/Salut

The Digital Health Strategy for Catalonia

Towards the open platform paradigm in healthcare

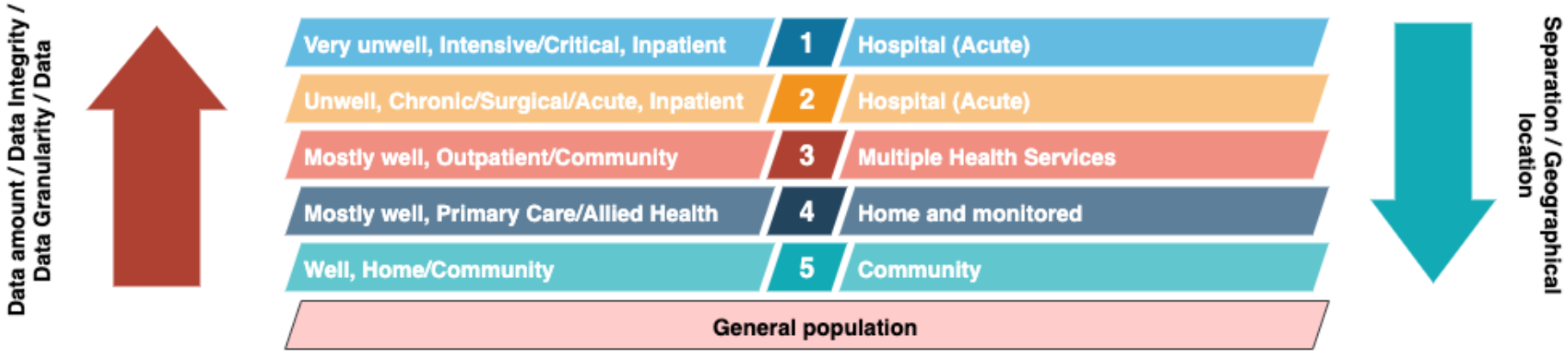
13th of June 2024
Medcom Coordination Group

Generalitat de Catalunya

Sistema de Salut de Catalunya

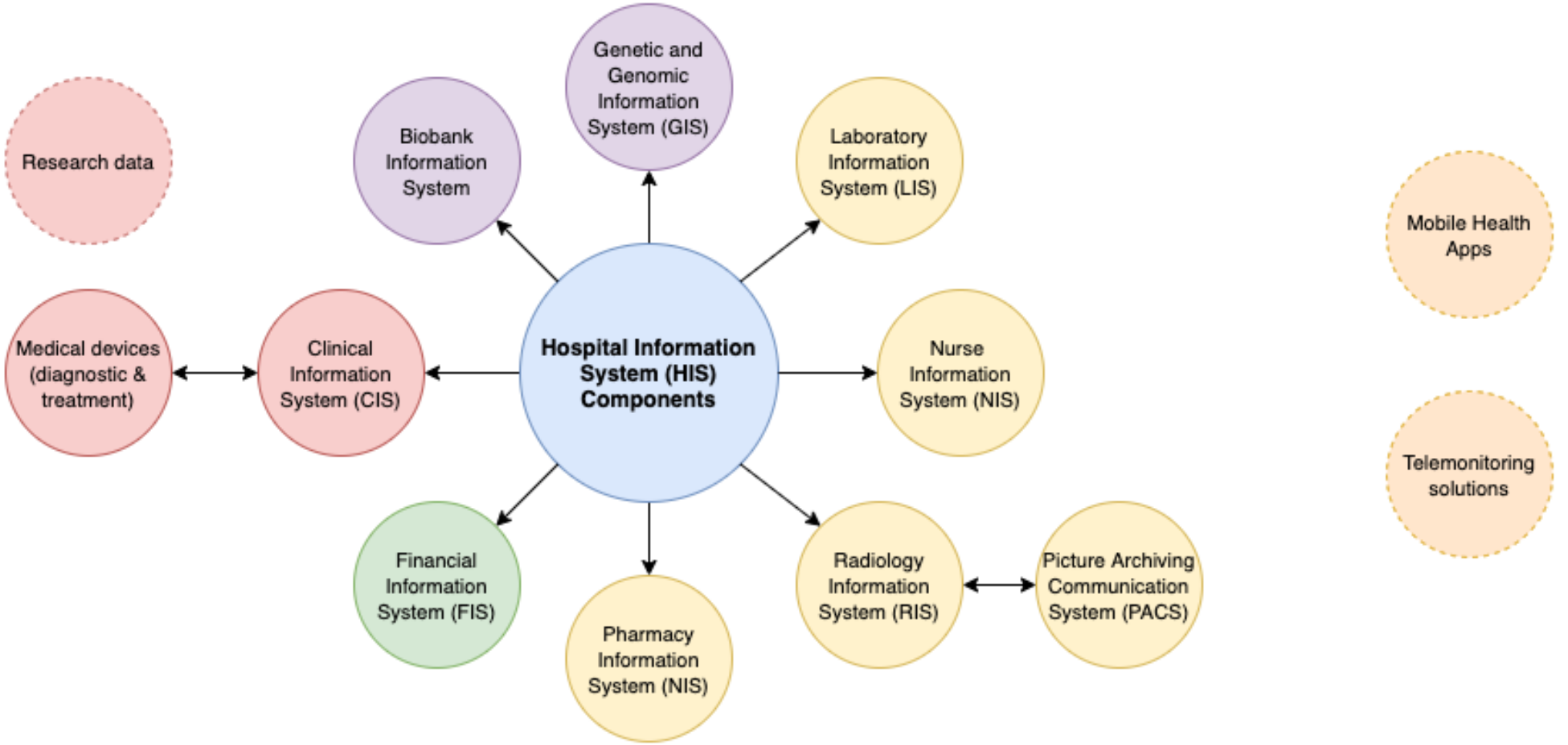
First part: let’s talk about health data

Which are the data we collect? Where are data produced?



