

Sharing Medical Data
Sébastien Jodogne

The topic of this talk



The topic of this talk



Why sharing medical data is important?

Continuity of care

Second opinion

Legal archiving (30 years)

Legal obligation
for “objective” data

Training of skilled workers

Artificial intelligence
(scientists + SaaS companies)

Patient literacy
“Patient-partner”

Remote expertise

(Cross-border) moving

Public health analyzes

Redundant clinical examinations

Clinical research

Rare diseases

(...)



The e-Health fantasy (nowadays)

Patients

Primary care

Insurances

“Mutuelles”

Government

Companies

Scientists

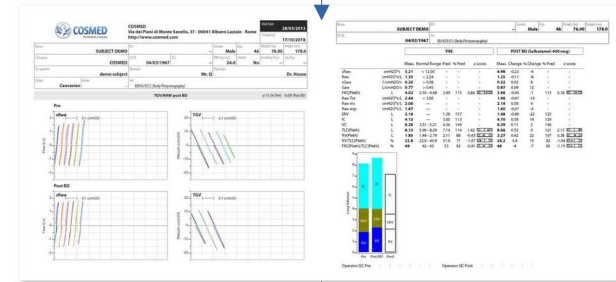
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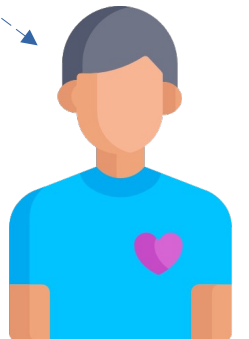
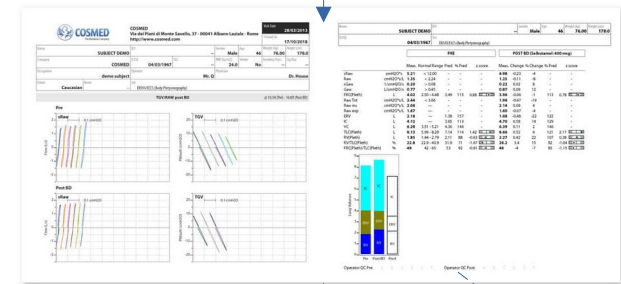
A visit to the pulmonologist



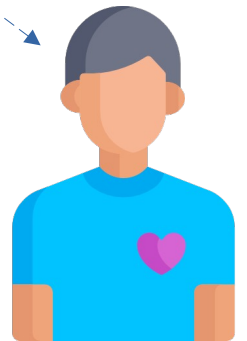
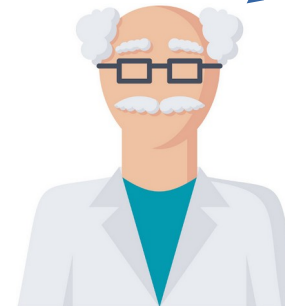
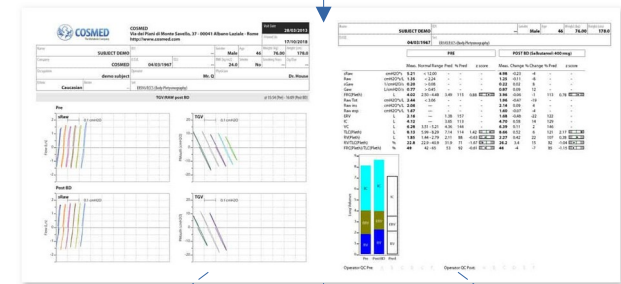
A visit to the pulmonologist



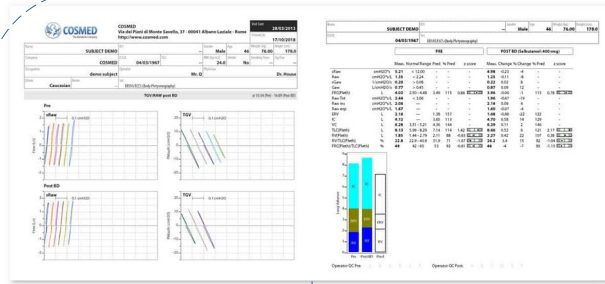
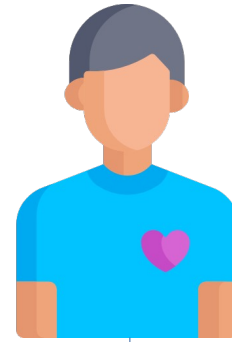
A visit to the pulmonologist



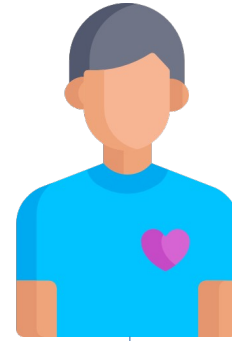
A visit to the pulmonologist



Hospital



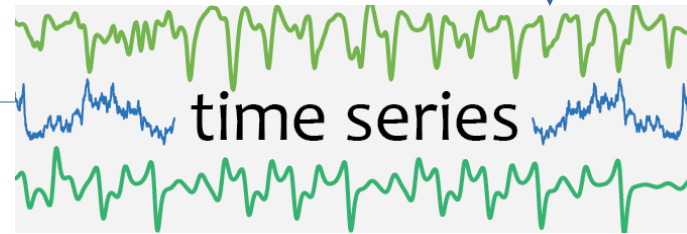
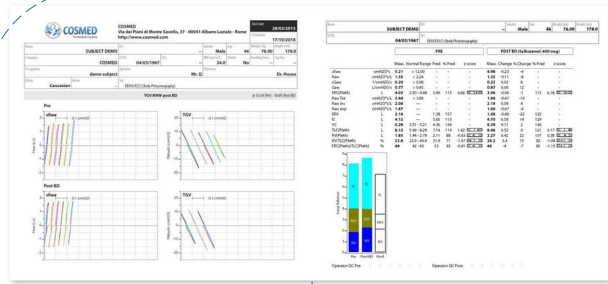
Electronic health record



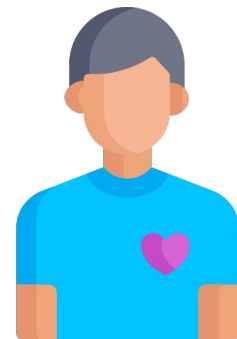
Brussels
Gezondheids
Netwerk.be

Réseau
Santé
Bruxellois.be

Hospital



Electronic health record

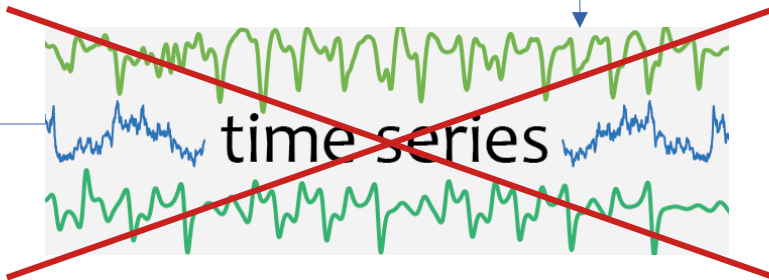
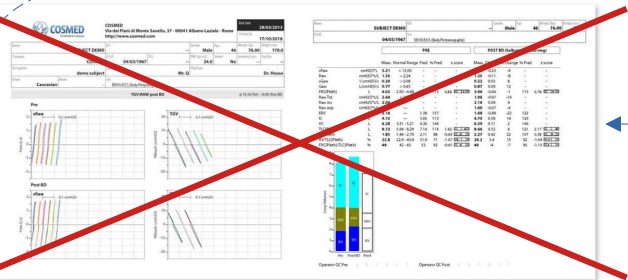


