The Digital Health Strategy for Catalonia: the role of openEHR and FHIR in the construction of the new EHR

HiGHmed SYMPOSIUM 2021

“Digitalization in the healthcare system: openEHR and FHIR – friends or foes?”

Berlin, 14th October 2021

Generalitat de Catalunya
Departament de Salut
/Salut

Health care entities to provide health care services.

Health care entities to provide health care services.

Applications across the Catalan Health System:

1. EMR for primary care.
2. > 29 EMR products for hospitals.
3. At least 10 different systems for social care records.

Catalan Health Service budget for 2020. The system is funded from general taxation and government founds and contributions.

Facilities that range from primary health care centres to hospitals and intermediate care centres.

- 71 hospitals (9 big third level)
- 369 primary care centres
- 96 intermediate care centres
- 41 mental health centres (including hospitalization unit)
- 422 other resources (rehabilitation centres, etc.)
The Catalonian Digital Health Platform

- Personal Health Portal
- Shared Electronic Health Record (HC3)
- National Patient Index (RCA)
- Primary care Electronic Medical Record
- Care Process Management (S3)
- Central Pacs System
- Electronic Prescribing
- Terminology Server
- Medical Messaging App

Health care Data

Analytics

Intermediate care and Hospitals

Pharmacies

Primary Health care
Health care platforms in Catalonia

**Electronic Prescribing (SIRE)**
- 416 M of prescriptions
- 37,000 health care professionals as users
- 1,346 M dispensing of medicines

**Personal Health Portal (LMS)**
- > 4.5 M citizens

**Central PACS System (SIMDCAT)**
- > 5,000 M images

**Care Process Management (IS3)**
- > 15,6 M referrals

**Remote Consultations**
- > 12 M

**National Patient Index (RCA)**
- 7,697,069 people (2021)
  + 43,224 previous year

**Shared Electronic Health Record (HC3)**
- > 600 M documents
- > 70% structured information

**Primary care EMR (1 product)**
- late 80s, early 90s

**Social care records systems**
- 2000

**Hospitals intermediate care EMRs (29 products)**
- 2006

**Electronic Health Record (HC3)**
- 2007

**Central PACS System (SIMDCAT)**
- 2009

**Remote Consultations**
- 2014

**Health care platforms in Catalonia**

**Remote Consultations**
- 2018

**Health care platforms in Catalonia**

**Remote Consultations**
- 2020
The Catalonian Digital Health Platform: components view

- **2009**
  - Personal Health Folder (LMS)
  - Remote Consultations (synchronous & asynchronous)
  - Mobile Health apps & telemonitoring (mConnecta)

- **2017**
  - PHR

- **2007**
  - EHR
  - Shared Electronic Health Record of Catalonia (HC3)
  - Ambulatory Electronic Prescription (SIRE)
  - Digital Imaging Archive (SIMDCAT)

- **2021**
  - Genomic Bank (OMIQ-HES)

- **1980/90s**
  - Primary care EMR N = 1 (98%)
  - Hospital Information System (HIS) N = 29
  - Intermediate care and community mental health EMRs
  - Social Care Record

- **2014**
  - Care process management (IS3)
The primary care information system

- We started the development in year 1985
- Split among 22 databases and with more than 2k tables
- Runs in Oracle Forms and Visual Basic
- Gazillions of functionalities -> Frankenstein & X-mas tree
- Integrates all the information from the Shared EHR
- There is nothing alike in the market
The hospital information systems

- 71 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)
- Proprietary data models & semantic incoherence
## Shared Electronic Health Record of Catalonia