Source: NIH Grant application (Dr Jordi Piera-Jiménez et al, 2021)

Understanding the Electronic Medical Records

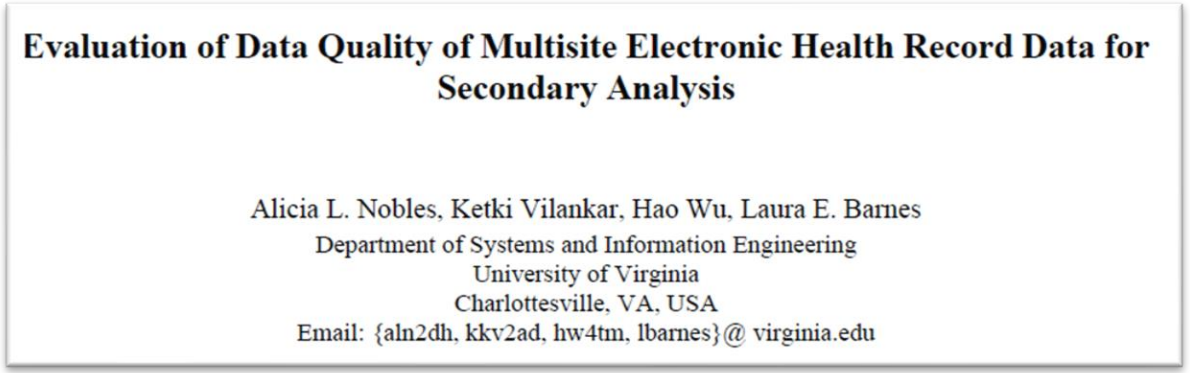


EMRs seen from the inside

The literature is full of references to data quality studies and frameworks

Impact of Electronic Health Record Systems on Information Integrity: Quality and Safety Implications

by Sue Bowman, MJ, RHIA, CCS, FAHIMA



Evaluation of Data Quality of Multisite Electronic Health Record Data for Secondary Analysis

Alicia L. Nobles, Ketki Vilankar, Hao Wu, Laura E. Barnes
Department of Systems and Information Engineering
University of Virginia
Charlottesville, VA, USA
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Data Quality in Electronic Health Records Research: Quality Domains and Assessment Methods

Western Journal of Nursing Research
1–14

DOI: 10.1177/0193945916689084
journals.sagepub.com/home/wjn
SAGE

Methods and dimensions of electronic health record data quality assessment: enabling reuse for clinical research

Nicole Gray Weiskopf, Chunhua Weng

Data quality in the EMRs is a well-known problem

Original Investigation | Health Informatics

Prevalence and Sources of Duplicate Information in the Electronic Medical Record

Jackson Steinkamp, MD; Jacob J. Kantrowitz, MD, PhD; Subha Airan-Javia, MD

Key Points

Question How much duplicate content is present in electronic medical records, where does it come from, and why is it there?

Findings In this cross-sectional analysis of 104 456 653 routinely generated clinical notes, 16 523 851 210 words (50.1% of the total count of 32 991 489 889 words) were duplicated from prior documentation. Duplicate content was prevalent in notes written by physicians at all levels of training, nurses, and therapists and was evenly divided between intra-author and inter-author duplication.

Meaning The prevalence of information duplication in electronic medical records suggests that it is an adaptive behavior requiring further investigation so that improved documentation systems can be developed.

BMC Public Health

BioMed Central

Research article

Open Access

What they fill in today, may not be useful tomorrow: Lessons learned from studying Medical Records at the Women hospital in Tabriz, Iran

Faramarz Pourasghar*[1,2,4], Hossein Malekafzali[3], Alireza Kazemi[1], Johan Ellenius[1] and Uno Fors[1]

Results: Almost all 300 Medical Records had problems in terms of quality of documentation. There was no record in which all information was documented correctly and compatible with the official format in Medical Records provided by Ministry of Health and Medical Education. Interviewees believed that poor handwriting, missing of sheets and imperfect documentation are major problems of the Paper-based Medical Records, and the main reason was believed to be high workload of both physicians and nurses.

Conclusion: The Medical Records are expected to be complete and accurate. Our study has unveiled that the Medical Records are not documented properly in the university hospital where the Medical Records are also used for educational purposes. Such incomplete Medical Records are not reliable resources for medical care too. Some influencing factors external to the structure of the Medical Records (i.e. human factors and work conditions) are involved.

Using a data entry clerk to improve data quality in primary care electronic medical records: a pilot study

Michelle Greiver MD MSc CCFP

Director, North Toronto Research Network, Toronto, Canada and Assistant Professor, Department of Family and Community Medicine, University of Toronto, Canada

ABSTRACT

Background The quality of electronic medical record (EMR) data is known to be problematic; research on improving these data is needed.
Objective The primary objective was to explore the impact of using a data entry clerk to improve data quality in primary care EMRs. The secondary objective was to evaluate the feasibility of implementing this intervention.
Methods We used a before and after design for this pilot study. The participants were 13 community based family physicians and four allied health professionals in Toronto, Canada. Using queries programmed by a data manager, a data clerk was tasked with re-entering EMR information as coded or structured data for chronic obstructive pulmonary disease (COPD), smoking, specialist designations and interprofessional encounter headers. We measured data quality before and three to six months after the intervention. We evaluated feasibility by measuring acceptability to clinicians and workload for the clerk.
Results After the intervention, coded COPD entries increased by 38% ($P = 0.0001$, 95% CI 23 to 51%); identifiable data on smoking categories increased by 27% ($P = 0.0001$, 95% CI 26 to 29%); referrals with specialist designations increased by 20% ($P = 0.0001$, 95% CI 16 to 22%); and identifiable interprofessional headers increased by 10% ($P = 0.45$, 95 CI −3 to 23%). Overall, the intervention was rated as being at least moderately useful and moderately usable. The data entry clerk spent 127 hours restructuring data for 11 729 patients.
Conclusions Utilising a data manager for queries and a data clerk to re-enter data led to improvements in EMR data quality. Clinicians found this approach to be acceptable.

Keywords: computerised/standards, data collection/standards, data quality, health care/methods, medical records systems, primary care, quality assurance

What is the real problem of all those problems for data science?

Not understanding the data means reinterpretation

Second part: health system level

The Digital Health Platform in Catalonia

Hospitals and intermediate care

29 products

Electronic Prescribing (SIRE)

150 M prescriptions / year
37,000 health professionals as users
5.5 M users

Personal Health Portal (LMS)

> 5.7 M citizens

Central PACS System (SIMDCAT)

> 6,200 M images

Unique therapeutic plan

OMICs platform

Primary care EMR

1 product

National Patient Index (RCA)

Shared Electronic Health Record (HC3)

>1.100 M documents
> 70% structured information

Care Process Management (IS3)