Brussels
Gezondheids
Netwerk.be

Réseau
Santé
Bruxellois.be



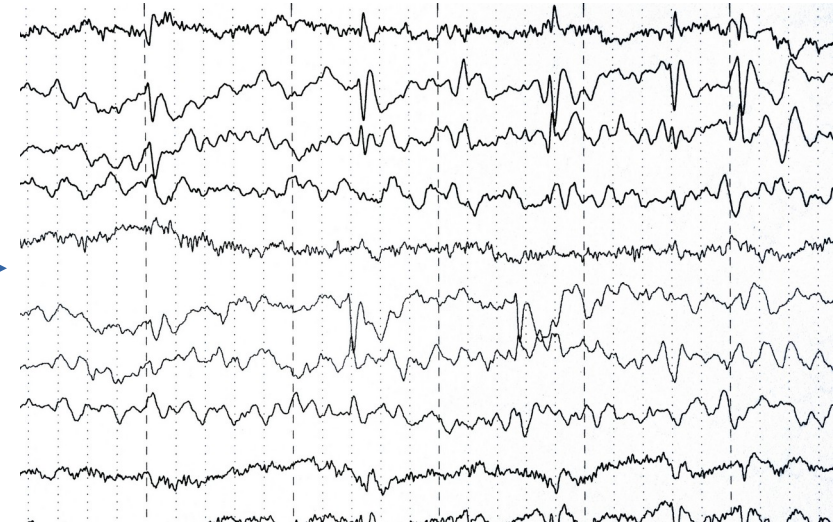
Hospital



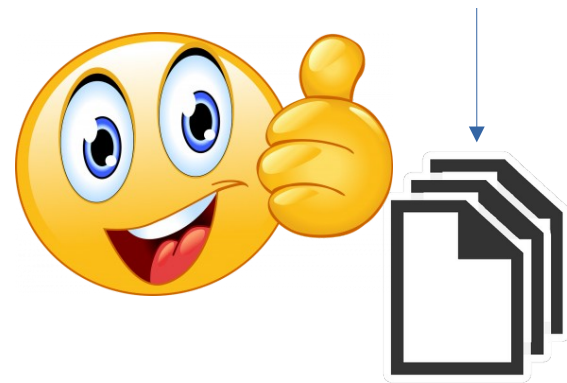
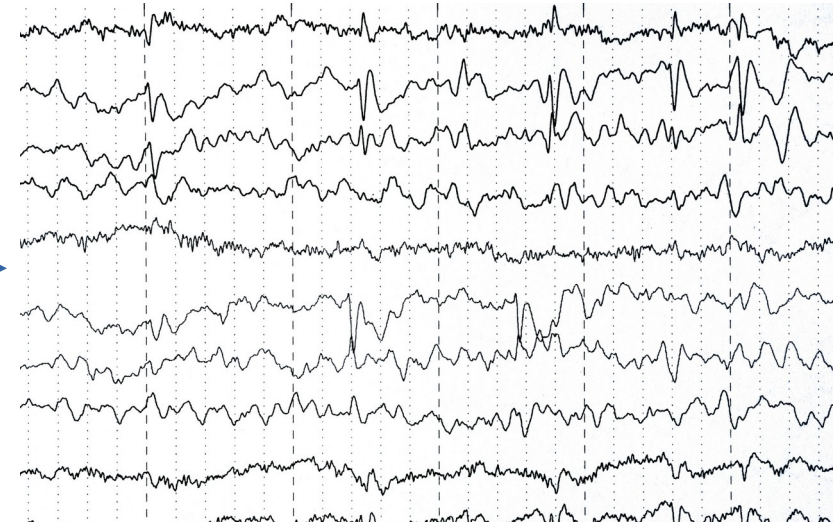
Electronic health record

(1) Need to go beyond PDF

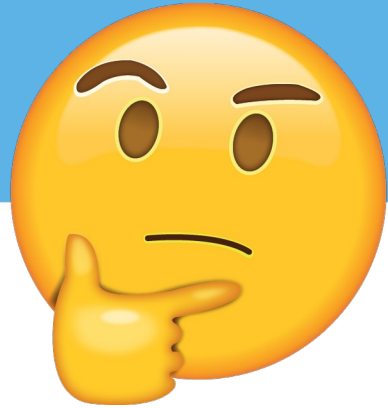
A visit to the neurologist



A visit to the neurologist



Yes, but...



Supported file formats

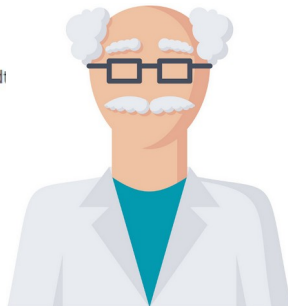
EEG / Electrophysiology

- ADInstruments LabChart (.adicht)
- ANT ASA (.msm/.msr)
- ANT EEProbe (.cnt, .avr)
- Axion AxIS (.raw)
- BDF / BDF+ (Biosemi 24bit binary)
- BESA exports (.avr, .mul)
- BIDS-formatted datasets
- Blackrock NeuroPort (.nev, .nsX)
- BrainVision BrainAmp (.eeg)
- BrainVision Analyzer (.txt)
- Cartool binary files (.ep, .eph)
- CED Spike2 (.smr, .smrx, .son)
- Compumedics ProFusion Sleep (.rda)
- Curry 6-7 (.dat/.dap/rs3)
- Curry 8 (.cdt/.dpa)
- Deltamed Coherence-Neurofile export (.txt/.bin)
- EDF / EDF+ (European Data Format)
- EEGLab sets (.set)
- ERPLab results (.erp)
- EGI NetStation epoch-marked file (.raw/.epoc)
- EGI-Philips (.mff)
- EmotivPRO (.edf)
- FieldTrip structures (.mat)
- g.tec / g.Recorder (.mat, .hdf5)
- Intan (.rhd, .rhs)
- MANSCAN Microamp (.mbi/.mb2)
- MEGA NeurOne (.bin)
- Micromed (.trc)
- Muse (.csv)
- Neuralynx (.ncs)
- Neurodata Without Borders (.nwb)
- Neuroelectrics (.easy, .nedf)
- NeurOne (.bin)
- Neuroscan (.cnt, .eeg, .avg, .dat)
- NeuroScope (.eeg, .dat)
- Nicolet (.e)
- Nihon Kohden (.EEG)
- Open Ephys flat binary (*.dat)
- Plexon (.plx, .pl2)
- Ripple Trellis (.nev, .nsX)
- The Virtual Brain (.h5)
- Tucker Davis Technologies (.tdf)
- Wearable Sensing (.csv)



