

Implementing SNOMED CT in the Netherlands

Pim Volkert

Coordinator Terminologies &
SNOMED CT NRC

November 1th, 2019

Nictiz  Better health through
better information



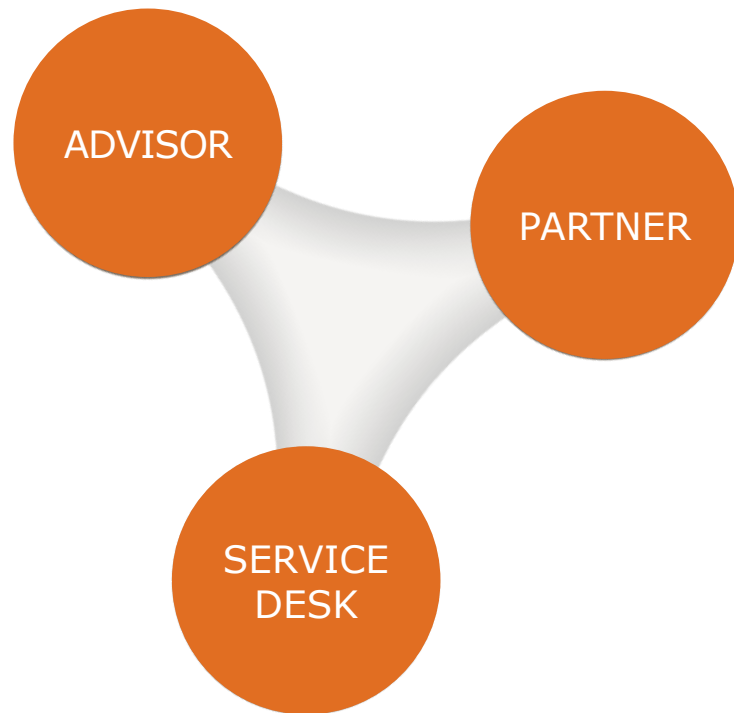
Pim Volkert

- Nictiz - Coordinator Terminologies
- TU Eindhoven – Clinical Informatics

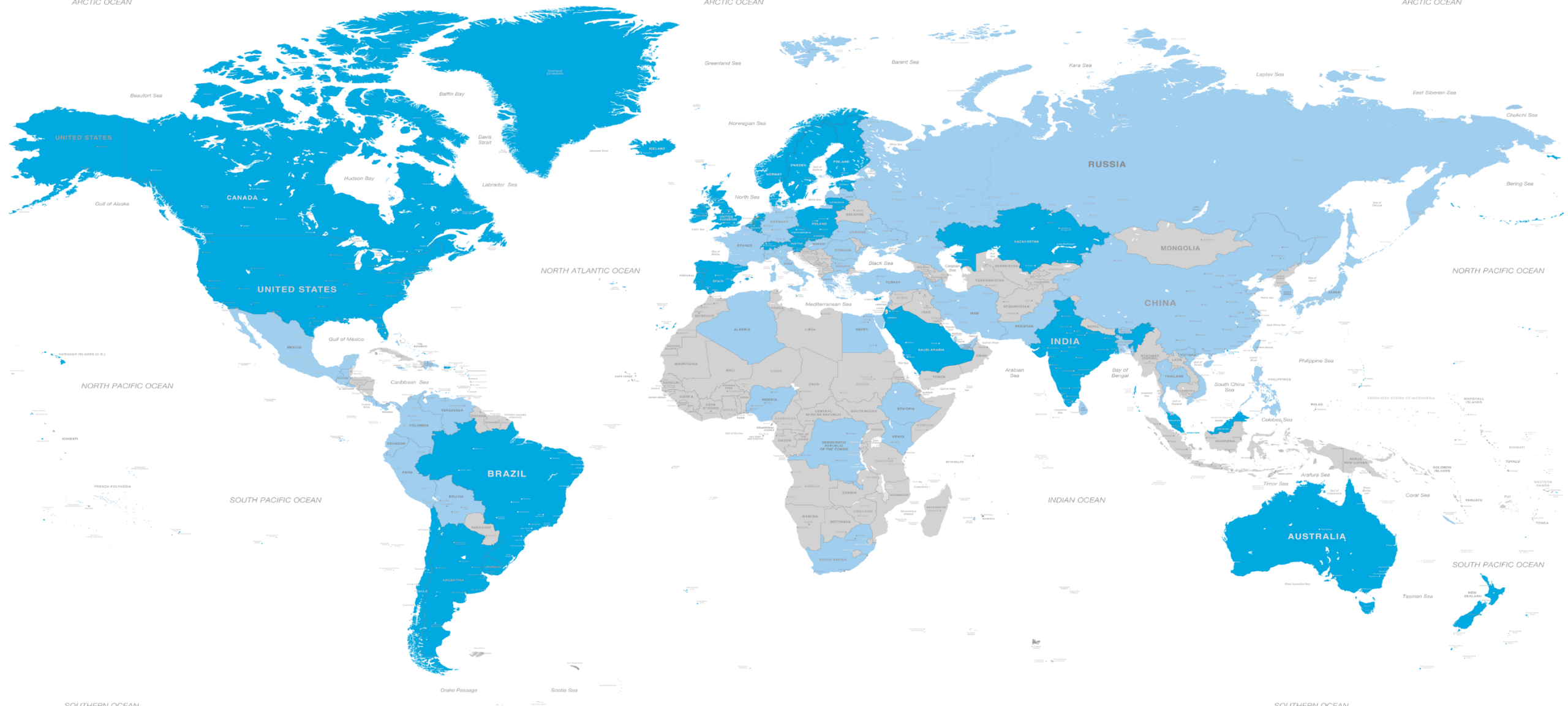
- Earlier
 - ALERT Life Sciences Computing (EHR Vendor)
 - Hospital Rivierenland, Tiel