> 80,6 M referrals / year

Remote consultations

> 80 M

Open platform

openEHR CDR
CKM

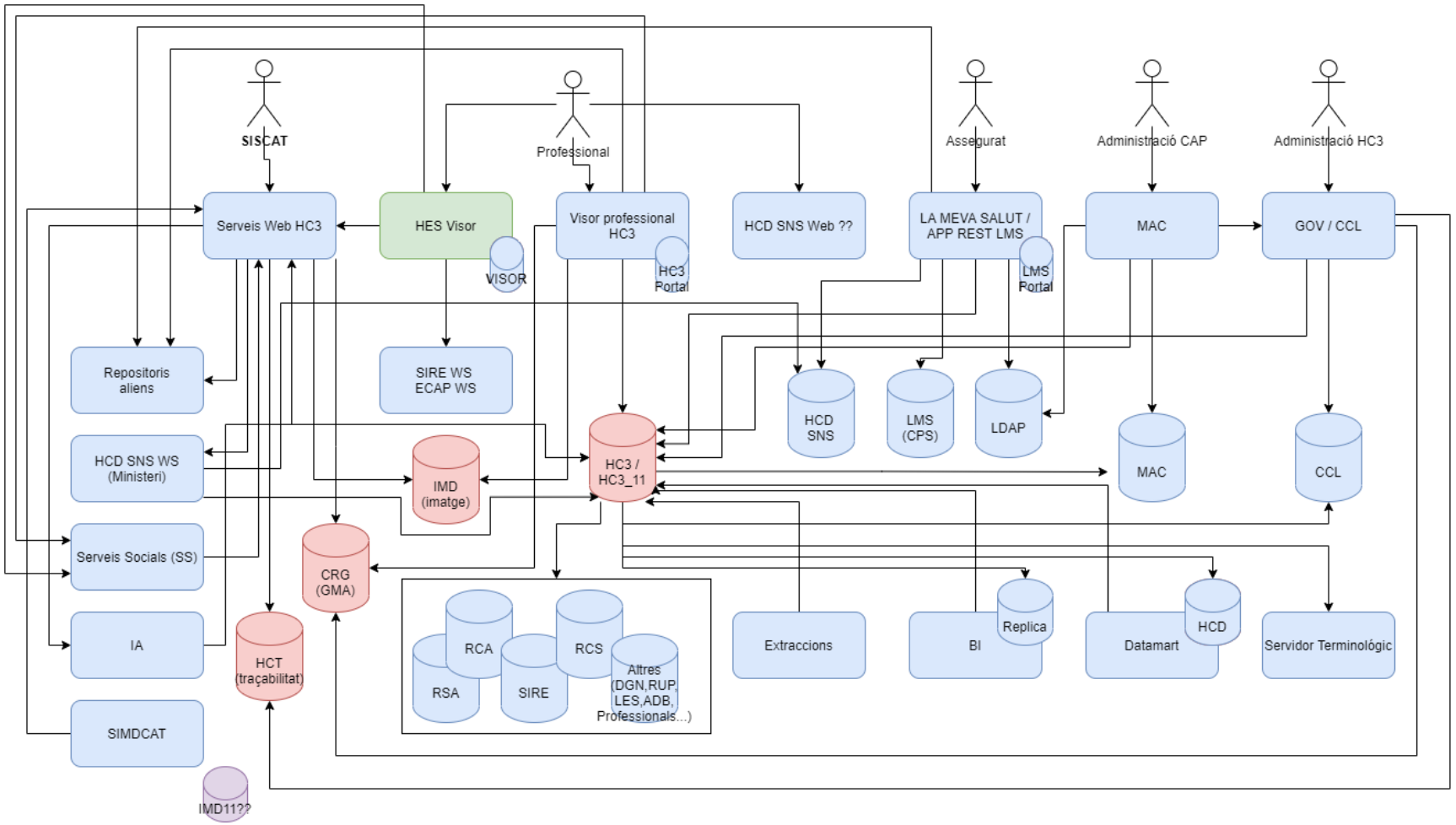
New apps

PROMs
Medications
Immunizations

A huge heterogeneity of data models

- 69 hospitals and 29 different vendor products
- Each tertiary hospital has around 800 silos of information
- Each secondary hospital has around 400 silos of information
- Our prospections indicate us we have more than 16k silos of patient related information being the EMRs the biggest source (and growing fast due to digital health solutions)
- Huge heterogeneity of proprietary data models

The Shared Electronic Health Record of Catalonia – Systems Architecture



EHRs from the inside

...

Data is not understood even when connecting the same vendor system…

> J Am Med Inform Assoc. 2022 Apr 13;29(5):753-760. doi: 10.1093/jamia/ocab289.

Quantitating and assessing interoperability between electronic health records

Elmer V Bernstam [1 2], Jeremy L Warner [3], John C Krauss [4], Edward Ambinder [5], Wendy S Rubinstein [6], George Komatsoulis [6], Robert S Miller [6], James L Chen [7]

Affiliations + expand

PMID: 35015861 PMCID: PMC9006690 (available on 2023-01-07)
DOI: 10.1093/jamia/ocab289

- Allscripts
- Varian Medical Systems
- General Electric
- Cerner
- Epic Systems
- IntrinsicQ
- Elekta
- NextGen
- Flatiron Health

As defined in the study, ***intra-vendor interoperability*** refers to the ability to share information between instances of the same vendor's product (e.g., Epic > Epic). ***Inter-vendor interoperability*** refers to the ability to share information between instances of different vendor products (e.g., Epic > Cerner)."

A recent study of EHR interoperability found that **68% of data was "understood" when exchanged across different sites using the same vendor**, but only **22% was "understood" when exchanged across different EHR vendors.**

Third part: The Digital transformation of the Catalan Health System

Limitations of the current information systems model

Broad ecosystem of applications with buried business logic and data models.

Old-fashioned solutions and a dramatic increase in technical debt.

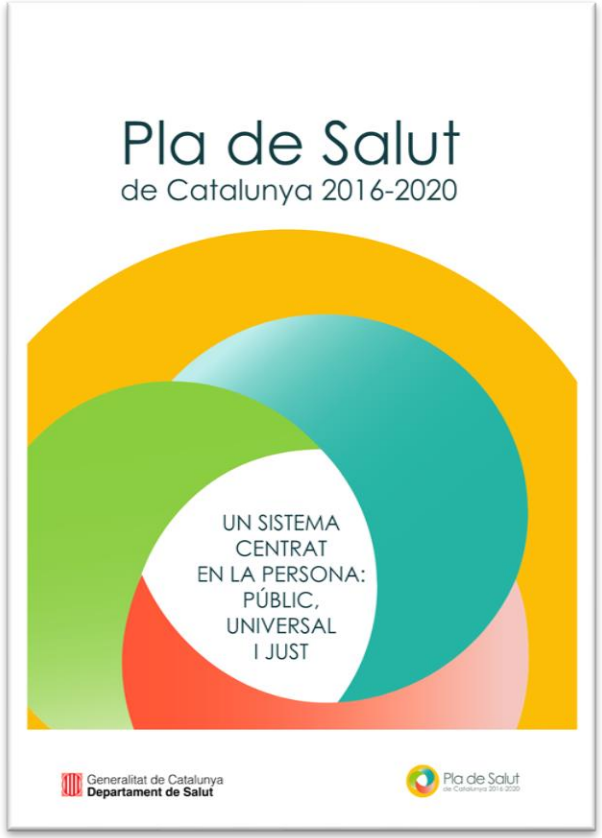
Communication between service providers and the NHS through static and incoherent interoperability solutions.

