



Direktoratet for  
e-helse

# SNOMED CT in a Dental EHR

## Is there a clinical use-case for dentists?

By Jørn André Jørgensen

# Clinical data with SNOMED CT in EHR Opus Dental

- Unique and unlimited reporting opportunities
- Solid source for research, with structured data directly from the EHR

The screenshot shows the 'SNOMED Statistics' window. On the left, there are search filters: Municipality, School, From - to (17.10.2019), Report year (2019), Gender (M&K), and Clinic/Company. A blue arrow points from the 'Show name' checkbox to the table below. The table contains the following data:

SCTText_Bodysite	SCTID_Surface	SCTText_Surface	SCTID	SCTText	SCTID_Procedure	SCTText_Procedure	SCTID_Attribute	SCTText_Attribute	Value	UO	ECLm	ECLh
ISO designation 11	773310004	Structure of oral surface of tooth (body structure)	82212003	Erosion of tooth							82212003	82212003  Erosion of tooth
ISO designation 16	773310004	Structure of oral surface of tooth (body structure)	733941004	Primary active dental caries extending into outer third of dentin (disorder)							733941004	733941004  Primary active dental caries extending into out
ISO designation 46	90933009,83473006,8483002	Structure of distal surface of tooth (body structure)	234787002	Insertion of amalgam restoration into tooth	408730004	Procedure context	773277008	Previously performed			234787002 : 408730004 = 773277008	234787002  Insertion of amalgam restoration into tooth  : 40
ISO designation 46	773310004	Structure of oral surface of tooth (body structure)	48947008	Abnormal tooth attrition							48947008	48947008  Abnormal tooth attrition
ISO designation 15	83473006	Structure of occlusal surface of tooth (body structur	733941004	Primary active dental caries extending into outer third of dentin (disorder)							733941004	733941004  Primary active dental caries extending into out
ISO designation 15	62579006	Structure of vestibular surface of tooth (body struct	47222000	Abrasion of tooth							47222000	47222000  Abrasion of tooth
ISO designation 46	3262009	Structure of root canal of tooth (body structure)	39273001	Apical periodontitis							39273001	39273001  Apical periodontitis
ISO designation 37	83473006	Structure of occlusal surface of tooth (body structur	733941004	Primary active dental caries extending into outer third of dentin (disorder)							733941004	733941004  Primary active dental caries extending into out
ISO designation 35	83473006	Structure of occlusal surface of tooth (body structur	733941004	Primary active dental caries extending into outer third of dentin (disorder)							733941004	733941004  Primary active dental caries extending into out
ISO designation 43	8483002	Structure of mesial surface of tooth (body structure)	733940003	Primary active dental caries extending into inner half of enamel (disorder)							733940003	733940003  Primary active dental caries extending into inn
ISO designation 17	83473006	Structure of occlusal surface of tooth (body structur	234789004	Insertion of composite restoration into tooth (procedure)	408730004	Procedure context	398166005	Performed			234789004 : 408730004 = 398166005	234789004  Insertion of composite restoration into tooth (p
ISO designation 47	83473006	Structure of occlusal surface of tooth (body structur	733941004	Primary active dental caries extending into outer third of dentin (disorder)							733941004	733941004  Primary active dental caries extending into out
ISO designation 28			278661005	Tooth present							278661005	278661005  Tooth present
ISO designation 38			278661005	Tooth present							278661005	278661005  Tooth present
ISO designation 38			235104008	Impacted tooth							235104008	235104008  Impacted tooth
Mouth region structure			34043003	Dental consultation and report	408730004	Procedure context	398166005	Performed			34043003 : 408730004 = 398166005	34043003  Dental consultation and report  : 408730004  Pro
Mouth region structure			48450000	Radiography of head (procedure)	408730004	Procedure context	398166005	Performed			48450000 : 408730004 = 398166005	48450000  Radiography of head (procedure)  : 408730004
ISO designation 15	83473006	Structure of occlusal surface of tooth (body structur	234789004	Insertion of composite restoration into tooth (procedure)	408730004	Procedure context	398166005	Performed			234789004 : 408730004 = 398166005	234789004  Insertion of composite restoration into tooth (p

# Quality with structured data from the source: The dental record

Opus Dental 7.1.827.0 - <Test-Tannlege Jørn Andre Jørgensen> 17.10.2019

20003 Danser Line 13.11.1969-00216

Reg Health Record App.Bk Search Today Recall Appmts Cash Kort Invoice Paym W.Proc Update

In-/Outbox 0002 Tannlege Jørn Andre Jørgensen

**Record**

**Diagnosis**

- Caries
- Defect
- Fracture
- Overhang
- NB
- Endo.
- Perio.
- Trauma
- Ortho.
- TMD
- Aplasia
- Retained
- Supernum.
- Root rem.
- Oral m.
- Surgery
- Misc.