Nictiz The national competence centre for eHealth



Better health through better information



 MEMBERS
 AFFILIATE LICENSES
 AS OF APRIL 2019

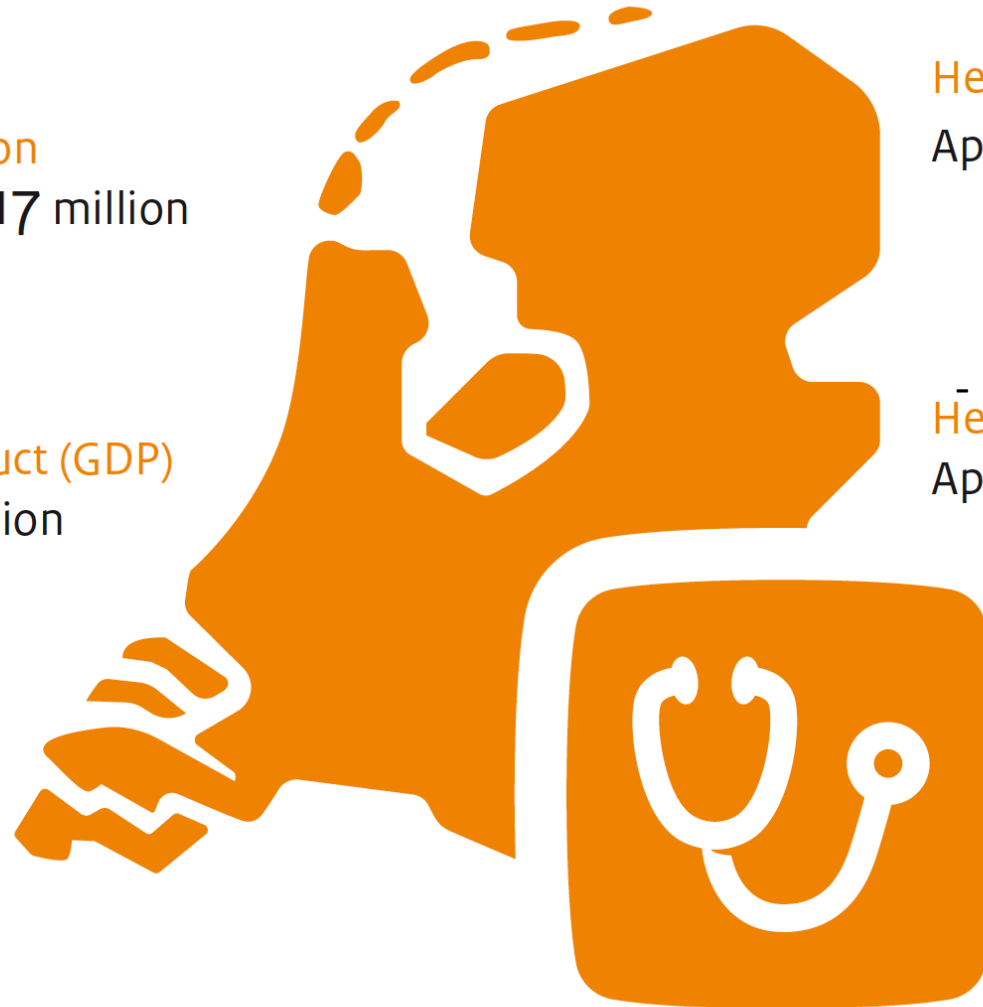




Healthcare in the Netherlands

Population
Approx. 17 million

Gross Domestic Product (GDP)
Approx. EUR 700 billion



Healthcare expenditure in EUR
Approx. EUR 70 billion

- Relatively high
Healthcare expenditure
Approx. 10% of GDP

Total number of people employed
in the healthcare field
Roughly 1,1 million



Dutch eHealth Challenges

- The **empowered patient** that needs to know and enrich his medical information
- **Continuity of care**, as patients deal with multiple health care providers
- **Closing the quality loop**: knowing, understanding and managing health care better

Good Climate

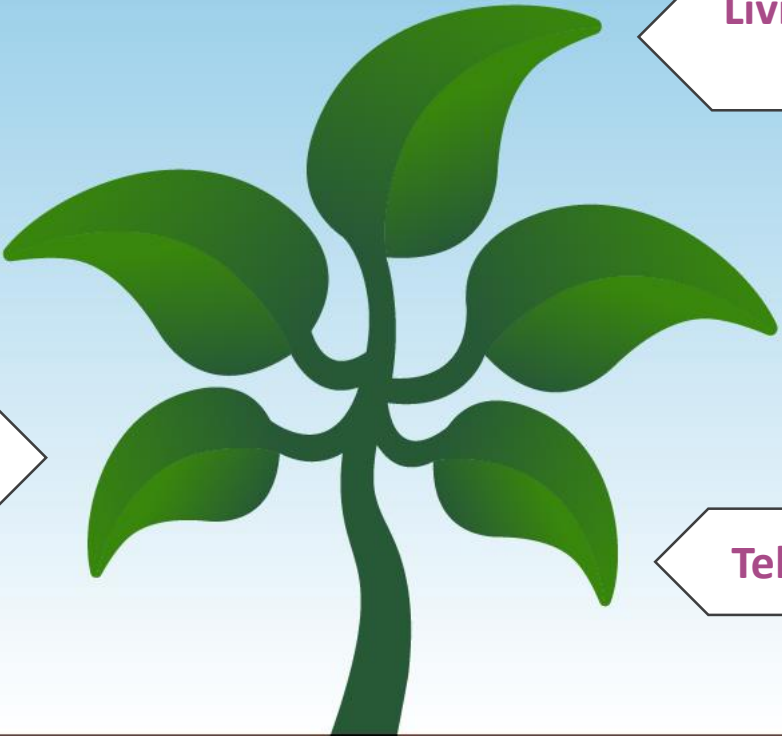
Everybody CEO
of their own Health

New Treatments
with Big Data & AI

Living at home longer,
self sustained

Self-measurements

Tele Health



Funding Programs – VIPP

- Personal Health Environments
- Hospitals (patient portals)
- GPs
- Mental care
- Long term care
- Home care
- Maternity care



The Cabinet wants doctors to be better able to access patient records in emergencies

Critical medical data should become more available to doctors if a patient arrives unconscious in first aid. Patients are therefore given the opportunity to register in advance that they will give permission for this in an emergency. Minister Bruno Bruins (Medical Care) wants to make this possible soon.

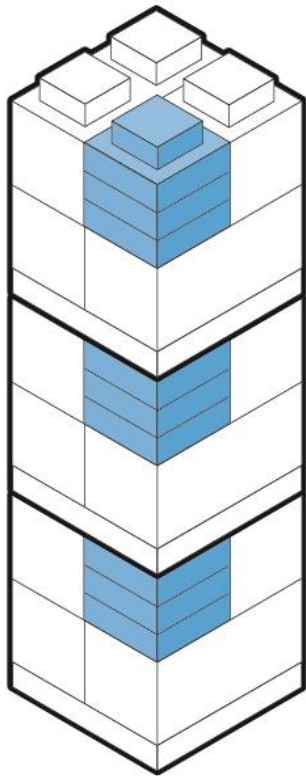
Gijs Herderschee October 30, 2019 , 5:00 AM



SNOMED NRC comes in



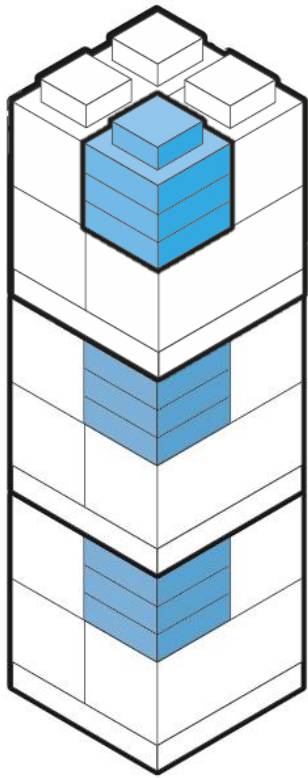
Patient Summary HCIMs



Patient
Payers
Advance directives
Contact Person
Functional status
Problems
Social status
Living situation
Use of drugs
Use of alcohol
Use of tobacco
Nutrition advice

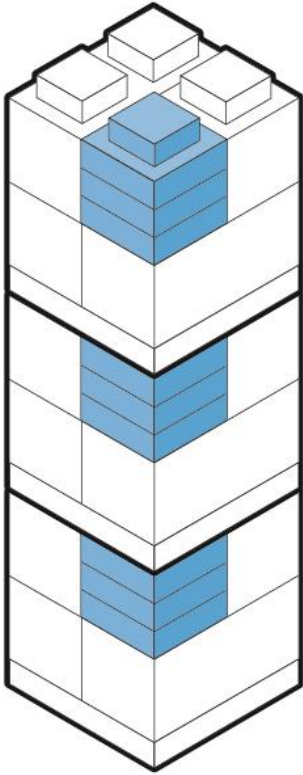
Alerts
Allergies and intolerances
Medication
Medical devices
Immunizations
Vital signs
Laboratories results
Procedures
Encounters
Plan of care
GP