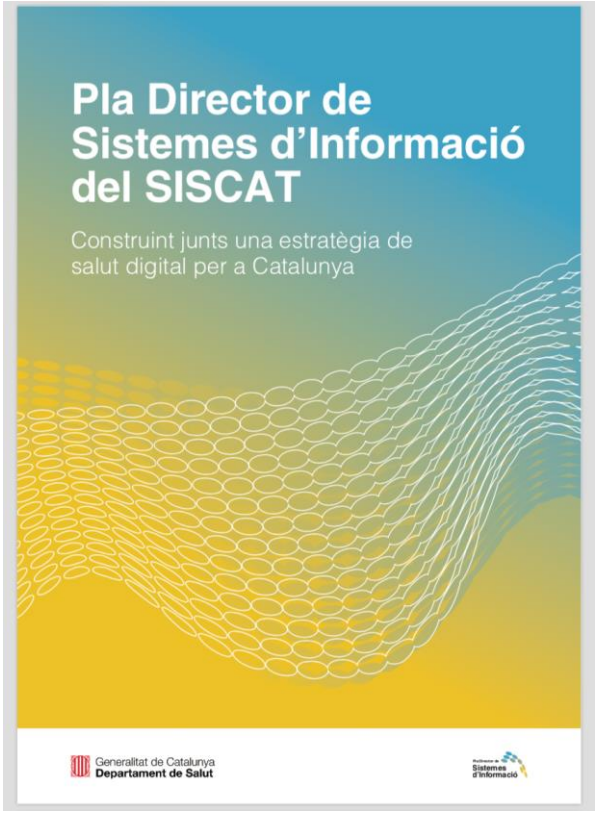
High costs for maintenance, corrective and evolutionary development.

Difficulties to scale-up innovations and best practices.

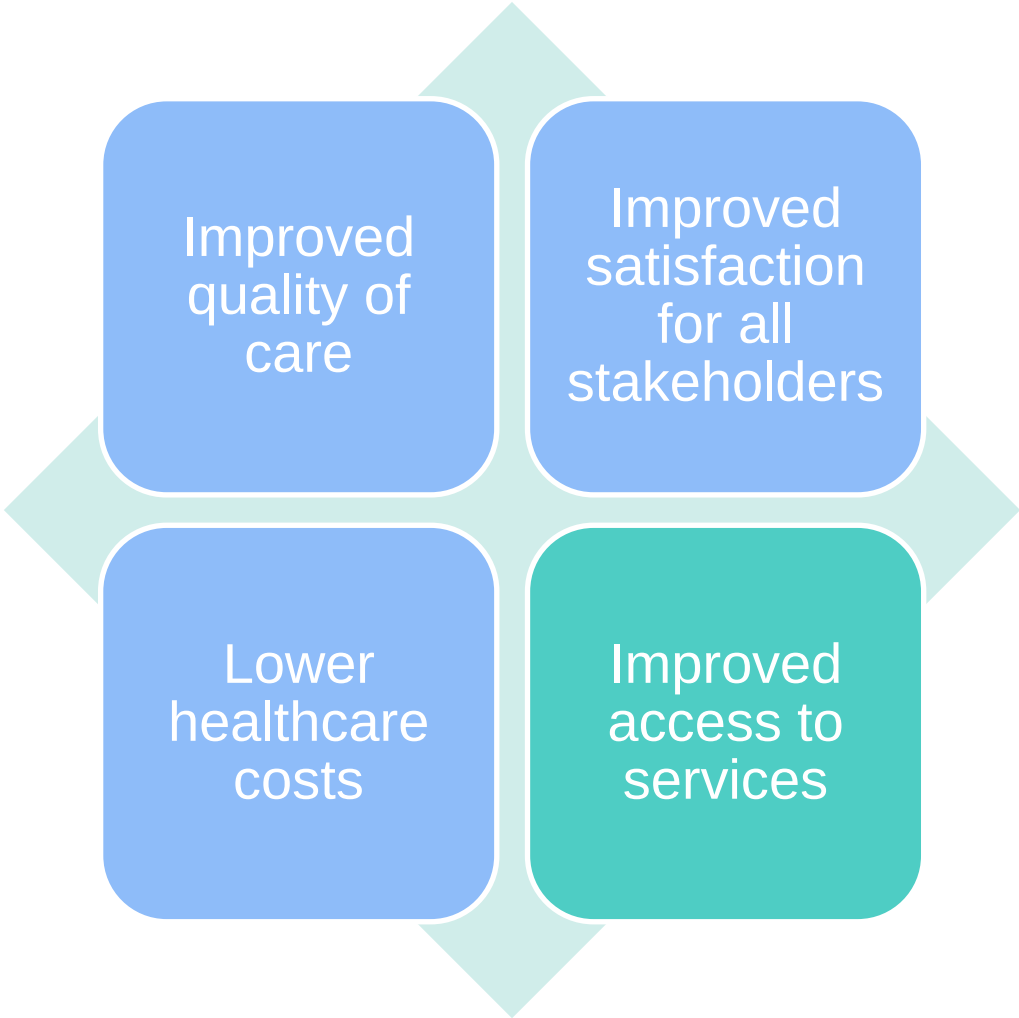
Rigid model that does not foster adaptation to change.