**Completed**

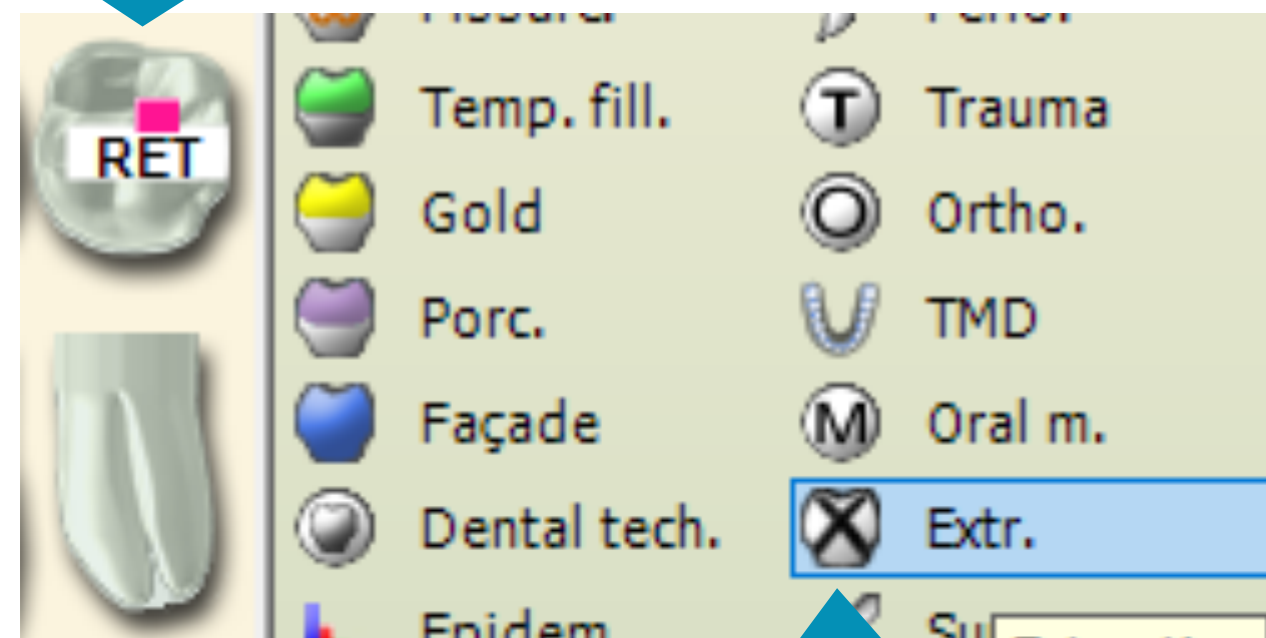
- Exam.
- X-ray
- Proph.
- Hygiene
- Anaest.
- Amalgam
- Comp.
- Glass
- Temp. fill.
- Gold
- Porc.
- Façade
- Dental tech.
- Epidem
- Sales
- Finance
- Crown
- Temp. crown
- Bridge a.
- Bridge p.
- Prost.
- Impl.
- Pillar
- Endo.
- Ortho.
- TMD
- Oral m.
- Extr.
- Surgery
- Root sep.
- Misc.