Semantics in National Programs

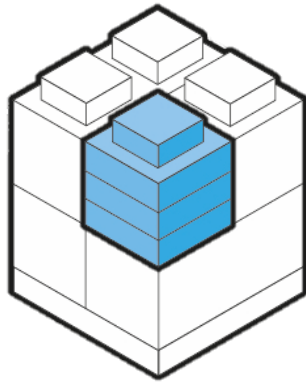


Core Set

Semantics in National Programs

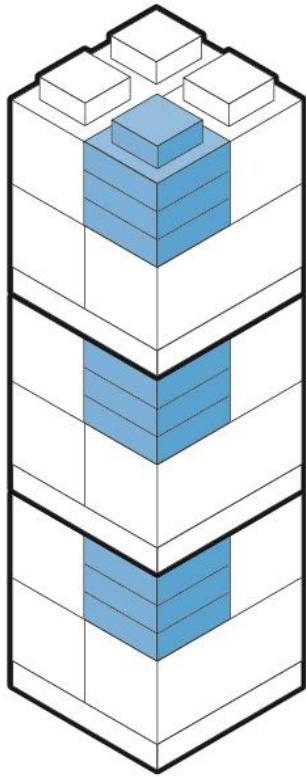


Core Set

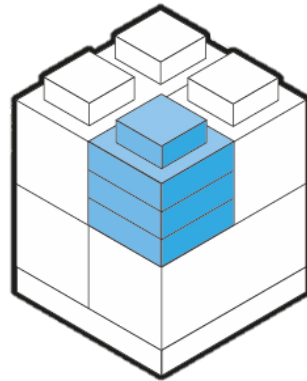


HCIM

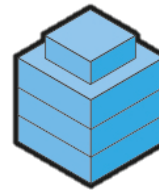
Semantics in National Programs



Core Set



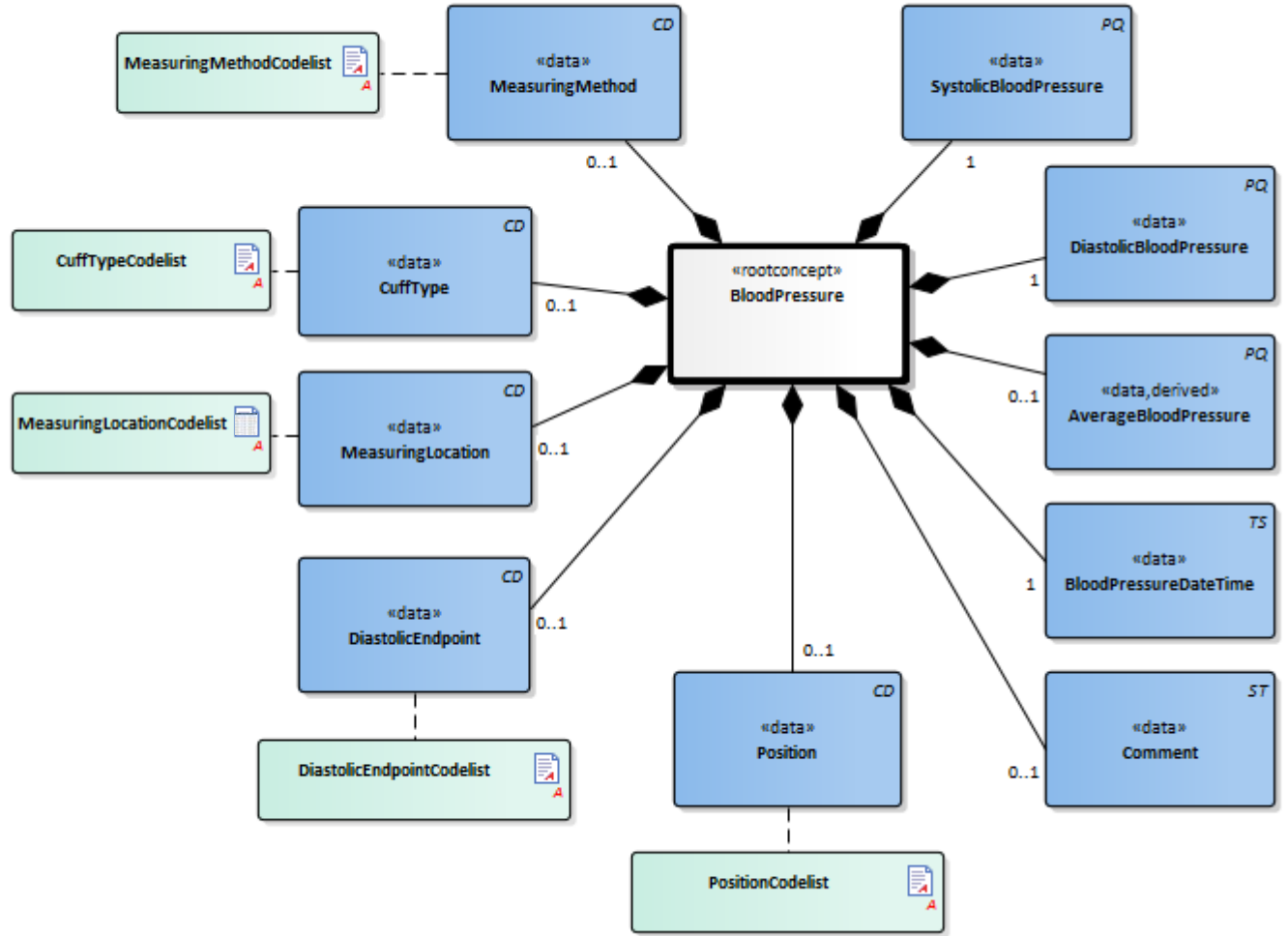
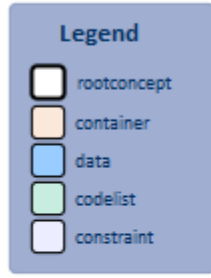
HCIM



SNOMED CT/LOINC/IDMP

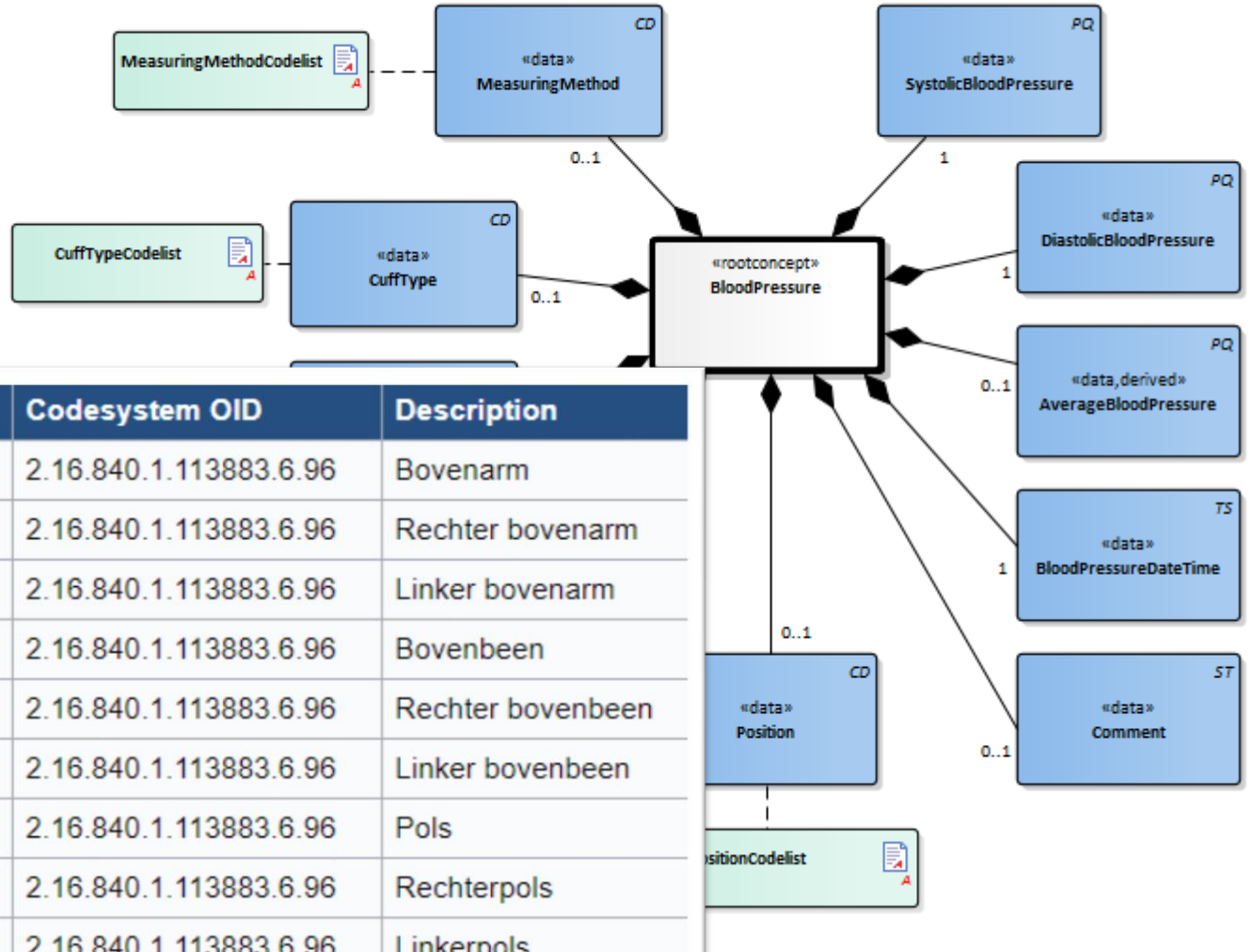
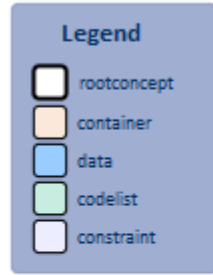


class Information Model





class Information Model



Conceptname	Conceptcode	Codesystem name	Codesystem OID	Description
Upper arm structure	40983000	SNOMED CT	2.16.840.1.113883.6.96	Bovenarm
Right upper arm structure	368209003	SNOMED CT	2.16.840.1.113883.6.96	Rechter bovenarm
Left upper arm structure	368208006	SNOMED CT	2.16.840.1.113883.6.96	Linker bovenarm
Thigh structure	68367000	SNOMED CT	2.16.840.1.113883.6.96	Bovenbeen
Structure of right thigh	11207009	SNOMED CT	2.16.840.1.113883.6.96	Rechter bovenbeen
Structure of left thigh	61396006	SNOMED CT	2.16.840.1.113883.6.96	Linker bovenbeen
Wrist region structure	8205005	SNOMED CT	2.16.840.1.113883.6.96	Pols
Structure of right wrist	9736006	SNOMED CT	2.16.840.1.113883.6.96	Rechterpols
Structure of left wrist	5951000	SNOMED CT	2.16.840.1.113883.6.96	Linkerpols
Finger structure	7569003	SNOMED CT	2.16.840.1.113883.6.96	Vinger
Ankle region structure	344001	SNOMED CT	2.16.840.1.113883.6.96	Enkel
Structure of right ankle	6685009	SNOMED CT	2.16.840.1.113883.6.96	Rechterenkel
Structure of left ankle	51636004	SNOMED CT	2.16.840.1.113883.6.96	Linkerenkel