Catching up the time:
Digital Health Strategy for Catalonia

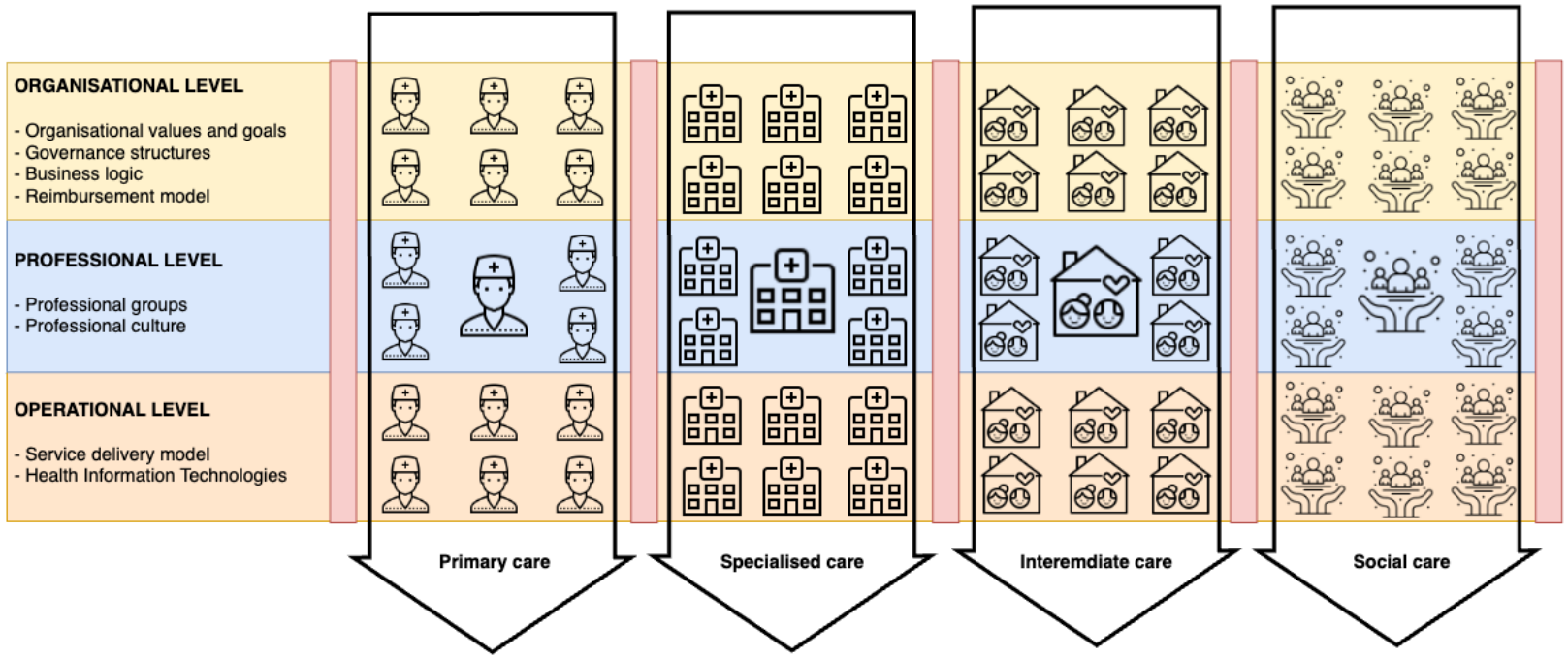




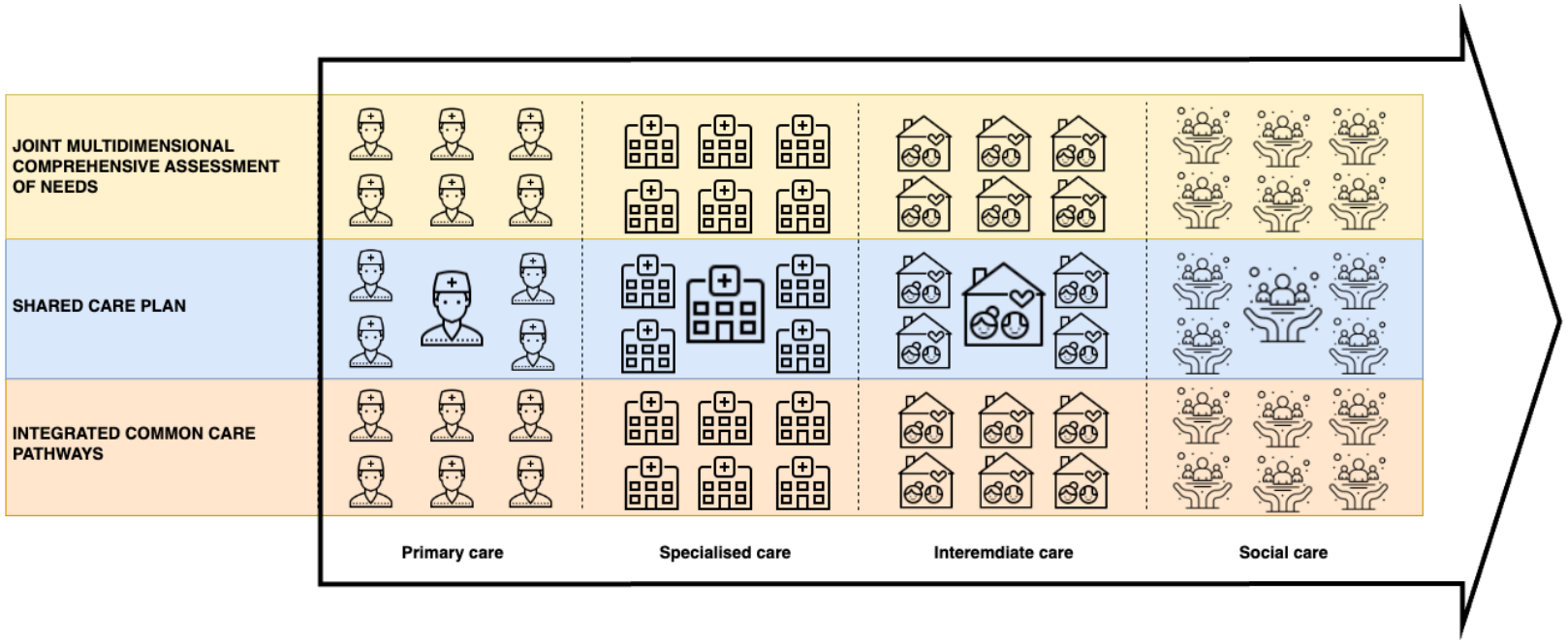
Why integrated care? Quadruple aim, quintuple aim...



What are the difficulties?



What is the goal? Working together!