#	ID	Logi	Date	Group	To	Srvc	Prod. no.	T	Min	Text	Dekn.type	S	T	Off.hon	Direkte	Pasient	Lab	Fee	S	Sign	F
u	0002	Pe...	05.03.2019	MISC				M		Pasienten har vondt i tannen 27 og dette skyldes caries								0,00	Y		
u	0002	Pe...	05.03.2019	PREV. ...	26	MOB				Amalgamfylling											
u	0002	Pe...	05.03.2019	PREV. ...	25	OBP				Amalgamfylling											
u	0002	Pe...	05.03.2019	PREV. ...	23	B				Porselensfasade								0,00	Y		
u	0002	Pe...	05.03.2019	MISC	24	P				Tilbakeført 17.10.2019: Tannfarget											
u	0002	Pe...	21.03.2019	PROSTH	36		304-1	M		Helkrone						1935,00	1000	1 935,00	Y		
u	0002	Pe...	21.03.2019	SALES				M		tannbørste						200,00		200,00	Y		
u	0002	Pe...	21.03.2019	PAYM						Betaling - kontant, spesifisert kvitt. nr. 1						-20265,00		-20 265,00	Y		
u	0002	Pe...	17.10.2019	MISC	24	P				Tilbakeføring av: 05.03.2019 Tannfarget								0,00	Y		
u	0002	Pe...	17.10.2019	MISC			1-2	M		Moved: Undersøkelse, recall						300,00		300,00	N		
u	0002	Pe...	17.10.2019	X-RAY			802-1	M		Moved: Tannrøntgen, pr bilde (2 å kr 55)						110,00		110,00	N		
d	0002	Pe...	17.10.2019		11	P				Erosjon											
d	0002	Pe...	17.10.2019	CARIES	16	P				Karies 3											
u	0002	Pe...	17.10.2019	PREV. ...	46	MOD				Amalgamfylling											
d	0002	Pe...	17.10.2019		46	L				Attrisjon											
d	0002	Pe...	17.10.2019	CARIES	15	O				Karies 3											
d	0002	Pe...	17.10.2019		15	B				Abrasjon											
d	0002	Pe...	17.10.2019	ENDO	46	r.				Apikal											
d	0002	Pe...	17.10.2019	CARIES	37	O				Karies 3											
d	0002	Pe...	17.10.2019	CARIES	35	O				Karies 3											
d	0002	Pe...	17.10.2019	CARIES	43	M				Karies 2											
u	0002	Pe...	17.10.2019	REST	17	O	201	M		Preparering og fylling med kompositt						240,00		240,00	N		
d	0002	Pe...	17.10.2019	CARIES	47	O				Karies 3											
d	0002	Pe...	17.10.2019	MISC	38					Retinert tann											
u	0002	Pe...	17.10.2019	REST	15	O	201	M		Preparering og fylling med kompositt, 1 flate						240,00		240,00	N		

Direkte: 0,00 Pasient 890,00 Provider 890,00 Total 890,00

# The key – easy to get reliable data

1) Mark tooth/surface



2) Select category of treatment

New record entry

Treatment list  Price list  Insurance list  Tooth

Text

Printout text

Predefined record texts

Code	Description	Price
401	Ukomplisert ex av ytterligere tann eller rot i samme kjeve-region	175,00
401	Ukomplisert ekstraksjon	300,00
405-1	Komplisert ex	1165,00
405-2	Fjerning av retinert tann / rot	1165,00

Off. dekning

Spec. cause  
 (caries)  
 (periodontitis)  
 (orthodontics)  
 (trauma)  
 (exfoliated)  
 (other cause)

Fee  
 Hourly  
 High  
 Middle 300,00  
 Low  
 Own

Code   
Pricecode   
Ins. code

Dental labshare  VAT  Ref.hon  Ref.andel  Pas.andel  Amount

Treatmentdate

Ferdig ført journal IDAG

Attach file(s) OK Cancel

3) Select predefined record text

4) Select the cause

No changes for the dentist.

The dentist performs a normal EHR workflow.

It is easy for the dentist to document using SNOMED CT, without even

# The key – easy accessible, reliable clinical data

5) Result: automatic coding with SNOMED CT

SCTText_Bodysite	SCTID	SCTText	SCTID_Due to	SCTText_Due to	SCTID_Due to Attribute	SCTText_Due to Attribute	SCTID_Procedure	SCTText_Procedure	SCTID_Attribute	SCTText_Attribute
ISO designation 38	55162003	Tooth extraction	42752001	Due to	80967001	Dental caries	408730004	Procedure context	398166005	Performed

ECLm

55162003 : 42752001 = 80967001, 408730004 = 398166005

ECLh

55162003 |Tooth extraction| : 42752001 |Due to| = 80967001 |Dental caries|, 408730004 |Procedure context| = 398166005 |Performed