Health and care information models prerelease 2019-1



group: Administrative, count: 6

ContactPerson-v3.2.1	HealthcareProvider-v3.2	Patient-v3.1.1
Encounter-v4.0	HealthProfessional-v3.3	Payer-v3.1

group: Basic elements, count: 1

BasicElements-v1.0.1

group: Clinical context, count: 21

Alert-v3.4	FeedingPatternInfant-v1.0	NutritionAdvice-v3.2	Vaccination-v4.0
AllergyIntolerance-v3.3	FeedingTubeSystem-v3.3	Pregnancy-v3.1	VisualFunction-v3.1
BladderFunction-v3.2	FunctionalOrMentalStatus-v3.1.1	PressureUlcer-v3.2	Wound-v3.1
BowelFunction-v3.1.1	HearingFunction-v3.2	Problem-v4.2.1	
Burnwound-v3.2	Infusion-v3.3	SkinDisorder-v3.2	
DevelopmentChild-v1.1	MedicalDevice-v3.3	Stoma-v3.2	

group: Measurements, count: 13

BloodPressure-v3.1	FluidBalance-v1.0	LaboratoryTestResult-v4.4	TextResult-v4.2
BodyHeight-v3.1	GeneralMeasurement-v3.0	O2Saturation-v3.1	
BodyTemperature-v3.1.1	HeadCircumference-v1.1	PulseRate-v3.3	
BodyWeight-v3.1	HeartRate-v3.3	Respiration-v3.1	

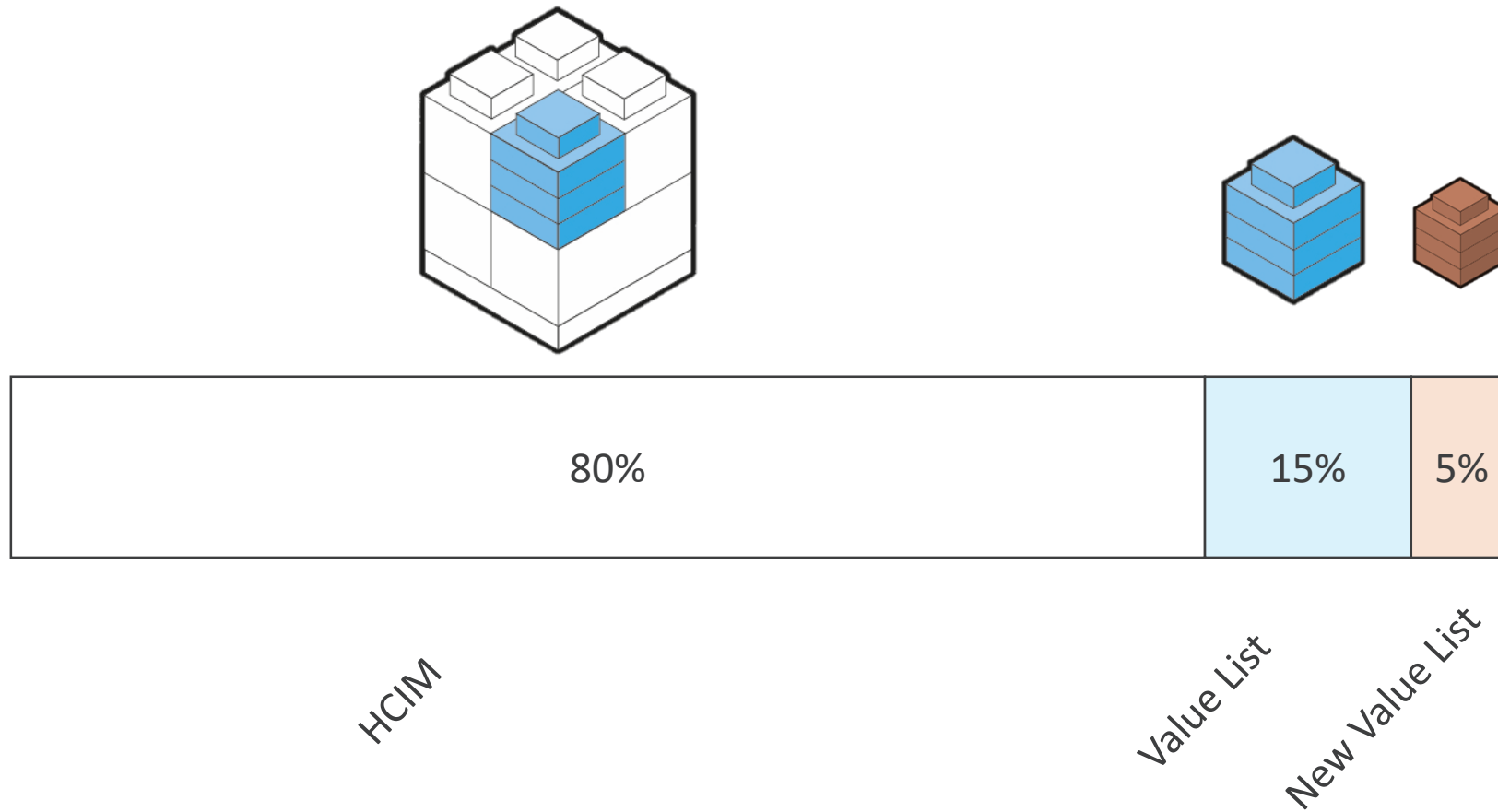
group: Medication, count: 6

AdministrationAgreement-v1.0.1	MedicationAdministration2-v1.0.1	MedicationDispense-v2.0.1
DispenseRequest-v1.0.1	MedicationAgreement-v1.0.1	MedicationUse2-v1.0.1

group: Partial information models, count: 7

AddressInformation-v1.0	InstructionsForUse-v1.1.3	PharmaceuticalProduct-v2.1	TimeInterval-v1.0
ContactInformation-v1.1	NameInformation-v1.0.1	Range-v1.0.1	

HCIM's to be used in Registries



Reference lists

Inclusion list LIR

In order to be able to use the implants list for the National Implant Register in accordance with the healthcare information building blocks, the SNOMED National Release Center has made a SNOMED CT reference set. SNOMED CT Licensees can this list - including mapping to the GMDN codes - download via [MLDS portal](#) . For questions about this list, contact info@snomed.nl

bare-metal carotisstent	bare-metal carotisstent (fysiek object)	<u>700988000</u>
'bare-metal' coronaire stent	'bare-metal' coronaire stent (fysiek object)	<u>464052002</u>
'bare-metal' intracraniële vasculaire stent	'bare-metal' intracraniële vasculaire stent (fysiek object)	<u>700589004</u>
'baseplate' van 'reversed' schouderprothese	basisplaat van 'reversed' schouderprothese (fysiek object)	<u>465895005</u>
'coil' voor longvolumereductie	'coil' voor longvolumereductie (fysiek object)	<u>469789005</u>
'drug-eluting' carotisstent	'drug-eluting' carotisstent (fysiek object)	<u>468987009</u>
'drug-eluting' femoralisstent	'drug-eluting' femoralisstent (fysiek object)	<u>469161002</u>
'drug-eluting' nierarteriestent	'drug-eluting' nierarteriestent (fysiek object)	<u>468674001</u>
'drug-eluting' stent voor arterie van onderbeen	'drug-eluting' stent voor arterie van onderbeen (fysiek object)	<u>701709006</u>