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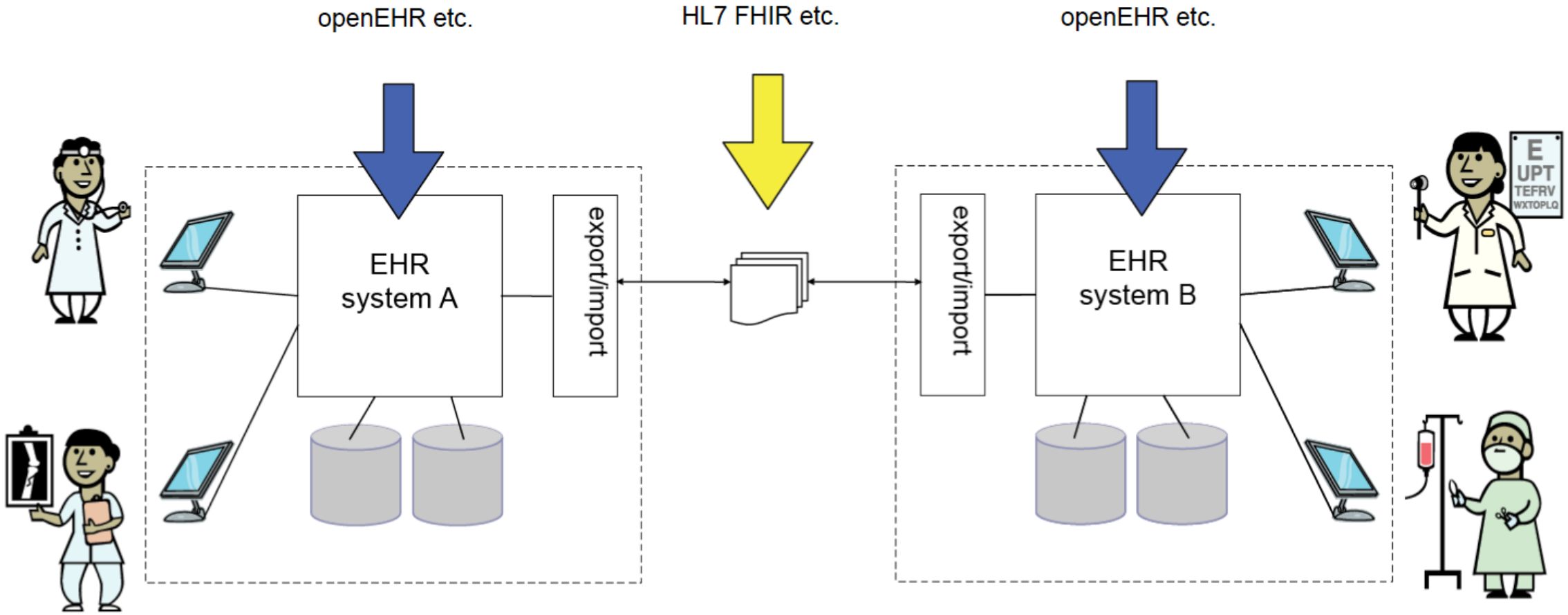
Agree where?

openEHR

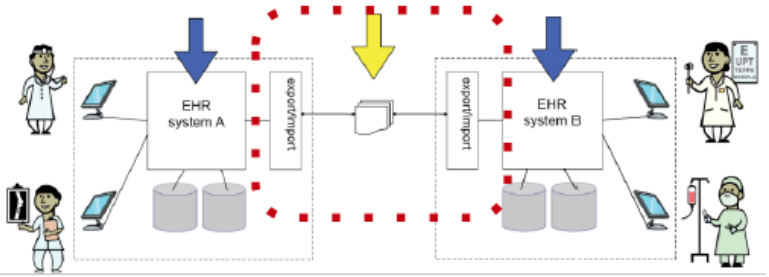


Interoperability vs Intraoperability

openEHR

- A model is agreed to that allows all systems to exchange what needs to be exchanged, **without requiring any design changes to the way their systems works** ☺
- Whatever is done can be done on the periphery. And **what can be done is therefore constrained** to the **lowest common denominator** of the way that the systems function – all **systems are constrained to the dumbest system** ☹
  (But it is a fast start for many simple use-cases ☺)
- **Smarter systems need to come up with their own (only partly standardized) "extensions"** to the basic model so they can do smarter things. Many well known deficiencies of this (semantic scalability, fragmentation etc.) ☹
- Examples: **Messaging**, **HL7 FHIR** etc.

Source: Grieve, G. Good Exchange Specifications: Interoperability vs Intraoperability. *Health Intersections.* http://www.healthintersections.com.au/?p=820



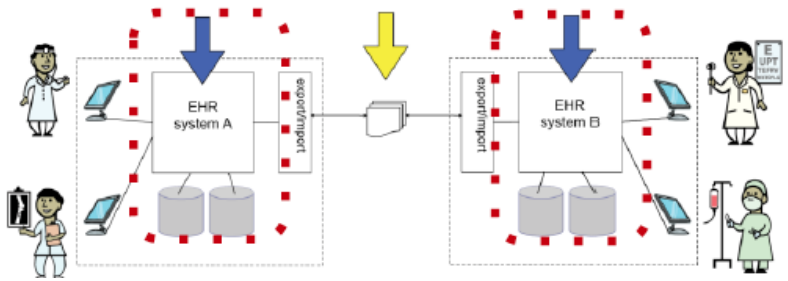
Interoperability vs Intraoperability

openEHR

- **Rework the core structures** of the systems **to function in an agreed way**. Because all the systems work the same way, then **exchange between the systems is easy and straight forward.** ☺ (And internal model maintenance/update workload can be shared globally/nationally ☺.)
- Intraoperability has fewer deficiencies, but they are much bigger: it's much **harder to get agreement**… ☹ (Both technical and clinical agreements are needed to get maximum benefit of this approach ☹)
- Examples: **CIMI, openEHR**, some usages of **ISO13606** etc…

Typically, at this point, the system designers (often vendors) get the blame. But – it's not as simple as that – vendors do whatever sells, which is whatever the purchaser wants to buy…

Based on a post by Grahame Grieve (member of FHIR-core team) on February 28, 2012: http://www.healthintersections.com.au/?p=820. A more descriptive name for this kind of open intraoperability approach might be something like "shared model driven strategy" Note that the positive view of intraoperability described above is concerning **vendor neutral models**, there is also another different (risky, lock-in-prone) definition of intraoperability focused around dominating market actors described at http://www.ecis.eu/intraoperability/)