- **SNOMED CT generated automatically from a normal EHR workflow.**
- **No requirements of knowledge of SNOMED CT for the user.**
- **SNOMED CT mapping behind the user interface of the EHR, results in reliable data.**
- **Implemented use of Expression Constraint Language.**

# Building the use-case (and a disclaimer...)

- The project aims at demonstrating the potential for data collection and analysis using SNOMED CT
- Analysis of data for dental research is out of scope
- We have used a very simple method of analysis – so far

# Material

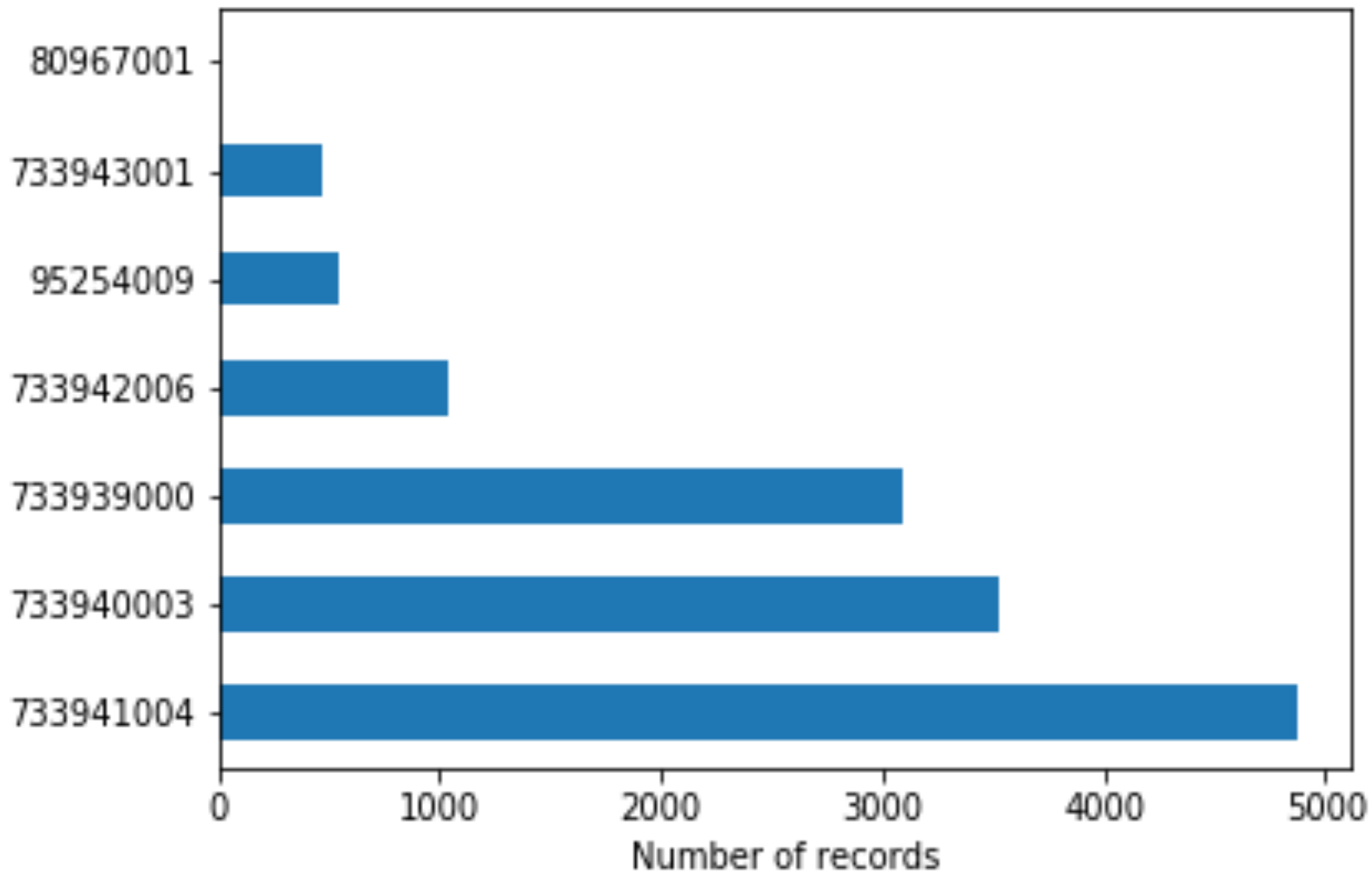
- 10 377 879 registrations in the dental records with Snomed CT codes
- Population: 136 324 patients
- Historical data extending over a period of 25 years back to October 1994