<table>
<thead>
<tr>
<th>Type of information</th>
<th>Structured?</th>
<th>Observations</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documents</td>
<td>No</td>
<td>clinical reports, imaging-related reports, complementary test reports, laboratory reports, and pathological anatomy</td>
<td>SNOMED-CT (only the document type)</td>
</tr>
<tr>
<td>Medical images</td>
<td>No</td>
<td>WS to publish the medical images taken at the centres and previously registered from SIMDCAT</td>
<td>SERAM/SEMNIM</td>
</tr>
<tr>
<td>Pathological anatomy</td>
<td>Yes</td>
<td>data of the samples and results (conclusions) of the same</td>
<td>SNOMED-CT</td>
</tr>
<tr>
<td>Clinical laboratory results</td>
<td></td>
<td>laboratory determination data</td>
<td>LOINC</td>
</tr>
<tr>
<td>Immunizations</td>
<td>Yes</td>
<td>data on administered vaccines</td>
<td>SNOMED-CT</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Yes</td>
<td>Health problems and allergies identified by health centres</td>
<td>ICD-9 and ICD-10</td>
</tr>
<tr>
<td>Chronic markers</td>
<td>Yes</td>
<td>identification of chronic patients (PCC/MACA)</td>
<td>Propietary</td>
</tr>
<tr>
<td>Spirometry</td>
<td>Yes</td>
<td>collection of spirometry test data</td>
<td>SNOMED-CT</td>
</tr>
<tr>
<td>Cancer screening</td>
<td>Yes</td>
<td>data from breast and colon/rectal cancer screenings</td>
<td>SNOMED-CT</td>
</tr>
<tr>
<td>Agendas</td>
<td>Yes</td>
<td>information on visits planned by citizens in health centres</td>
<td>Propietary</td>
</tr>
<tr>
<td>Type of information</td>
<td>Structured?</td>
<td>Observations</td>
<td>Standard</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Clinical parameters</td>
<td>Yes</td>
<td>data on clinical variables or functional assessment scales</td>
<td>SNOMED-CT</td>
</tr>
<tr>
<td>Clinical Course</td>
<td>Yes/No</td>
<td>it is semi-structured information because the content of each section of a clinical course is not structured information</td>
<td>Propietary</td>
</tr>
<tr>
<td>DAIA Warnings</td>
<td>No</td>
<td>Non-persistent information to HC3 of the alerts of files opened by the DGAIA - RSA</td>
<td>Propietary</td>
</tr>
<tr>
<td>Organ Donation Notice</td>
<td>No</td>
<td>Non-persistent information in HC3 of the official register of organ donors - RSA</td>
<td>Propietary</td>
</tr>
<tr>
<td>Notice of last wills</td>
<td>No</td>
<td>Non-persistent information at HC3 official register - RSA</td>
<td>Propietary</td>
</tr>
<tr>
<td>Social consent</td>
<td>Yes</td>
<td>information of citizens who have given consent to intercavinate health and social data</td>
<td>Propietary</td>
</tr>
<tr>
<td>Social Data</td>
<td>No</td>
<td>Non-persistent information in HC3 of social data of the city councils</td>
<td>Propietary</td>
</tr>
<tr>
<td>Risk stratification</td>
<td>Yes</td>
<td>information on the GMA classification and the risk of mortality and urgent admission of citizens</td>
<td>Propietary</td>
</tr>
</tbody>
</table>
Shared Electronic Health Record of Catalonia (3)
**Shared Electronic Health Record of Catalonia (4)**

### Cronicitat

#### Fraga VIG

<table>
<thead>
<tr>
<th>Dimensió</th>
<th>Escala</th>
<th>Data</th>
<th>Valor</th>
<th>Interpretació</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitiva</td>
<td>MM+ Estim. Cognitiva de Llengua</td>
<td>24-02-2021</td>
<td>20</td>
<td>Normal</td>
</tr>
<tr>
<td>Funcional</td>
<td>MM+ Estim. Cognitiva de Llengua</td>
<td>24-02-2021</td>
<td>15</td>
<td>Deteriorament cognitiva important</td>
</tr>
<tr>
<td>Física</td>
<td>MM+ Estim. Física</td>
<td>23-09-2020</td>
<td>90</td>
<td>Inestabilitat motora</td>
</tr>
<tr>
<td>Nutricional</td>
<td>MM+ Estim. Nutricional</td>
<td>23-09-2020</td>
<td>7</td>
<td>Desnutrició Reapareix</td>
</tr>
</tbody>
</table>

#### Curs Clínico

<table>
<thead>
<tr>
<th>Data Clínic: (12/1)</th>
<th>(0 resultats)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09-02-2021 08:00</td>
<td>Control, envío a nivel respiratori...</td>
</tr>
<tr>
<td>14-05-2021 09:00</td>
<td>Malària en menors oberta amb síndrome nausea</td>
</tr>
<tr>
<td>14-10-2021 09:00</td>
<td>Diuresia amb comas de llor</td>
</tr>
</tbody>
</table>

#### Ruta Asistencial (13m)

<table>
<thead>
<tr>
<th>Urgències (2 resultats)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-02-2021</td>
</tr>
<tr>
<td>21-02-2021</td>
</tr>
</tbody>
</table>

Prescripcions: (0 resultats)

Aquest estat és en construcció.
The Shared Electronic Health Record of Catalonia – Systems Architecture
Catching up the time:
Digital Health Strategy for Catalonia
Limitations of the current information systems model

