining relationships
  - Access maps to/from SNOMED CT
- Standardized FHIR API
- Open source and commercial options available (swappable)

Implementation[3]

Snowstorm Terminology Services

Snowstorm

- Great way to get started with Terminology Services
- Open source under Apache 2.0
- Stand up your own SNOMED CT FHIR Terminology Server in less than an hour
- github.com/ihtsdo/snowstorm
- **User interface demo** using Snowstorm http://snomed.org/ui

SNOWSTORM

by SNOMED International

Implementation[3]

Simplifying Terminology Services

Planned Terminology Services Projects

- Add support for multiple code systems
- Simple extension (Simplex) toolkit
  - Publish and maintain derivative artifacts
    - Map, translation, subset files → RF2
    - Manage changes between releases
    - Find inactive codes & suggest alternatives
- Snowstorm dashboard for easy deployment
- Postcoordination support, guide and FHIR APIs
- Terminology data syndication

Discover More

snomed.org @snomedct linkedin.com/company/ihtsdo/

SNOMED International

SNOMED International: Delivering SNOMED CT

Discover More

- **Learn** - https://courses.ihtsdotools.org
- **Explore** - http://snomed.org/links
  - Implementation portal - http://snomed.org/support
- **Ask**
  - Helpdesk - info@snomed.org
  - Slack channel (general) - public-snomedintl.slack.com
  - Github repositories- https://github.org/IHSTDO
- **Participate** - http://snomed.org/wotw
  - User groups
    - SNOMED on FHIR - http://snomed.org/fhir
    - SNOMED languages group - http://snomed.org/slpg
    - User support group - http://snomed.org/usrg
    - Mapping tool user group - http://snomed.org/mtug
    - Drug extension user group - http://snomed.org/deusg
    - Clinical reference groups - http://snomed.org/crg

Quality Data, Informed Healthcare

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Questions?

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Web Series

Thank You

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