# SNOMED CT based analysis (limited to 100.000 lines)

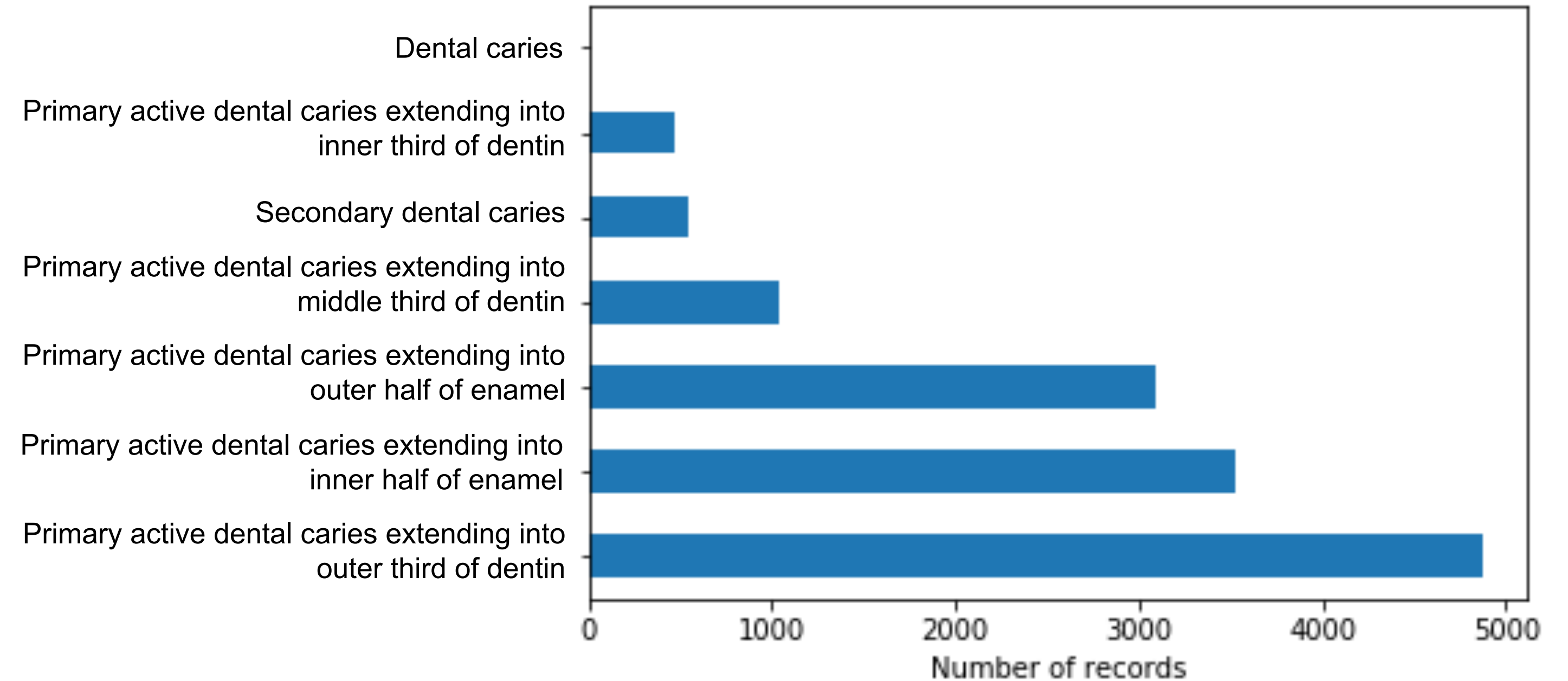
## «Is-a» subsumption

## Causative agent = Bacteria

Snomed counts of caries



Diagnosis caused by bacterias



**Caries is the only disease with a causative agent of bacteria in the refset**



# Reason for tooth extraction – first permanent premolar

SCTtext_DueToAttribute	Antall
Disturbance of tooth eruption or exfoliation	25
Dental trauma	15
Orthodontic procedure	7669
NULL	486
Periodontitis	754
Dental caries	1907