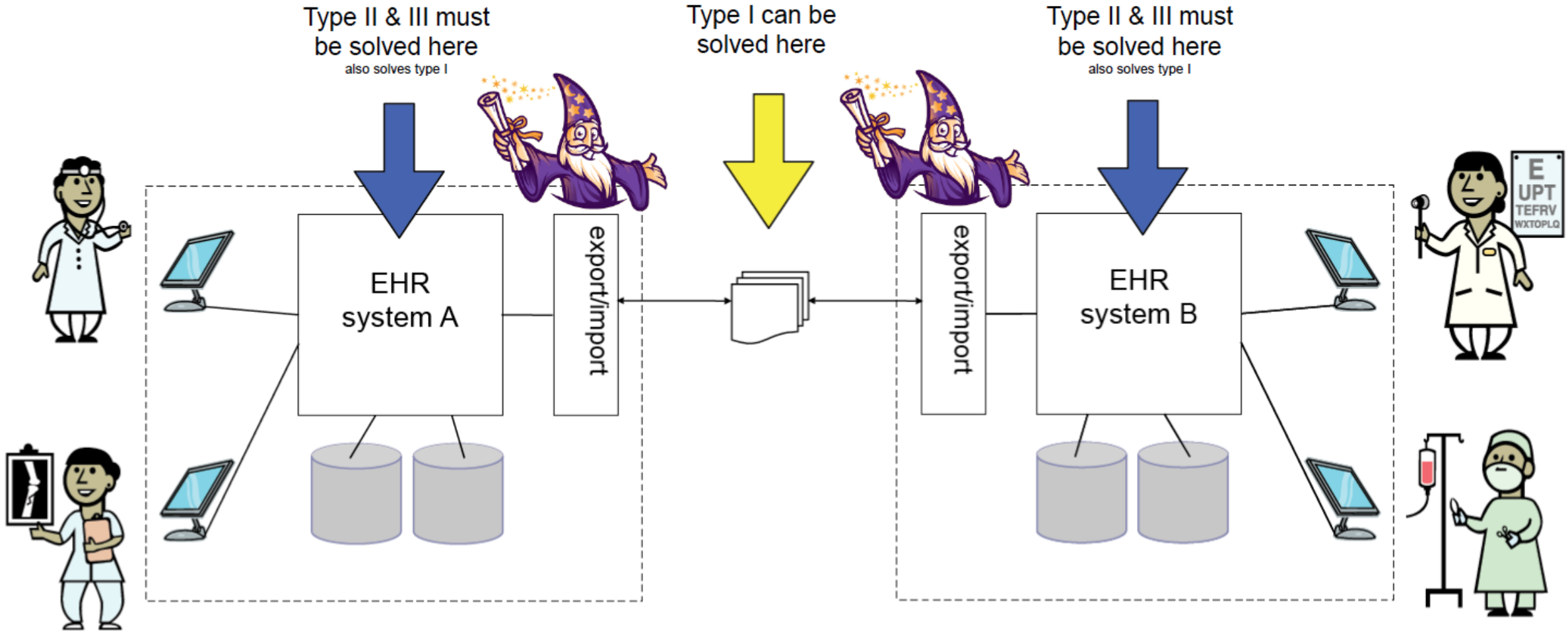


Classic reinterpretation problems

Example	System A	System B
Type I **A <-- --> B** Can be done with algoritm/program	**Birth weight**: 3300g **Date**: 1954-03-13	**Body weight**: 3,3 kg **TImepoint**: 13 Mar 1954
Type II **A --> B** **Semantic loss and distortion due to reinterpretations.** Hard, dangerous or impossible with algorithm/program… …but often done manually by medically skilled staff over and over for each transfer… **B --> A** **Missing information** impossible with algorithm/program	**Needs surgery at latest**: 2018-01-30 **Surgery scheduled**: 2018-01-20 15:30 **Main diagnose***: 323291000119108 | Osteoarthritis of left hip joint| **Other Diagnosis***: 25343008 | Secondary localized osteoarthrosis of pelvic region| 299308007 | Hip joint painful on movement | **Procedure***: 19954002 | Reconstruction of hip with use of methyl methacrylate| **Surgery type****: Lubinus SP II **Preferred anesthesia***: 18946005 | Epidural anesthesia | **NEWS2-score at admission**: 1 **Anesthesia assessment**: - Fitness: can handle light physical exercise - Cardiovascular: OK - Lungs: OK - Throat: OK - Gastrointestinal*: 16331000 | Heartburn	**Surgery date**: 2018-01-20 **Diagnosis code**: M16.7 | Other secondary coxarthrosis **Surgery code*****: NFB49 | Primär total höftledsplastik med cement (Primary total hip arthroplasty with cement) **Anesthesia code*****: ZXH50 | Epiduralanestesi (epidural anestesia) **ASA-classification**: ASA I = normal healthy patient **) Codes from Snomed CT* ***) special kind of hip replacement with cement* ****) Codes from the Swedish "KVÅ" terminology for procedures*
Type III **Reinterpretaion impossible** (even for skilled humans) **due to aggregations** etc.	**Number of cigarettes smoked per week**: 6-10 …specified in a system with the options: 0, 1-5, 6-10, 11-15, 16-30, 31-50, 51-100, 101+	**Number of cigarettes per week**: ? …specified in a system with the options: 0, 1-3, 4-7, 8-14, 15-28, 29-69, 70+

Agree on what, where?

openEHR



What is the real problem?

Interoperability

- Interoperability is bad: get the systems to agree on content up front
  - Still have protocol challenges etc
- In general, the earlier you can agree, the better off everyone is
  - Healthcare is characterised by being unable to agree
  - Messy interoperability isn't going away

8

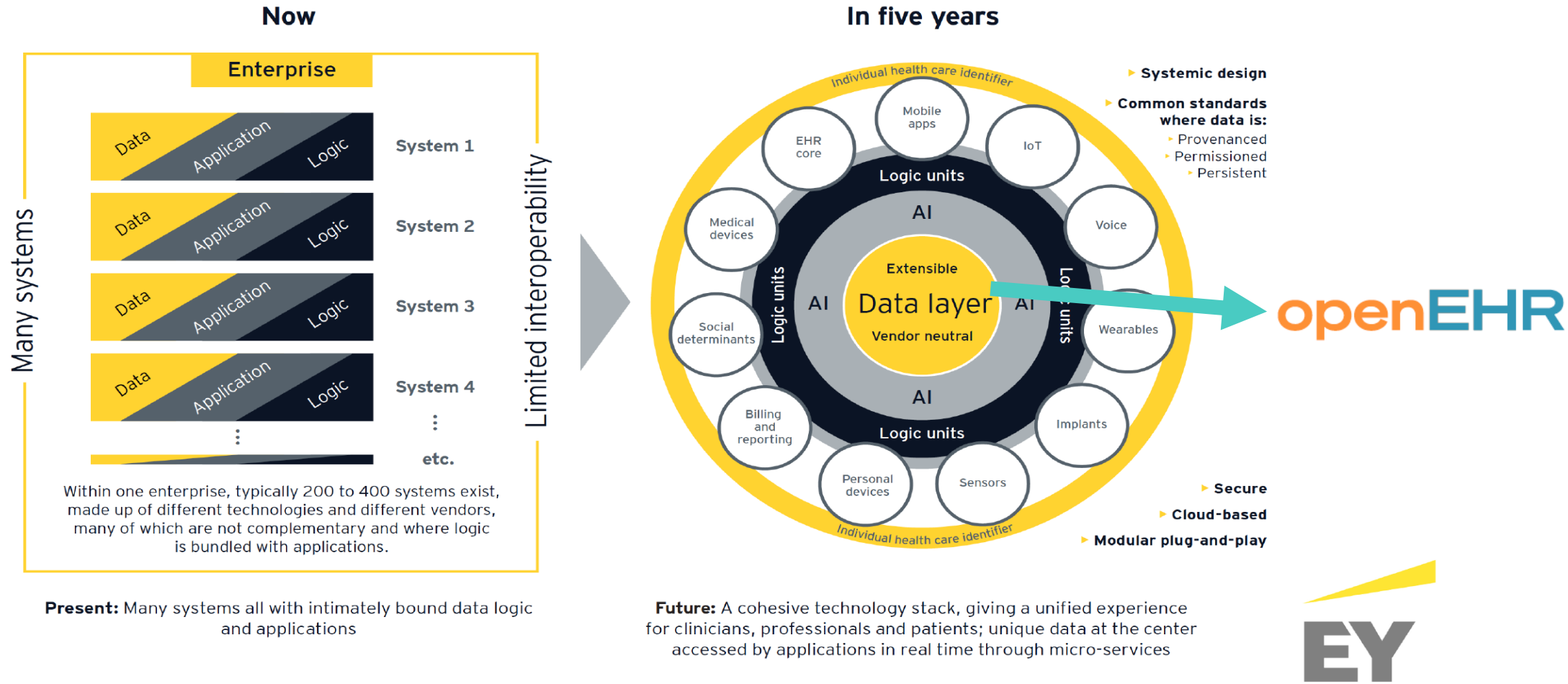
What is this all about?