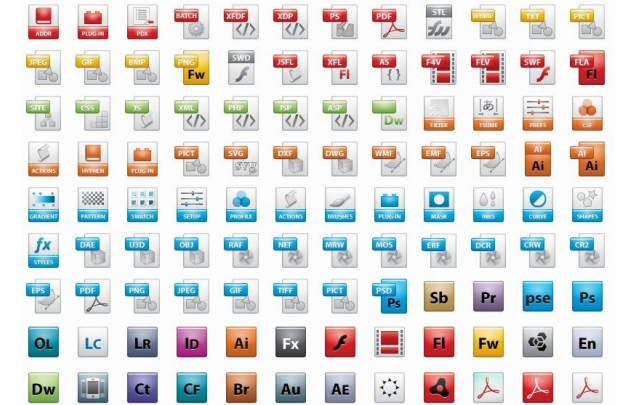
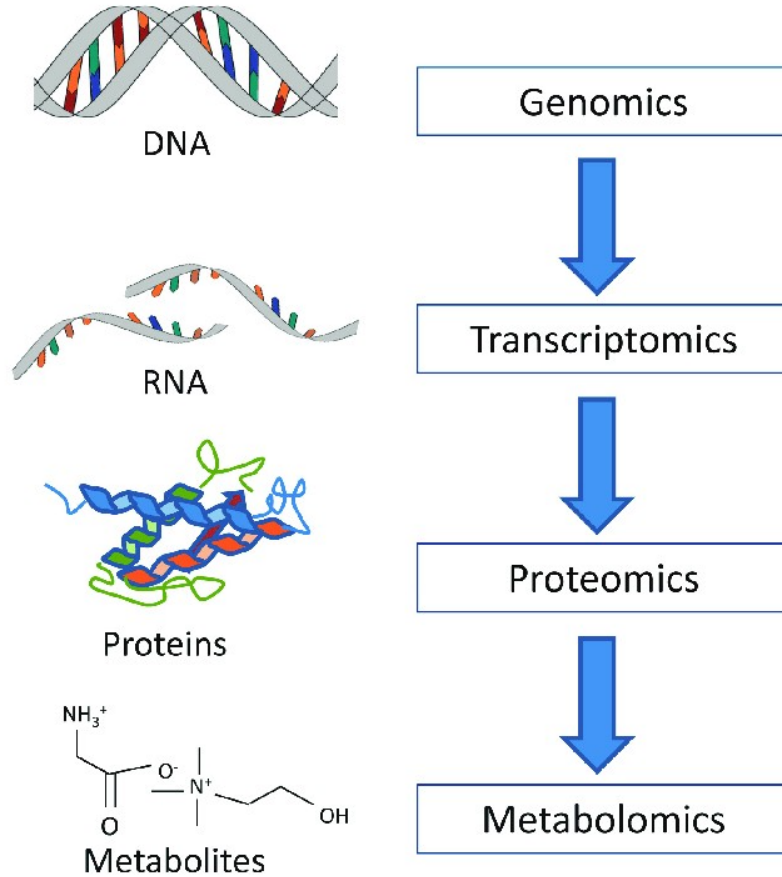
*Which software?
How can I get
my **raw objective data**?
What does this mean?*

Patient literacy



+ Multi-centric

Omics data: A new challenge



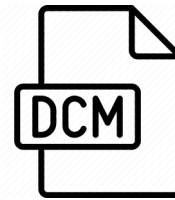
+ Multi-centric

(2) Need for interoperability

A visit to the radiologist



A visit to the radiologist



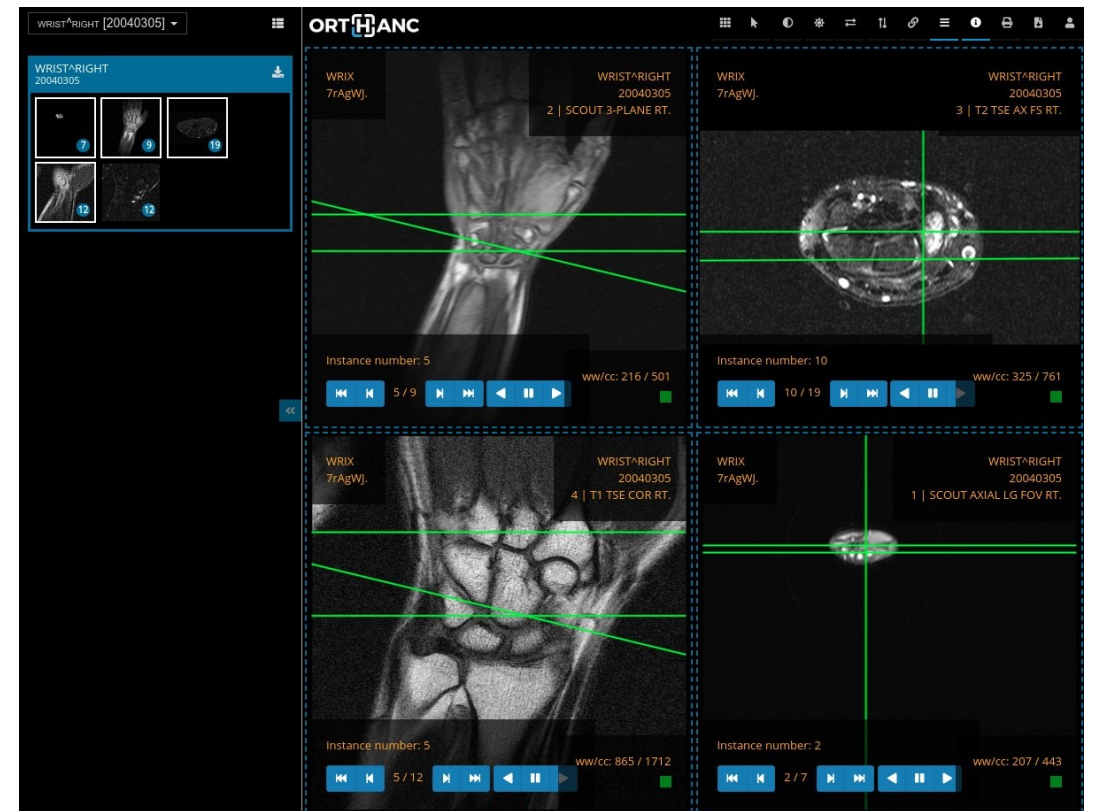
"One standard to rule them all..."