Micro organisms

This reference list contains the Dutch subset of SNOMED CT micro-organism codes for the uniform and standardized communication between medical microbiology laboratories and with RIVM. Clicking on the ID number will take you to the displayed microorganism in the SNOMED CT browser.

referentieset voor micro-organismen

<u>Omschrijving</u> ↓	<u>SNOMED-CT FSN</u>	<u>Id</u>
Abiotrophia	genus Abiotrophia (organisme)	115161005
Abiotrophia defectiva	Abiotrophia defectiva (organisme)	113714003
Absidia	Absidia (organisme)	57145009
Absidia caerulea	Absidia caerulea (organisme)	2591000146102
Acanthamoeba	Acanthamoeba (organisme)	50875003
Acetobacter	genus Acetobacter (organisme)	396949003
Acetobacter aceti	Acetobacter aceti (organisme)	396950003
Acetobacter cerevisiae	Acetobacter cerevisiae (organisme)	413399008

Labcodeset

Applicatie

Inloggen

Zoekterm(en)

hemo A1

Zoeken

Help









LOINC 2.61 2017-06-23

Taal: nl-NL












Nederlands







Resultaten [2]

Status	LOINC	Volledige naam	Component	Kenmerk	Timing	Systeem	Schaal	Methode	Aanvraag/Resultaat	Panel type
	4548-4 	 Hemoglobine A1c/Hemoglobine.totaal [massa fractie] in bloed	 Hemoglobine A1c/Hemoglobine.totaal	Massa fractie	Moment	Bloed	Kwantitatief		Both	
	59261-8 	 Hemoglobine A1c/Hemoglobine.totaal [stof fractie] in bloed d.m.v. IFCC protocol	 Hemoglobine A1c/Hemoglobine.totaal	Stof fractie	Moment	Bloed	Kwantitatief	IFCC protocol	Both	

Details

LOINC	4548-4	Gebruiker	
Status	 ACTIVE	Klasse	 HEM/BC
Component	 Hemoglobine A1c/Hemoglobine.totaal	Kenmerk	 Massa fractie
Timing	 Moment	Systeem	 Bloed
Schaal	 Kwantitatief	Methode	
Unit	%	Unit text	percent
Volledige naam	 Hemoglobine A1c/Hemoglobine.totaal [massa fractie] in bloed	Omschrijving	
Volledige naam (en-US)	 Hemoglobin A1c/Hemoglobin.total in Blood		
Oude volledige naam	 Hemoglobine A1c/Hemoglobine.totaal in bloed		

Materiaal

Status	Materiaal	Root
	bloed  	Specimen 

Methode

Status	Methode	Root

Uitkomst

Rm	Unit Description
%	percent



Zoekterm(en)



bacteriële artritis



SNOMED Clinical Terms version: 20190131 [R] (January 2019 Release)

Help

Licentie

Resultaten (16 van 16)

P bacteriële artritis

P acute bacteriële artritis

S bacteriële artritis van SI-gewricht

S acute bacteriële suppuratieve artritis

Bacterial arthritis (disorder)

Acute bacterial arthritis (disorder)

Bacterial arthritis of sacroiliac joint (disorder)

Acute suppurative arthritis caused by bacteria (disorder)

[Bacterial musculoskeletal infection](#)[infectieuze artritis](#)

bacteriële artritis (aandoening)

bacteriële artritis

ontsteking van gewricht door bacteriële infectie

Bacterial arthritis

Arthritis due to bacterial infection

Septic arthritis

Medical

Patient friendly

Synonyms

Id	48245008
Status	Defined

Associated morphology	ontsteking
Causative agent	Bacteria
Finding site	structuur van gewricht
Pathological process	infectieus proces

General Practice / Family Practice reference set

DHD Diagnosethesaurus-referentieset

▶ International Classification of Primary Care, Second edition complex map reference set

▶ ICD-10 complex map reference set

[acute bacteriële artritis](#)

1

[arthritis gonorhoica](#)

2

[arthritis door infectie met spirocheten](#)

3

[arthritis door Pseudomonas](#)[arthritis door Salmonella](#)[arthritis door stafylokokken](#)

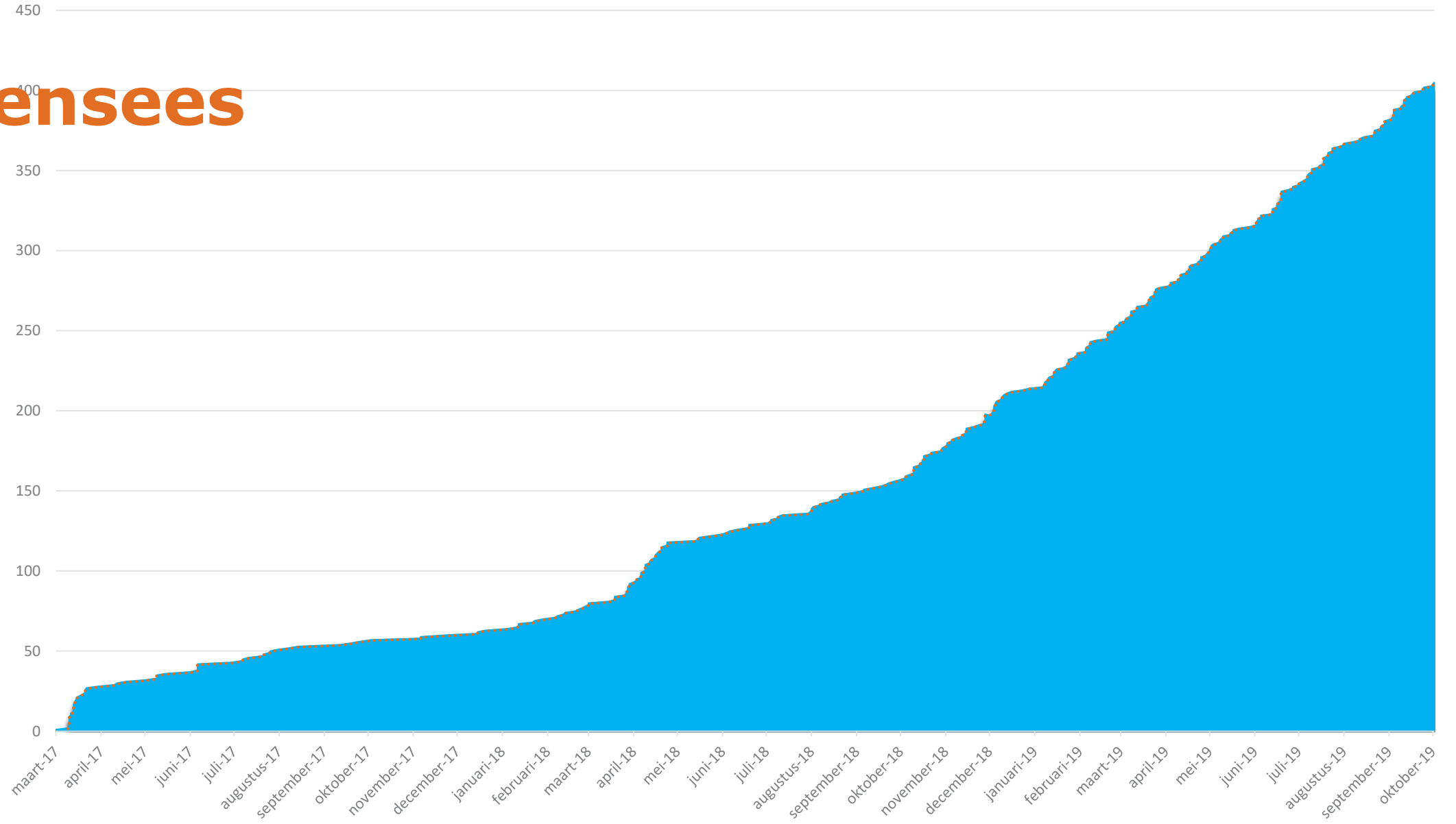
1

Transfer





Licensees



Why use **SNOMED CT**

- **Transfer**
- **Re-use**
- **Innovate!**





Take away messages

- **SNOMED is a means not a goal**
- **Define the goals**
- **Define use cases**
- **Use Building Blocks**
- **Be Patient**