## Caries, outer third of dentin:

	SCTID	antall
1	733941004	497995

	Pro Text	antall
1	Fissure seal tooth (procedure)	31220
2	Fit post core to tooth	12
3	Fit veneer to tooth	8
4	Insertion of amalgam restoration into tooth	1734
5	Insertion of composite restoration into tooth (p...	91976
6	Insertion of dental bridge abutment (procedure)	136
7	Insertion of dental bridge pontic (procedure)	24
8	Insertion of glass-ionomer restoration into toot...	42680
9	Insertion of temporary dental crown	32
10	Insertion of temporary dental filling in tooth	27129
11	Procedure on mouth (procedure)	33
12	Prosthetic dental implant	4
13	Replacement of tooth with removable denture	164
14	Restoration, crown, single (procedure)	420
15	Restoration, inlay, metallic (procedure)	8
16	Root canal therapy, comprehensive (procedure)	8940
17	Tooth extraction	2064

## Caries, outer third of dentin, deciduous teeth:

	SCTID	antall
1	733941004	114319

	Pro Text	antall
1	Procedure on mouth (procedure)	8
2	Insertion of amalgam restoration into tooth	86
3	Fissure seal tooth (procedure)	2052
4	Root canal therapy, comprehensive (procedure)	595
5	Tooth extraction	792
6	Insertion of temporary dental filling in tooth	10515
7	Insertion of composite restoration into tooth (pr...	1624
8	Insertion of glass-ionomer restoration into tooth...	18810

# Free Text in Oral Medicine and Surgery

Number of registrations

	SCTID	antall
1	423066003	9618
2	107100119107	7849

- Oral Medicine
- Oral Surgery

# Why is SNOMED CT important?

- Structured documentation using an international standard
- Interoperability
- Analytics

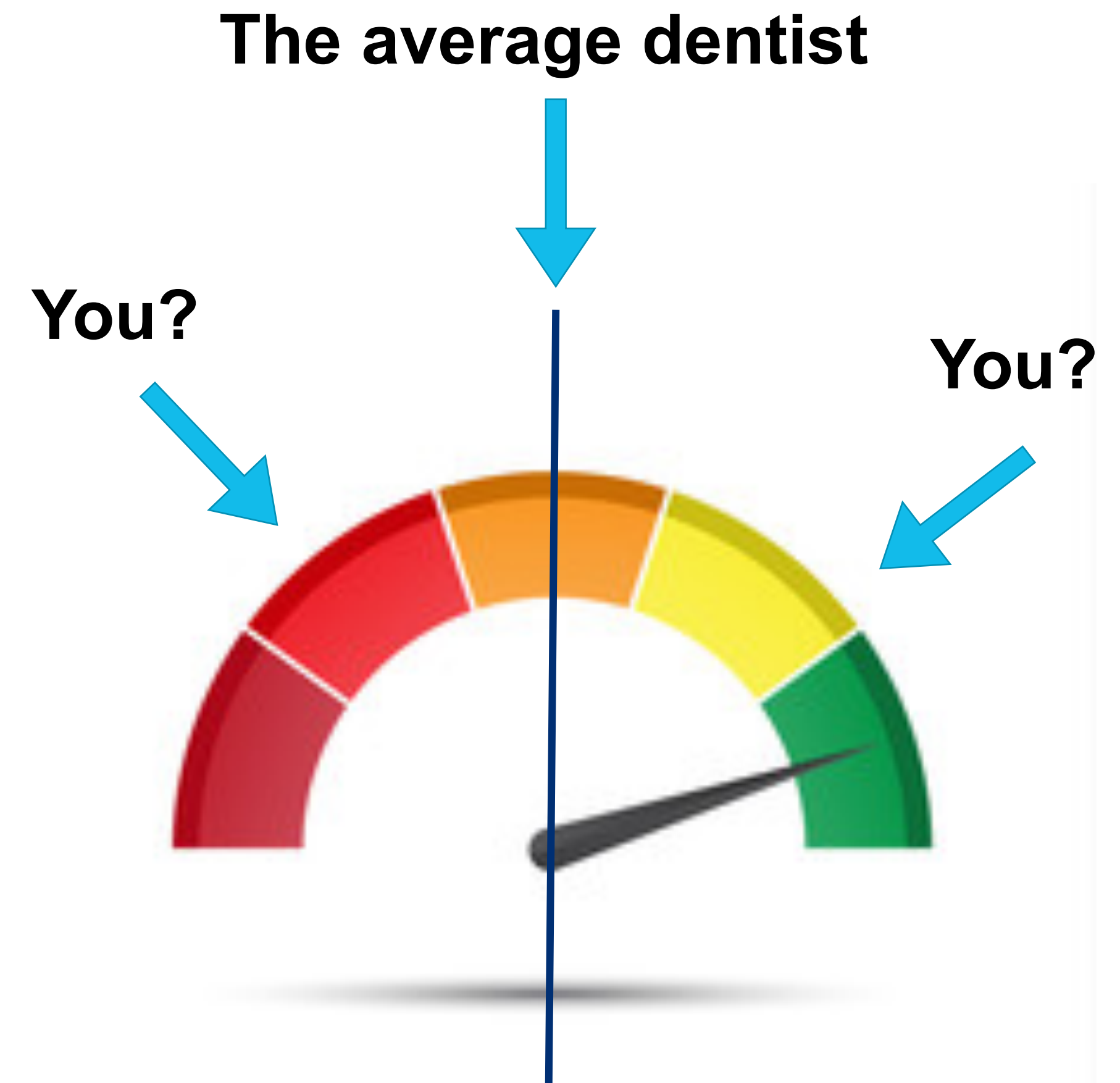
SO WHAT?