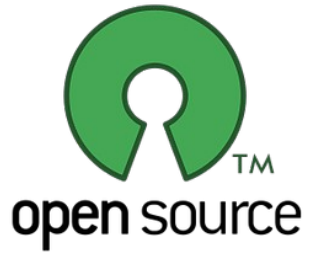
OPEN standard → OPEN implementations



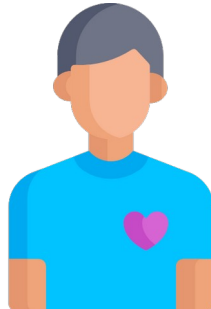
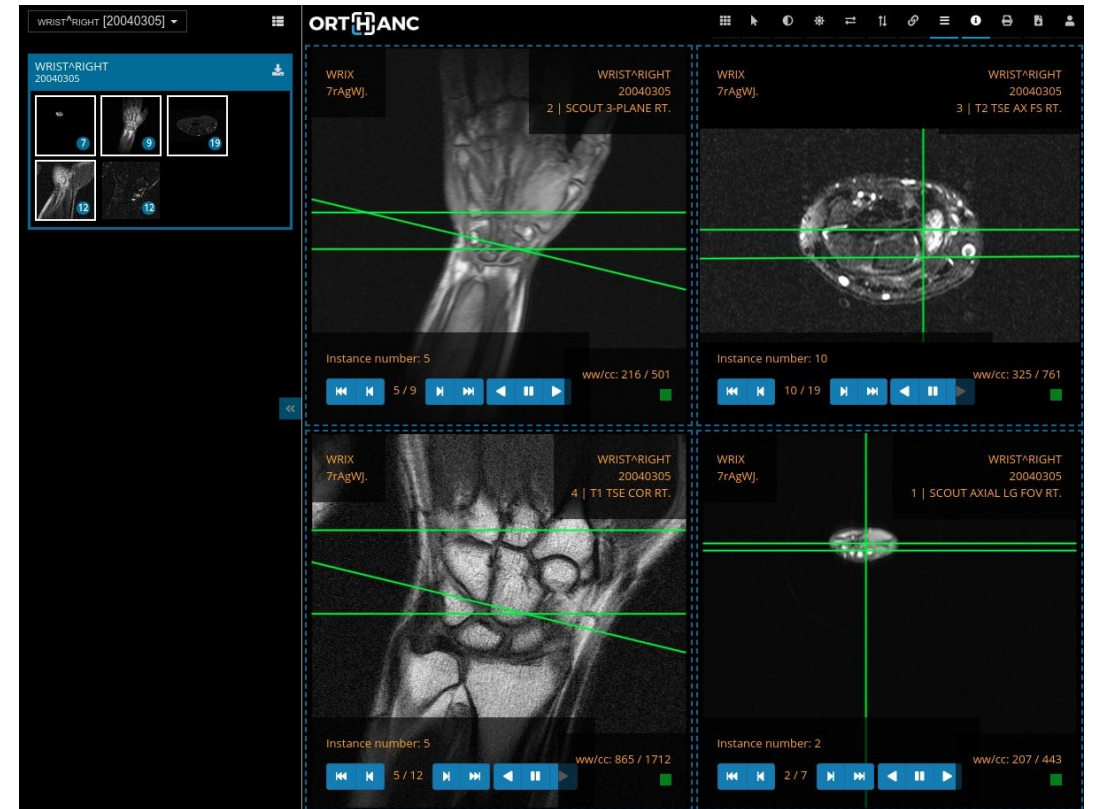
→ **ORTHANC** →



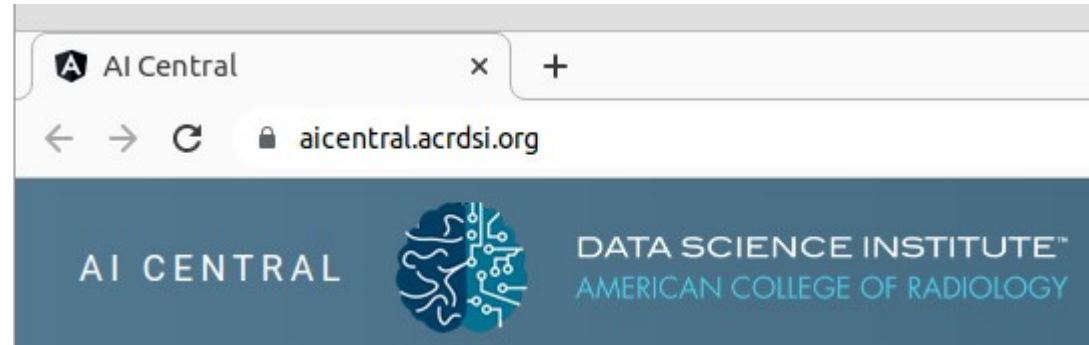
OPEN standard → OPEN implementations



→ **ORT_HANC** →



OPEN standard reduces barriers to entry



Date Cleared	Product	Company	Type	Finding	BodyArea	Subspecialty	Modality	Age
2022-03-21	BriefCase- CTA	Aidoc Medical, Ltd.	CADt	Aneurysm	Brain	Neuroradiology	CTA	Unspecif
2022-03-14	BriefCase- Ptx	Aidoc Medical, Ltd.	CADt	Pneumothorax	Chest	Chest Imaging	XRAY	Unspecif
2022-03-14	Arterys MICA	Arterys Inc.	Image Processing...	Cardiac measurements	Heart	Cardiac Imaging	MR	Unspecif
2022-03-10	ClearRead Xray Pneum...	Riverain Technologies	CADt	Pneumothorax	Chest	Chest Imaging	XRAY	Adult only
2022-03-07	Syngo.CT Applications	Siemens Healthineers	Image Processing...	Cardiac measurements	All	All	MR	Unspecif
2022-03-01	BoneView	Gleamer	CADe/x	Fracture	Upper Ex...	Musculoskeletal I...	XRAY	Adult only
2022-02-24	Annalise Enterprise CX...	Annalise-AI Pty Ltd.	CADt	Pneumothorax	Chest	Chest Imaging	XRAY	Adult only
2022-02-18	Viz Aneurysm, Viz ANX	Viz. ai, inc.	CADt	Aneurysm	Brain	Neuroradiology	CT	Unspecif
2022-02-18	Deep Learning Image R...	GE Medical Systems	Image Processing...	Image Quality improvement	All	All	CT	Adult and p
2022-02-03	Contour ProtégéAI	Mim Software	Image Processing...	Radiation treatment plann...	All	All	CT,MR	Adult only
2022-01-28	syngo.CT Brain Hemorr...	Siemens Healthineers	CADt	Intracranial hemorrhage	Brain	Neuroradiology	CT	Unspecif
2022-01-19	Follicle Clarity Software	Cycle Clarity	Image Processing...	Ovarian follicles	Ovaries	Women's imaging	US	Unspecif
2022-01-19	Caption Interpretation ...	Caption Health	Image Processing...	Cardiac flow	Heart	Cardiac Imaging	US	Adult only
2022-01-14	Quantib ND	Quantib BV	Image Processing...	Brain anatomy	Brain	Neuroradiology	MR	Unspecif
2022-01-14	Eclipse II with Smart No...	Carestream	Image Processing...	Image Quality improvement	All	All	XRAY	Adult and p
2022-01-12	UNID Spine Analyzer	MediCREA (Medtronic)	Image Processing...	Surgical Planning	Spine	Musculoskeletal I...	UNSP	Adult and p
2021-12-29	LiverSmart	Resonance Health Analysis ...	Image Processing...	Liver iron deposition ,Fatty...	Liver	Abdominal Imaging	MR	Unspecif
2021-12-22	Claritas iPET	Claritas HealthTech Pte. Ltd.	Image Processing...	PET image denoising	Brain	Neuroradiology	PET,CT,MR	Unspecif
2021-12-22	BoneMRI	MRIguidance B.V	Image Processing...	Brain anatomy	Brain	Neuroradiology	CT	Adult only

What about clinical data?