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broad</td>
<td>Ecosystem of applications with buried business logic and data models.</td>
</tr>
<tr>
<td>Old-fashioned</td>
<td>Solutions and a dramatic increase in technical debt.</td>
</tr>
<tr>
<td>Communication</td>
<td>Communication between service providers and the NHS through static and incoherent interoperability solutions.</td>
</tr>
<tr>
<td>High</td>
<td>Costs for maintenance, corrective and evolutionary development.</td>
</tr>
<tr>
<td>Difficulties</td>
<td>Difficulties to scale-up innovations and best practices.</td>
</tr>
<tr>
<td>Rigid</td>
<td>Rigid model that does not foster adaptation to change.</td>
</tr>
</tbody>
</table>
Master Plan Goals

• Consolidate a **person-centred model** of information systems that enables clinical and managerial decision-making across the care cycle.
• Establish a **governance model** of information systems with a solid community support while ensuring care continuity.
• Set out a **financing framework** to ensure implementation and sustainability over time.

• Create environments and opportunities to design and **implement innovative person-centred ICT-based care services**.
• Set out an ambitious **roadmap**, yet realistic, which will allow a long-lasting, successful and safe implementation of the new model.
Strategic initiatives

1. Data Repository
2. New sources of information
3. Personal Health folder
4. Analytical repository
5. Technological services
6. Primary Care Information System
7. Hospital Information System
8. eHealth
9. Mobility Plan
10. Artificial Intelligence
11. Internet of Things
12. User experience and online collaboration
13. Digital and analytics workforce development
14. Sectorial Plans
   (Mental Health, Intermediate care, Public Health, Research, Pharmacy)
15. Shock plan for the clinical workplace
Information Systems Model

ELECTRONIC HEALTH RECORD (EHR)

- Identity and security manager
- Common data model
  - Other sources of information
  - New Primary Care Information System
  - Specialised Care Information System

Interoperability

Integration services (Open APIs)

Business Process Management

Suppliers, professionals and industry

HIS₁, HIS₂, HiSn

Referrals and other systems
The vision: A unique Electronic Health Record

The longitudinal Electronic Health Record (HES) is the main piece of the new Digital Health Strategy and represents the functional and technical repository of all the information of the citizen that must be registered and shared throughout the health system.

It is not just, or mainly, a technological update, but a **model for data management and an architecture of information systems** that corresponds to and anticipates the changes that are taking place in the healthcare model in:

- citizen's relations with the healthcare system
- work processes
- relations between the professionals themselves

Mechanisms are also envisaged to intensify collaboration between the different actors in the healthcare system, to define semantic and technical standards and to share and take advantage of technological innovation.
Program distribution

CITIZENSHIP
- EHR – CITIZEN

BUSINESS
- EHR – OUTPATIENT CARE
- EHR – INTEGRATED CARE
- EHR – THERAPEUTICS
- EHR – EMERGENCY
- EHR – INTERNMENT

ENABLERS
- PROJECT PREPARATION
- EHR - CORE
- EHR - NORMS
- EHR – FRAMEWORK
- EHR - INFORMATIONAL
Which is the project?

- Phase 1 of the Project: next 4 years == 40 million euros budget
- Development of the foundations of the new EHR
- Both informational and transactional
- Starting in ambulatory care (+community mental health, +residential care, +integration with social care) + merge with the Shared EHR
- Establishing a new relation model with specialised and intermediate care
How to approach the challenge?

Our proposal is:
- Transfer of core services, data and capabilities to a new paradigm based on a knowledge-driven platform, within a service infrastructure and a modern application development environment.

Discarded alternatives:
1. Purchase a commercial mega-suite (monolithic approach)
2. Purchase of different commercial parts (best-of-breed), followed by integration according to the desired standards
3. A technological update of current products with the aim of improving the UI / UX and, potentially, solving the problems of databases and interoperability
Future view (3 years..)
openEHR and FHIR in our project (1)

- We are establishing the foundations of a full EHR
- Our project is an INTRAoperability project
- The standard selection criteria have been:
  - Strong governance of clinical data models
  - Strong international community support
  - Unlocking clinical data models, thus enabling innovation
  - Persistence of data
  - Maximum granularity
  - Includes care pathway support
openEHR and FHIR in our project (2)

- We acknowledge the benefits of using FHIR for exchange purposes with external systems
- We also acknowledge the usage FHIR resources to build some applications (i.e., Master Patient Index)
- openEHR has been selected to build the new EHR
- We will use FHIR to communicate with external systems where applicable
- We think both are complementary
Thanks!

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