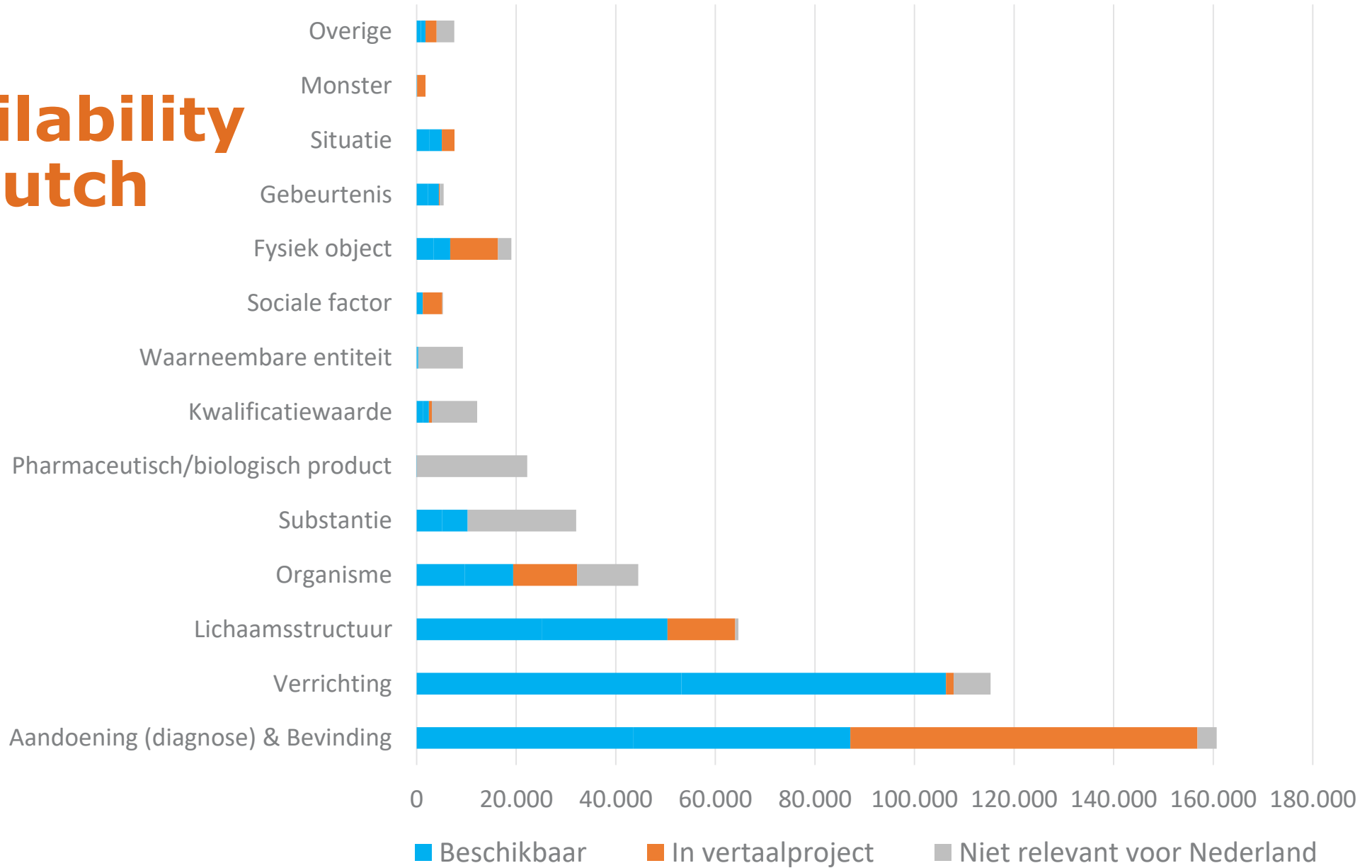


Questions & Discussion

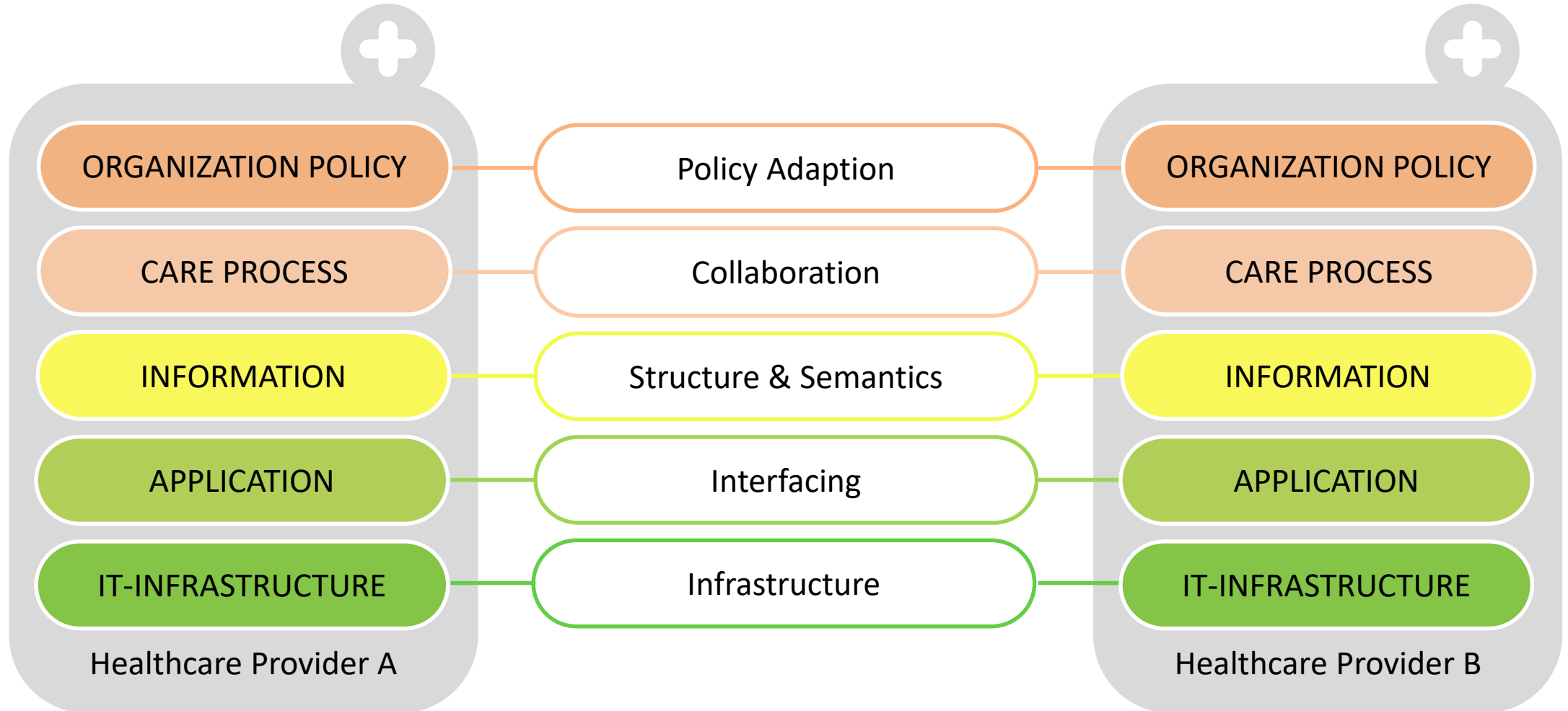




Availability in Dutch



Interoperability



```

126 display_subset_imaging(imaging_studies, "120574008", FALSE) # Filteren op body sites "Bovenste extremiteit" (SCTID = 1
127
128 ### Frequentie conditions gehele database
129 # Plot
130 a <- ggplot(data = conditions, aes(DESCRIPTION))
131 a + geom_bar() + scale_fill_discrete(drop=FALSE) + scale_x_discrete(drop=FALSE) + theme(axis.text.x = element_text(ang
132 # Plot descendants van diabetes
133 display_subset_conditions(conditions, "73211009", FALSE)
134 display_subset_conditions(conditions, "73211009", TRUE)
135
136 ### Frequentie medications gehele database
137 # Plot
138 a <- ggplot(data = medications, aes(DESCRIPTION))
139 a + geom_bar() + scale_fill_discrete(drop=FALSE) + scale_x_discrete(drop=FALSE) + theme(axis.text.x = element_text(ang
140 # Database bevat SCTID voor de reden van voorschrijven.
141 # Plot alles voorgeschreven voor # (254837009 borstkanker)
142 display_subset_medications(medications, "254837009", FALSE)
143 display_subset_medications(medications, "254837009", TRUE)
144 # Plot alles voorgeschreven voor # (38341003 Hypertensie)
145 display_subset_medications(medications, "38341003", FALSE)
146 display_subset_medications(medications, "38341003", TRUE)
147
148 # Ziekenhuisbezoeken
149 # Alle bezoeken, reden voor consult op X
150 a <- ggplot(data = encounters, aes(DESCRIPTION))
151 a + geom_bar() + scale_fill_discrete(drop=FALSE) + scale_x_discrete(drop=FALSE) + theme(axis.text.x = element_text(ang
152