WHO CARES?

# Why should the clinician care? (or: What's in it for me?)

- Dashboards measuring:
  - Variation in treatment
  - Lifespan of fillings
  - Lifespans of prosthetics
  - Post operative complications
- Comparisions with cohorts of dentists
- Decision support
- Predefined lists of diagnosis



# The next level – making text structured

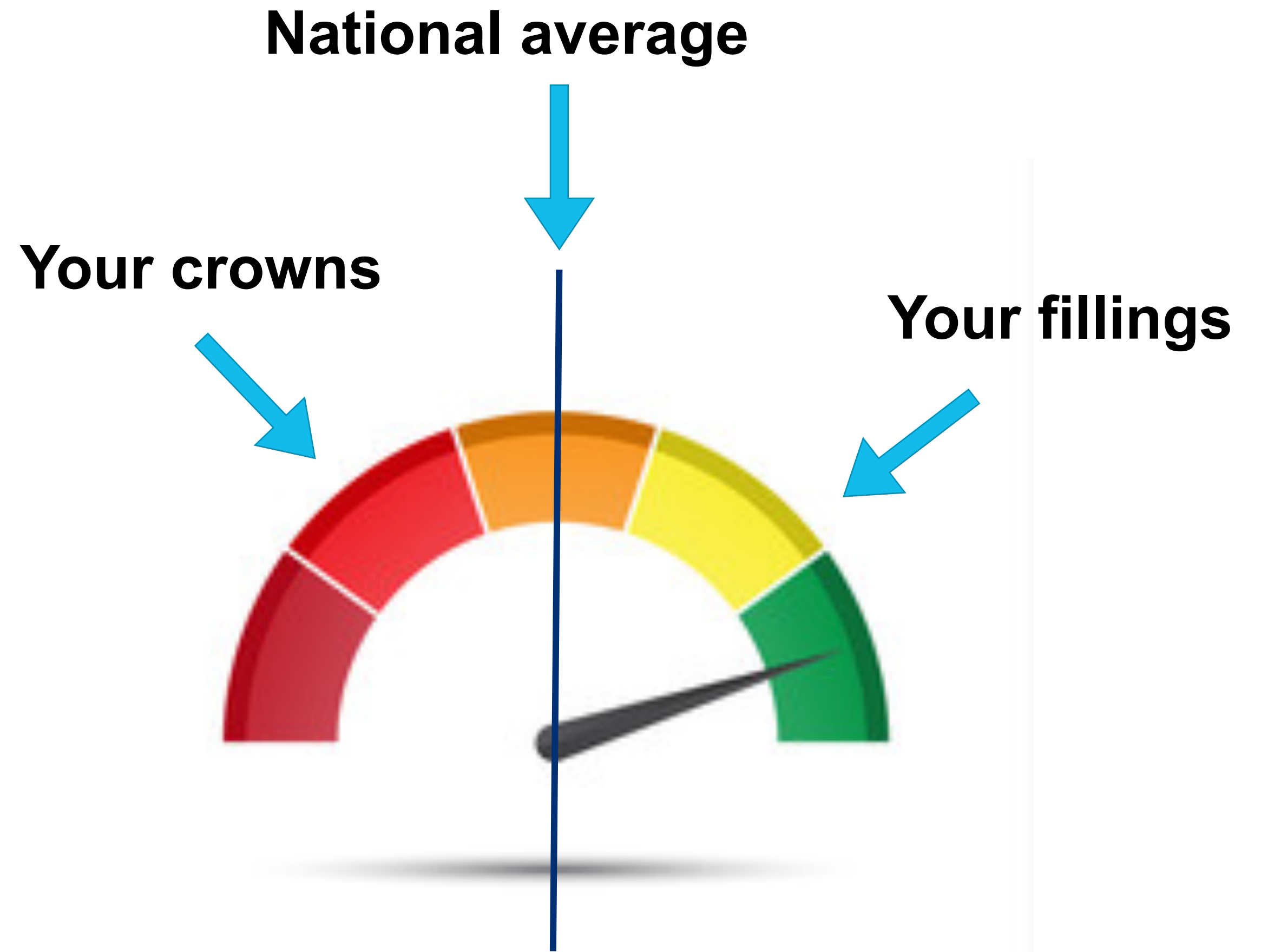
- <<404684003 |Clinical finding| : 363698007 |Finding site| = <<74336005 |Oral soft tissues structure (body structure)|