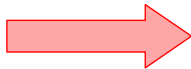
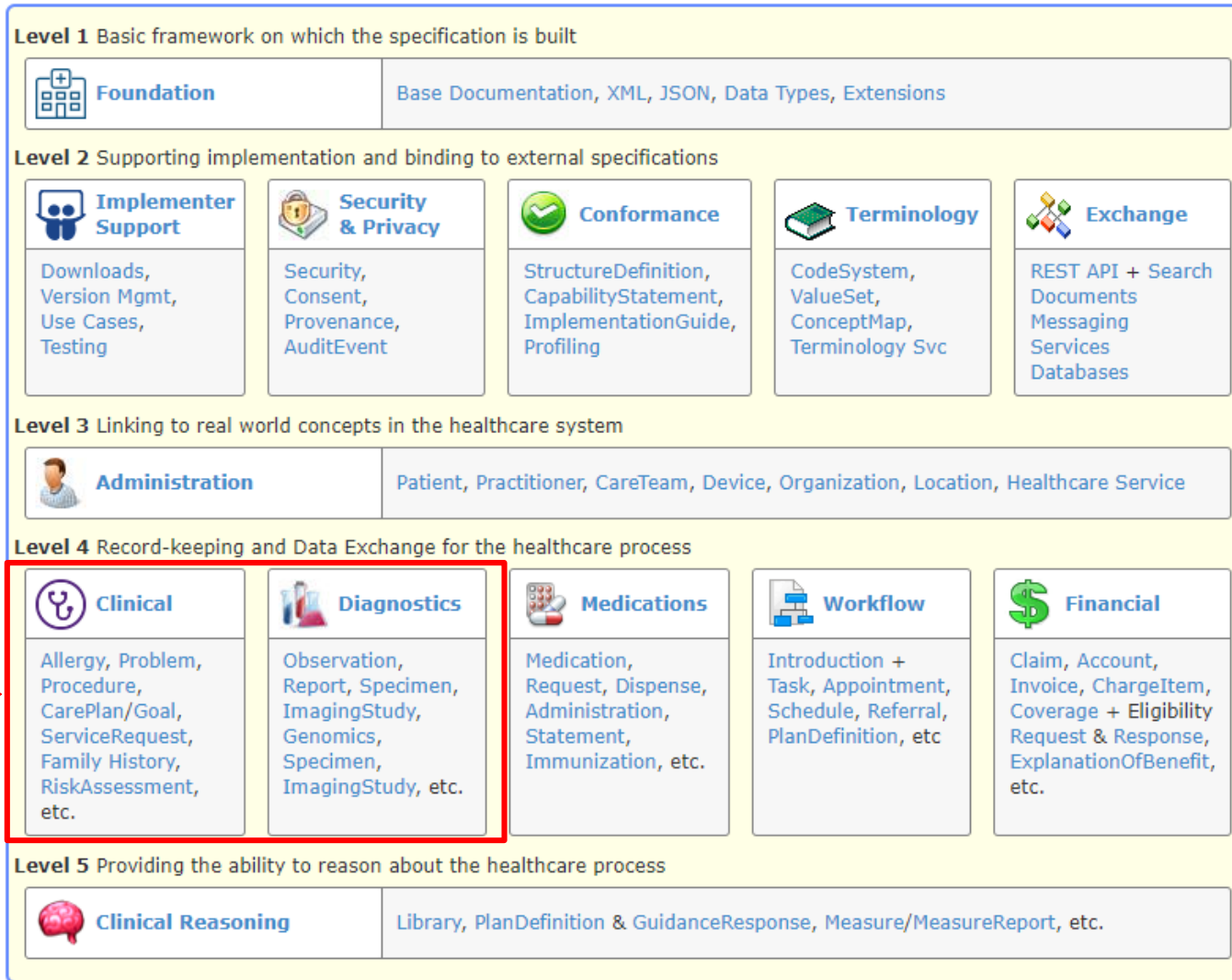


FHIR



- “Fast Healthcare Interoperability Resources”
- Ongoing work by HL7 consortium since 2011 (normative since 2019)
- Focused on developers to create external apps (JSON, REST API...)