```

```

148:1 (Top Level)
R Script

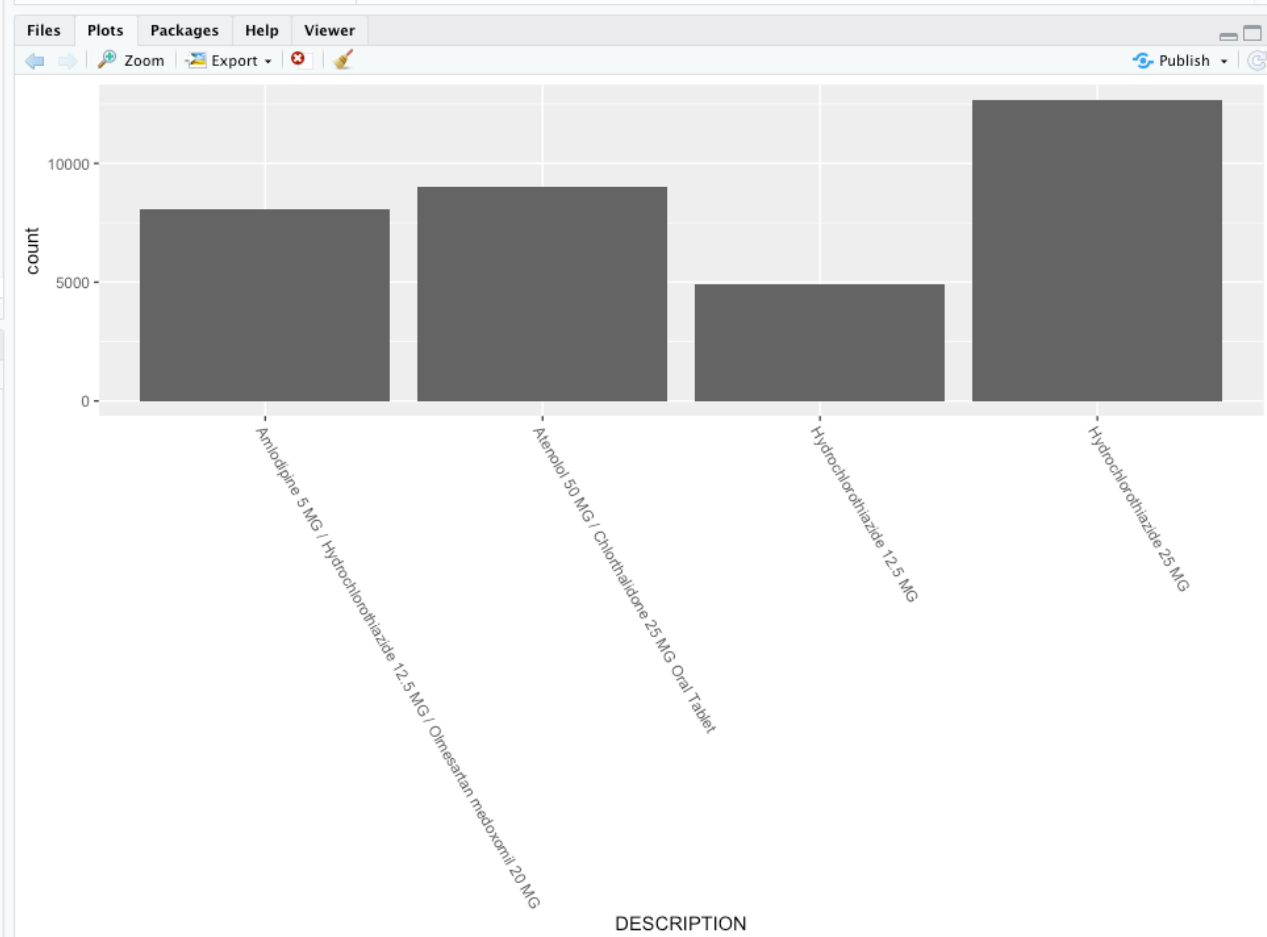
Console Terminal Jobs
~/GitHub/nictiz/rstudio/
Median :429503 Amlodipine 5 MG / Hydrochlorothiazide 12.5 MG / Olmesartan medoxomil 20 MG: 8055
Mean :602840 Hydrochlorothiazide 12.5 MG : 4934
3rd Qu.:746030 0.25 ML Leuprolide Acetate 30 MG/ML Prefilled Syringe : 0
Max. :999969 0.65 ML medroxyprogesterone acetate 160 MG/ML Prefilled Syringe : 0
(Other) : 0

> display_subset_medications(medications, "38341003", TRUE)
[1] "Head"
      id                                     pt.term
1 16229371000119106 Labile systemic arterial hypertension
2 10757401000119104 Pre-existing hypertensive heart and chronic kidney disease in mother complicating childbirth
3 10752641000119102 Eclampsia with pre-existing hypertension in childbirth
4 1078301000112109 Multiple drug intolerant hypertension
5 140131000119102 Hypertension in chronic kidney disease stage 2 due to type 2 diabetes mellitus
6 140121000119100 Hypertension in chronic kidney disease stage 3 due to type 2 diabetes mellitus

[1] "Samenvatting / Summary"
      CODE                                     DESCRIPTION
Min. :316049 Hydrochlorothiazide 25 MG :12680
1st Qu.:316049 Atenolol 50 MG / Chlorthalidone 25 MG Oral Tablet : 9029
Median :429503 Amlodipine 5 MG / Hydrochlorothiazide 12.5 MG / Olmesartan medoxomil 20 MG: 8055
Mean :602840 Hydrochlorothiazide 12.5 MG : 4934
3rd Qu.:746030 0.25 ML Leuprolide Acetate 30 MG/ML Prefilled Syringe : 0
Max. :999969 0.65 ML medroxyprogesterone acetate 160 MG/ML Prefilled Syringe : 0
(Other) : 0

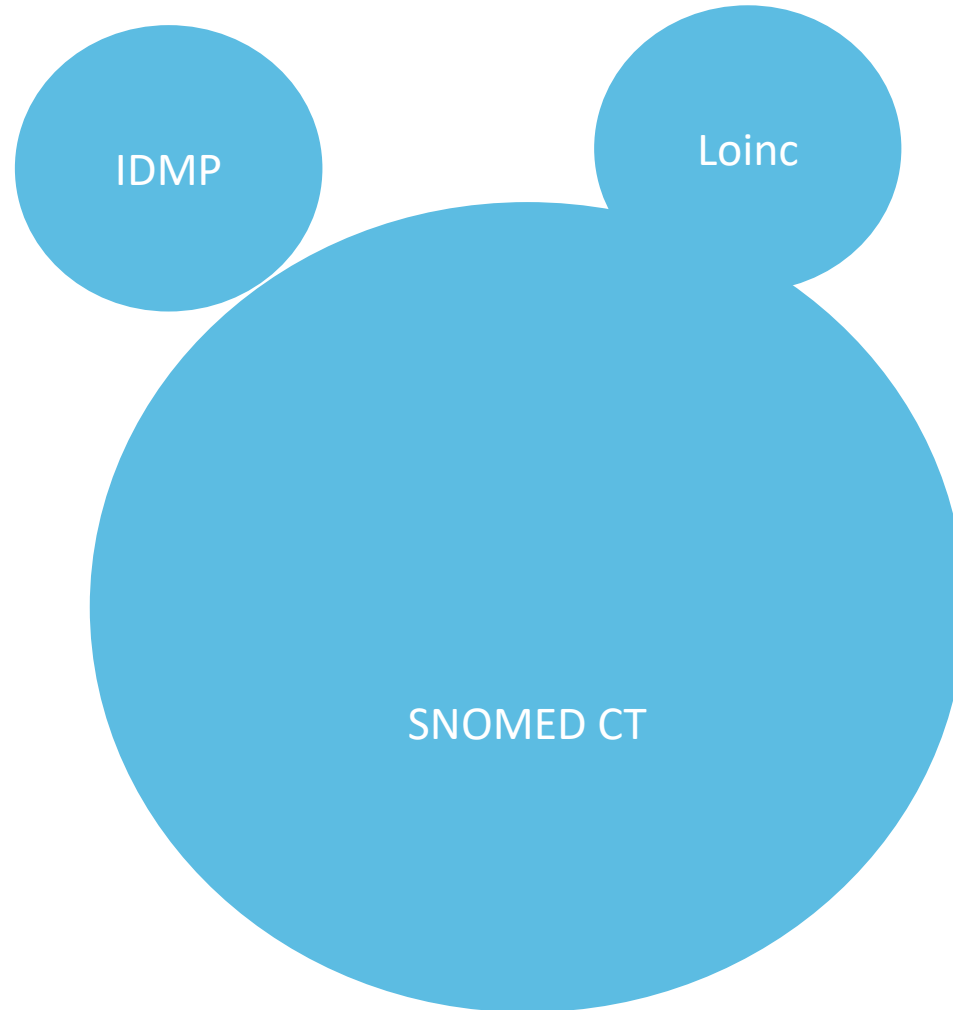
```