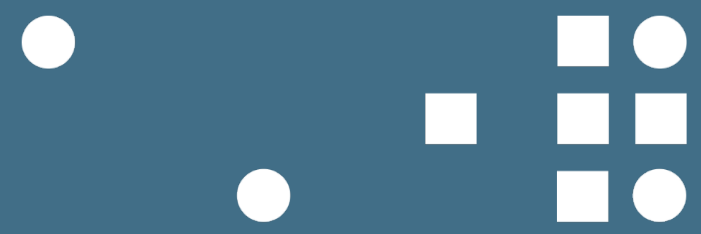
Results: Found 1504 concepts

Concept	Id
Mucous cyst of upper lip (disorder)	1092901000119107
Oral ulcerative mucositis due to antineoplastic therapy (disorder)	1089991000119109
Lesion of oral mucosa (disorder)	1089981000119106
Minimal keratinized residual ridge mucosa (finding)	1089881000119100
Excessive keratinized residual ridge mucosa (finding)	1086851000119100
Cleft of soft palate and cleft lip (disorder)	1085351000119101
Cleft of soft palate and bilateral cleft lip (disorder)	1085341000119103
Cleft palate and bilateral cleft lip (disorder)	1085331000119107
Cleft of hard palate and cleft lip (disorder)	1085301000119100
Uranostaphyloschisis with cleft lip (disorder)	1085291000119101
High attachment of labial frenum (disorder)	433981000124105
Cheilitis due to lupus erythematosus (disorder)	430961000124105
Posterior soft tissue impingement on teeth (disorder)	318161000119106

# Future goal

*Giving the power of analytics to the clinician.*





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Thank you!



# What is already performed?

- 1) Defined the standard set of data needed for the description message – analyzed the existing data
- 2) Mapped all body sites to SNOMED CT – tooth, surfaces, root surfaces, root canals, mouth region
- 3) Mapped all opportunities of registration within status, diagnosis, findings, therapy, previously performed, performed from Opus internal codes to SNOMED CT, and using ECL to express context
- 4) Mapped all fields in the Periodontal charting with six-area per tooth focus (procedure) from Opus internal codes to SNOMED CT, and using Expression Constraint Language to express values
- 5) Converted all historical data
- 6) Enabled advanced analysis internally in EPJ in addition to external analysis tool
- 7) Made a selection of data to be transferred to a central dental registry