OPEN implementation



HAPI FHIR

<https://hapifhir.io/>

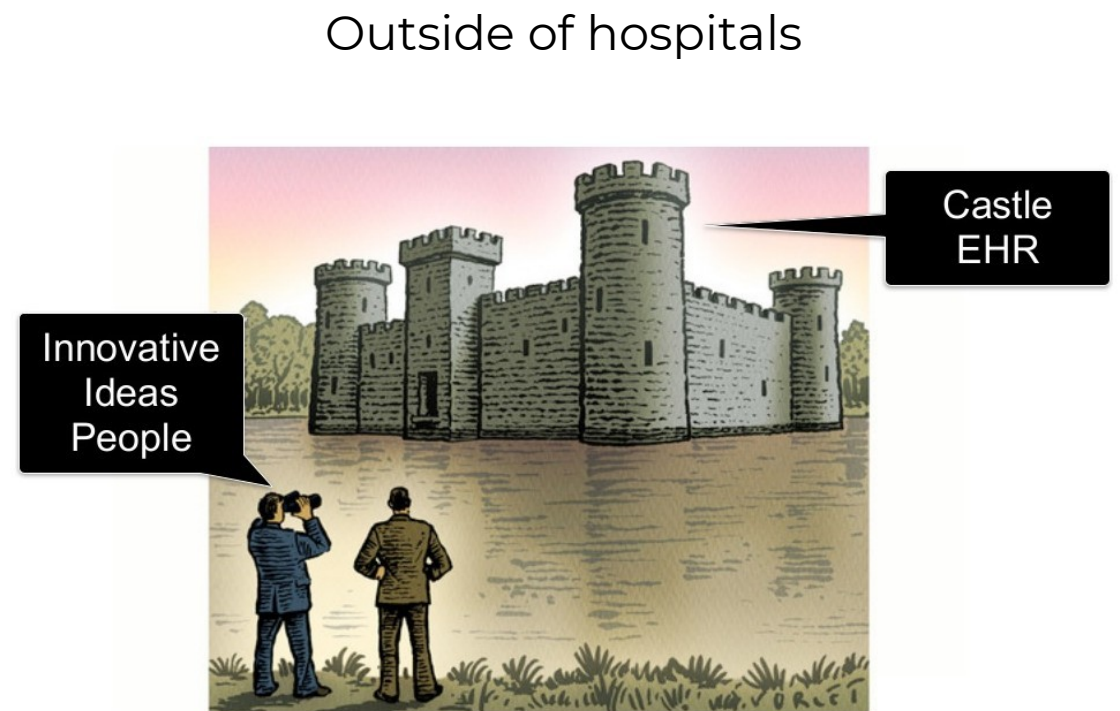
<https://www.hl7.org/fhir/>

DICOM + FHIR = Innovations in healthcare



(c) James Agnew

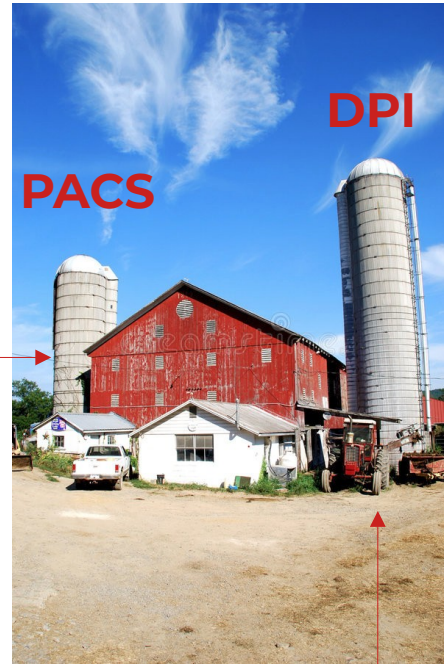
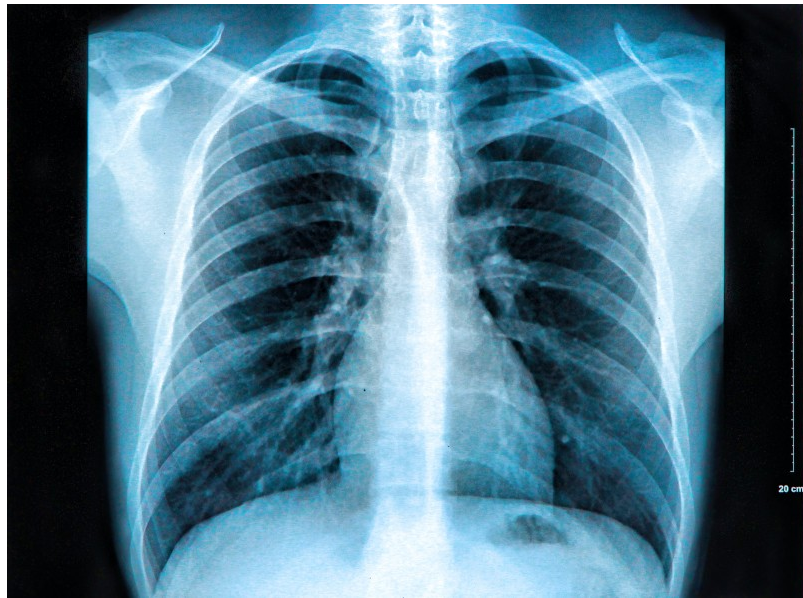
Within hospitals (e.g. CIM)



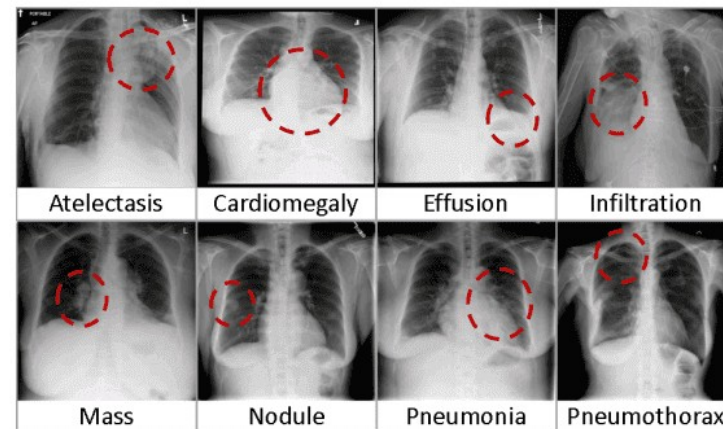
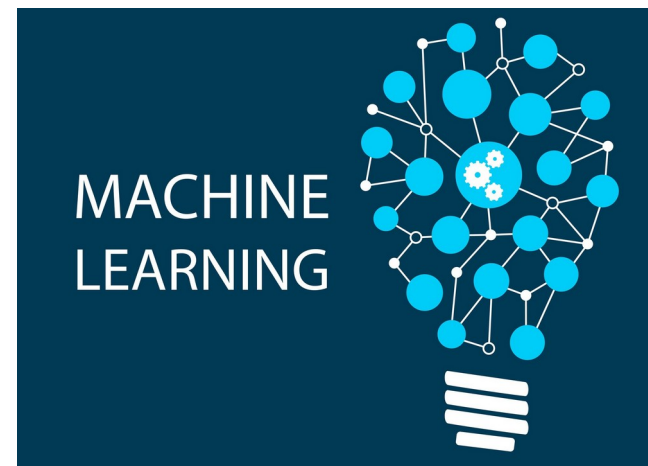
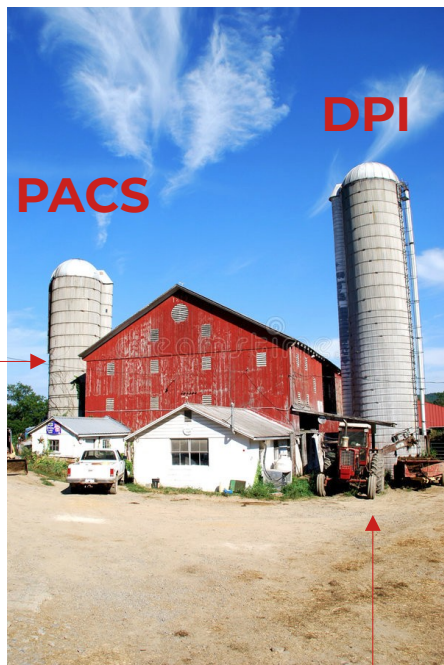
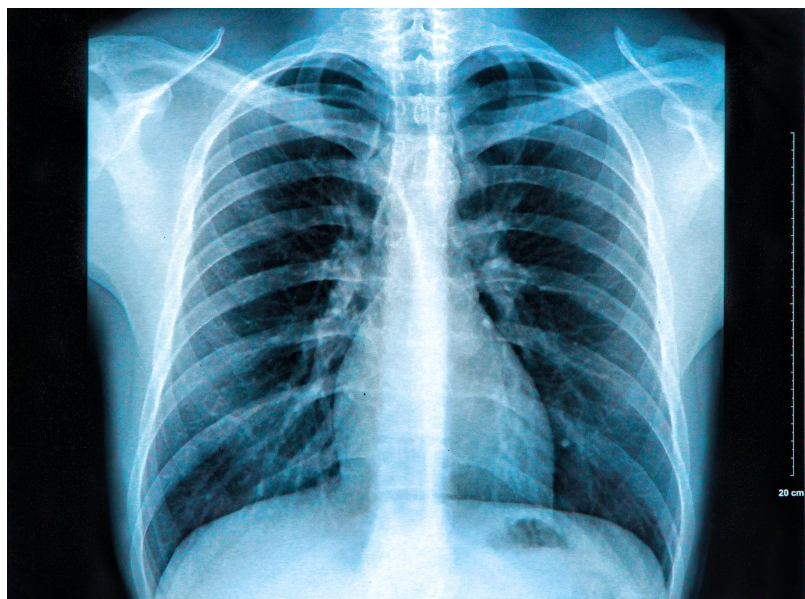
(c) James Agnew