Environment	History	Connections	Git
Global Environment	Import Dataset		
Data			
a	Large gg (9 elements, 187.3 Mb)		
conditions	864571 obs. of 6 variables		
descendants	4010 obs. of 2 variables		
encounters	4145981 obs. of 14 variables		
imaging_studies	82746 obs. of 10 variables		
medications	1142887 obs. of 13 variables		
procedures	3352931 obs. of 8 variables		
subset	12831 obs. of 10 variables		
Values			

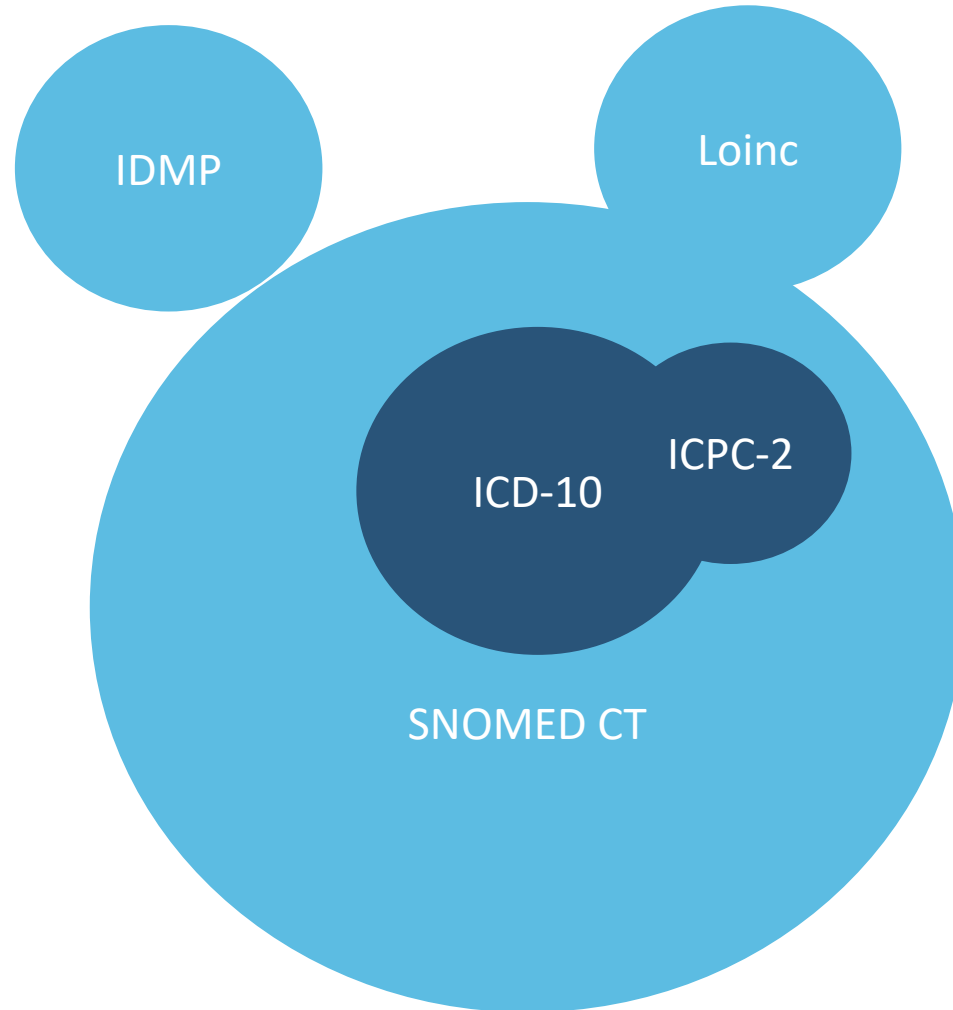




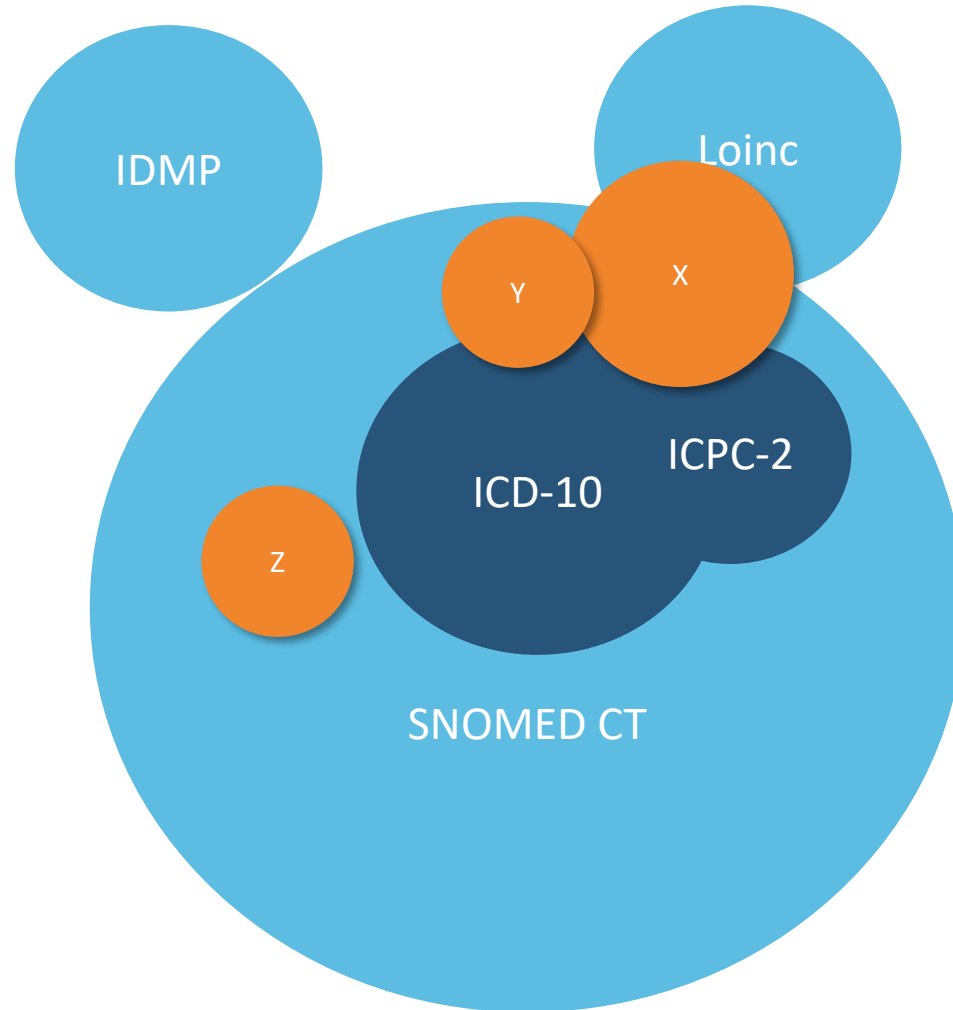
Base Layer for Semantic Unification



Base Layer & Classifications



National standards on the Base Layer



 **Orange reigns!**