The open platform paradigm

"For health care organizations, the shift in the **ecosystem** will likely look something like this:

an **open platform** and a **clinical data repository**, with integration of legacy and third-party elements, that support easy **data migration** and are **transparent** to **all applications** connected to the platform."

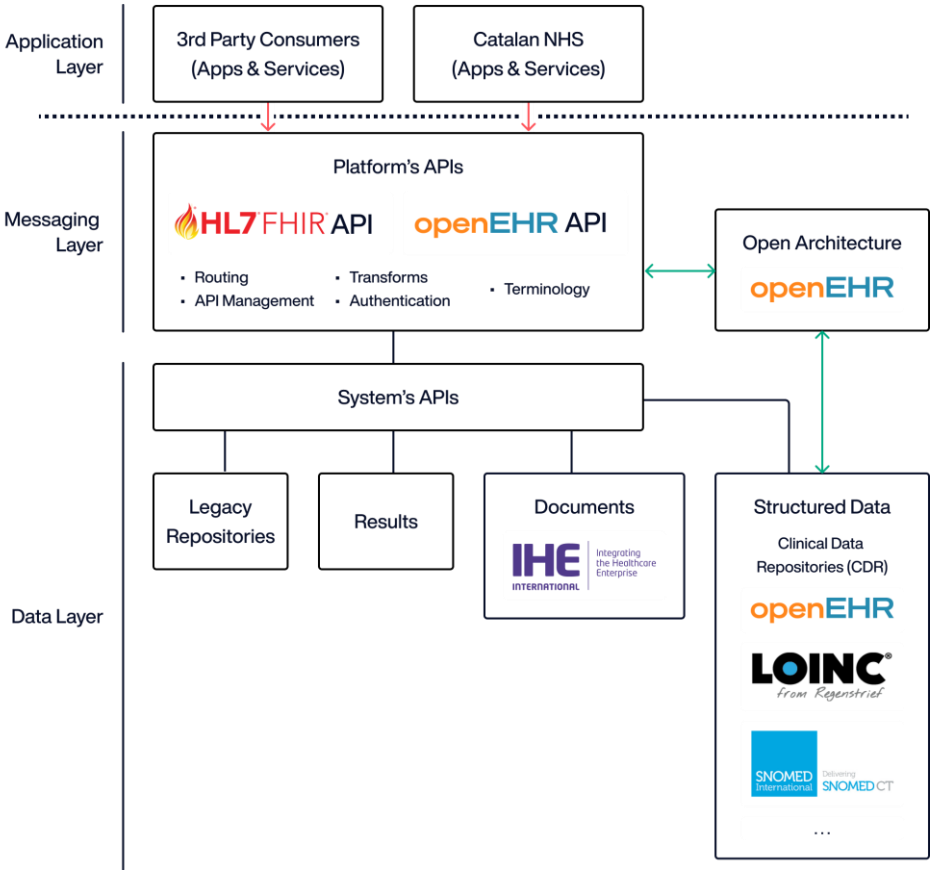
Current vs future view



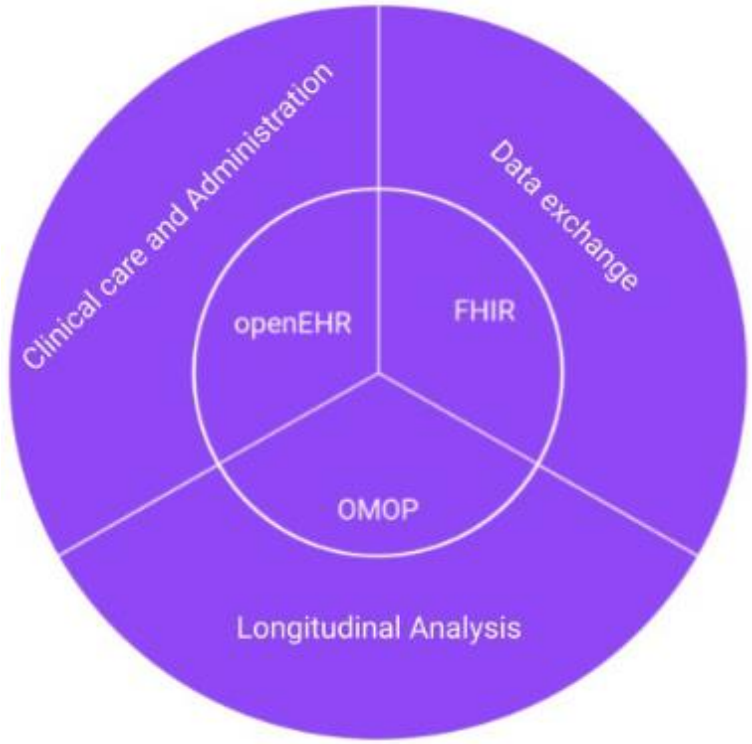
Present: Many systems all with intimately bound data logic and applications

Future: A cohesive technology stack, giving a unified experience for clinicians, professionals and patients; unique data at the center accessed by applications in real time through micro-services

Towards the third-generation EHR!



New architecture model for Catalonia based on the open platform (adapted from the Apperta Foundation – United Kingdom)



Tsafnat G, Dunscombe R, Gabriel D, Grieve G, Reich C. Converge or collide? Making sense of a plethora of open data standards in healthcare: an editorial. Journal of Medical Internet Research.

Our view for an open future

- We are building an INFOSTRUCTURE
  1. Business processes
  2. Information needs
  3. Applications
  4. Technology
- We will decouple data from applications, storing data in an open format
- This will enable data to follow the patient
- This will foster better integration and collaboration
- It will help scaling-up innovations

Thank you!

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