(3) Need for semantics

The example of medical imaging



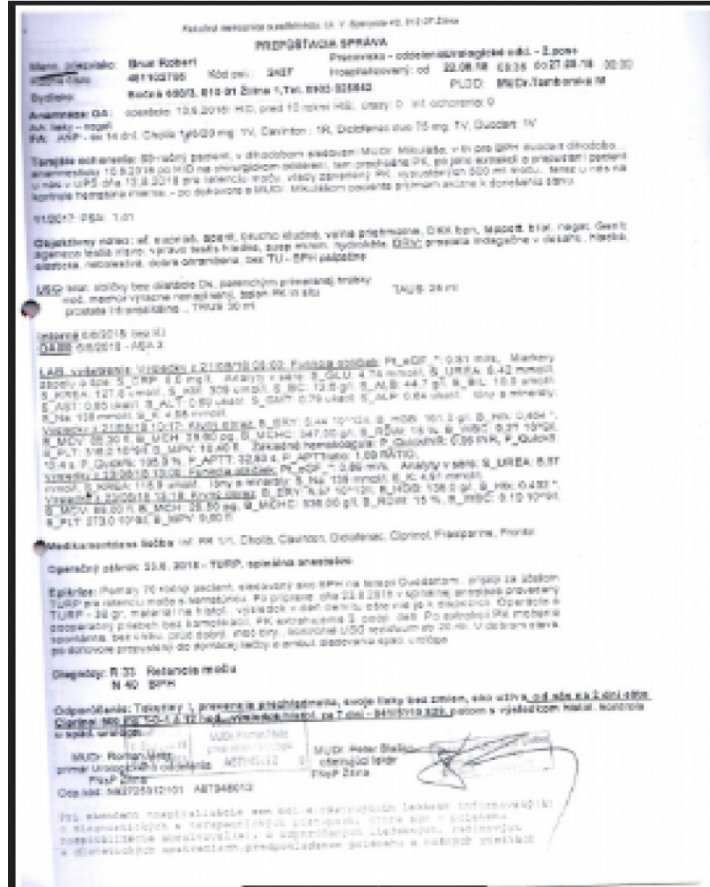
The example of medical imaging



Structured annotations

Standardizing the medical language

MEDICAL REPORT



```

define name="Findings">
-<element name="Findings" radlex:id="RID28486" radlex:match="Exact">
- <element name="Sex" radlex:id="RID5652" radlex:match="Exact" snomed:id="263495000">
- <choice>
- <element name="Male" radlex:id="RID5653" radlex:match="Exact" snomed:id="248153007">
  <empty/>
</element>
- <element name="Female" radlex:id="RID5654" radlex:match="Exact" snomed:id="248152002">
  <empty/>
</element>
</choice>
</element>
- <element name="Chronological_age" radlex:id="RID13163" radlex:match="Exact"
snomed:id="424144002">
- <element name="Years" radlex:id="" radlex:match="">
  <data type="nonNegativeInteger"/>
</element>
- <element name="Months" radlex:id="" radlex:match="">
  <data type="nonNegativeInteger">
    <param name="maxInclusive">11</param>
  </data>

```

Languages
 Ambiguities
 Specialisms
 Synonyms
 Polysemy
 Spelling mistakes

Some medical nomenclatures

SNOMED CT

The global language of healthcare

NHS Digital SNOMED CT Browser
© SNOMED International 2017 v1.36.4 - Hosted and maintained by NHS Digital

Taxonomy Search Favorites Refset

Taxonomy

Inferred view ▾

- SNOMED CT Concept
 - Body structure (body structure)
 - Clinical finding (finding)
 - Administrative statuses (finding)
 - Adverse incident outcome categories (finding)
 - Bleeding (finding)
 - Body piercing (finding)
 - Calculus finding (finding)
 - Clinical history and observation findings (finding)
 - Clinical stage finding (finding)
 - Color finding (finding)
 - Creatinine clearance decreased (finding)
 - Decreased vascular flow (finding)
 - Deformity (finding)
 - Disease (disorder)
 - Abscess (disorder)
 - Acquired immunodeficiency syndrome-associated disorder (disorder)
 - Acute disease (disorder)
 - Acute adrenal insufficiency (disorder)
 - Acute alcoholic intoxication in remission, in alcoholism (disorder)
 - Acute allergic reaction (disorder)
 - Acute complication due to diabetes mellitus (disorder)

Parents

- Chest pain (finding)
- Disorder characterized by pain (disorder)
- Ischemic heart disease (disorder)
- Pain of cardiovascular structure (finding)

Angina (disorder)

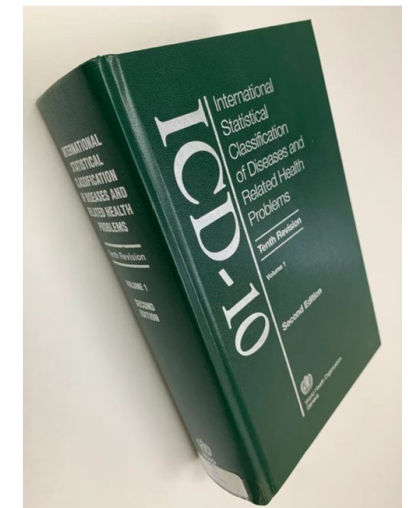
SCTID: 194828000

194828000 | Angina (disorder) |

Angina
Cardiac angina
Angina pectoris
Stenocardia
Anginal syndrome
AP - Angina pectoris
Ischemic heart disease - angina
Ischaemic heart disease - angina
Angina (disorder)

LOINC[®]

from Regenstrief



Belgian e-Health roadmap 2022-2024

DOC 55 **2294/003**

BELGISCHE KAMER VAN
VOLKSVERTEGENWOORDIGERS

28 oktober 2021

BELEIDSNOTA (*)

Volksgezondheid

Bovendien wordt er werk gemaakt van de *Health Data Authority* die het secundair gebruik van gegevens moet bevorderen ("*Real World Data*"); bij de ontwikkeling van het Geïntegreerd Patiëntendossier zal onmiddellijk aandacht worden besteed aan dit thema om ervoor te zorgen dat de privacy van de burger/patiënt wordt gerespecteerd, dat er een wettelijk, ethisch en deontologisch kader wordt ontwikkeld, dat het secundair gebruik gebeurt op een transparante en veilige manier en met geïnformeerde toestemming inclusief transparantie over de doelstellingen waarvoor de gegevens worden gebruikt. Tijdigheid en accuraatheid ("*real time data*", "*data quality*") zijn primordiaal. Daarenboven is standaardisering en interoperabiliteit de basis van gegevensuitwisseling en secundair gebruik, waarbij interoperabiliteit wordt voorzien via Snomed CT (*Systematized Nomenclature of Medicine -- Clinical Terms*) en ICD-11 (*International Classification of Diseases version 11*) voor waardensets en FHIR (*Fast Healthcare Interoperability Resources*) i.p.v. KMEHR (*Kind Messages for Electronic Health Record*) voor de uitwisseling van resources.

(4) And outside of hospitals?

Interoperability = necessary condition, but not sufficient!



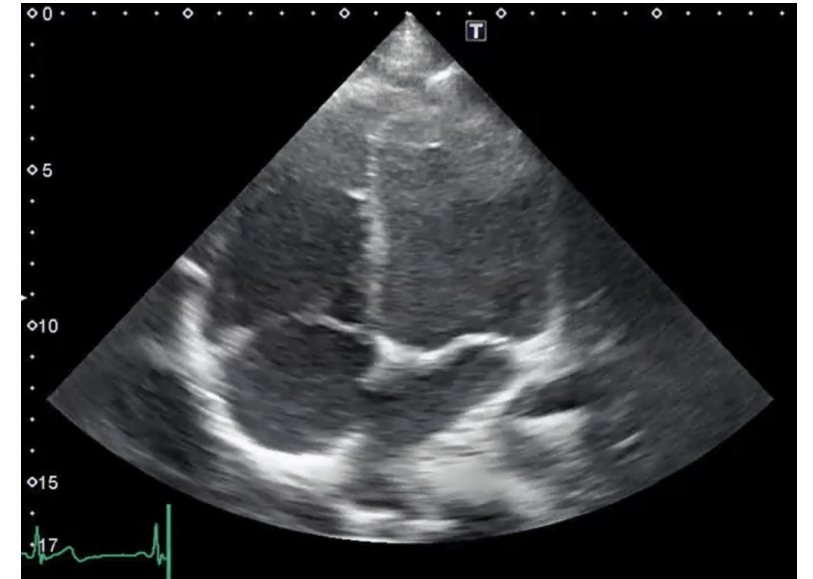
Technological innovation

Ethics committees
("unique counter"?)

Data protection



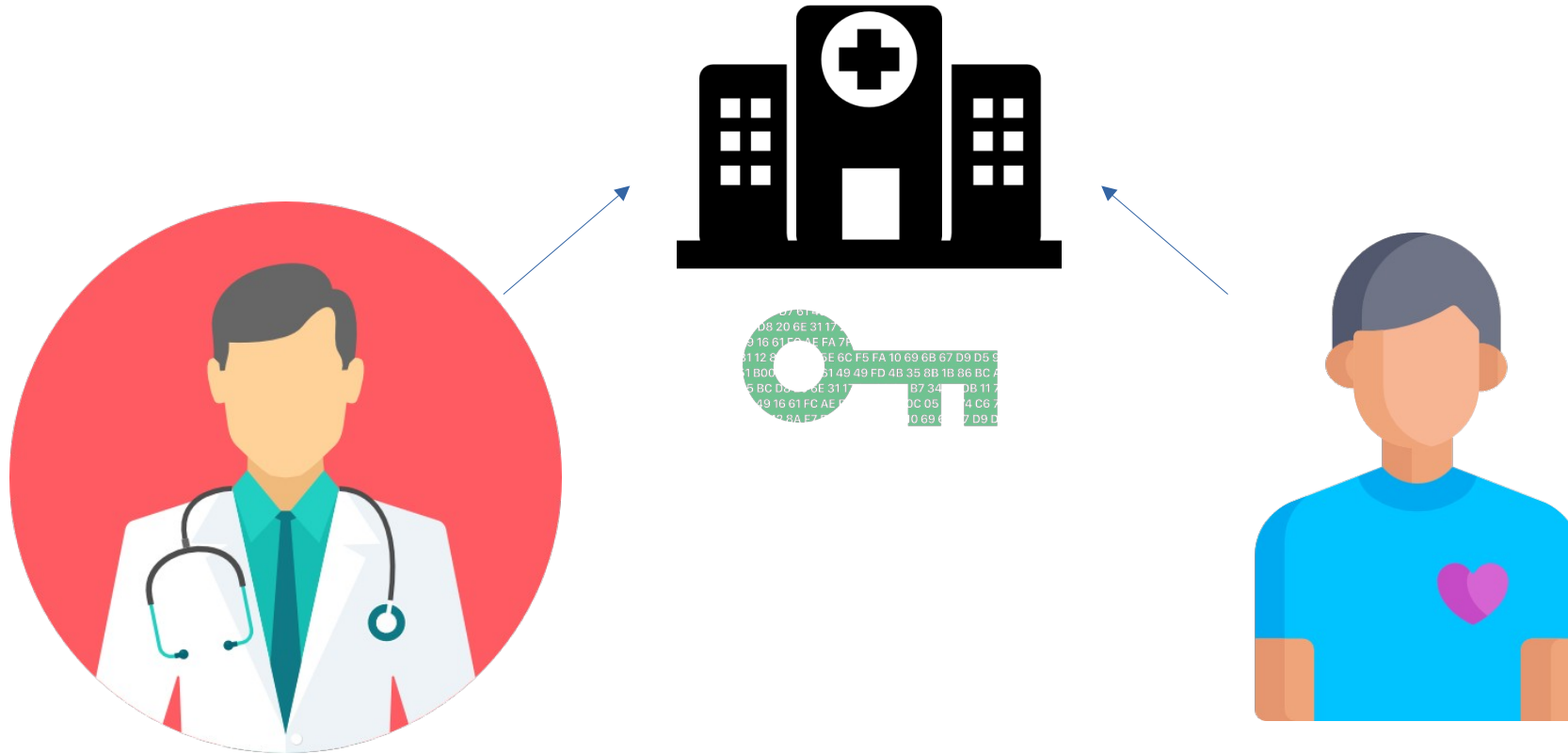
Misconception: Primary care doesn't only produce SUMEHR!



X-rays or ultrasounds **are** objective clinical data → patients should be able to access them!

How to exchange such data? How to protect them? How to legally archive them?

Interoperability to reinforce primary care



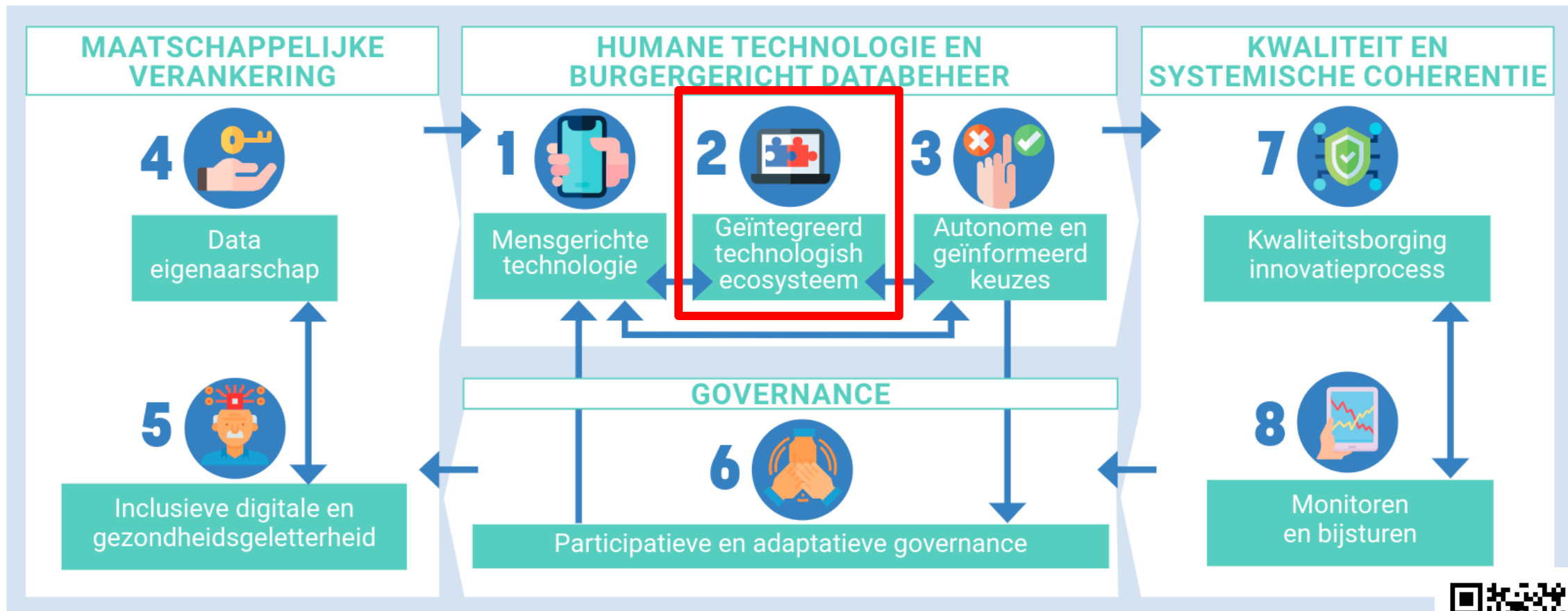
Better global view of the patient

Better understanding of my health conditions



Koning Boudewijnstichting

8 Caring Technology Principles



Take care of your patient data



<https://www.kbs-frb.be/nl/zorg-voor-je-data-0>



Conclusion



Conclusion



Conclusion





UCLouvain