Practical considerations in implementing Big Data in Health Care practice

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Professor of Human Biochemistry and Physiology, University of Liège

UH of Liège, Belgium

UH of Liège is an Academic Hospital

1038 beds and about 5,500 staff members

Activities spread over 8 localizations including 4 hospitalization sites

Since 2004, the UHL has an Electronic Patient Record (EPR) including medical, nursing and paramedical information and a complete RIS-PACS for its medical imaging

These computer tools allow both the exchange of data inside the hospital and outside, ensuring an optimal continuity of hospital care and extra-mural care

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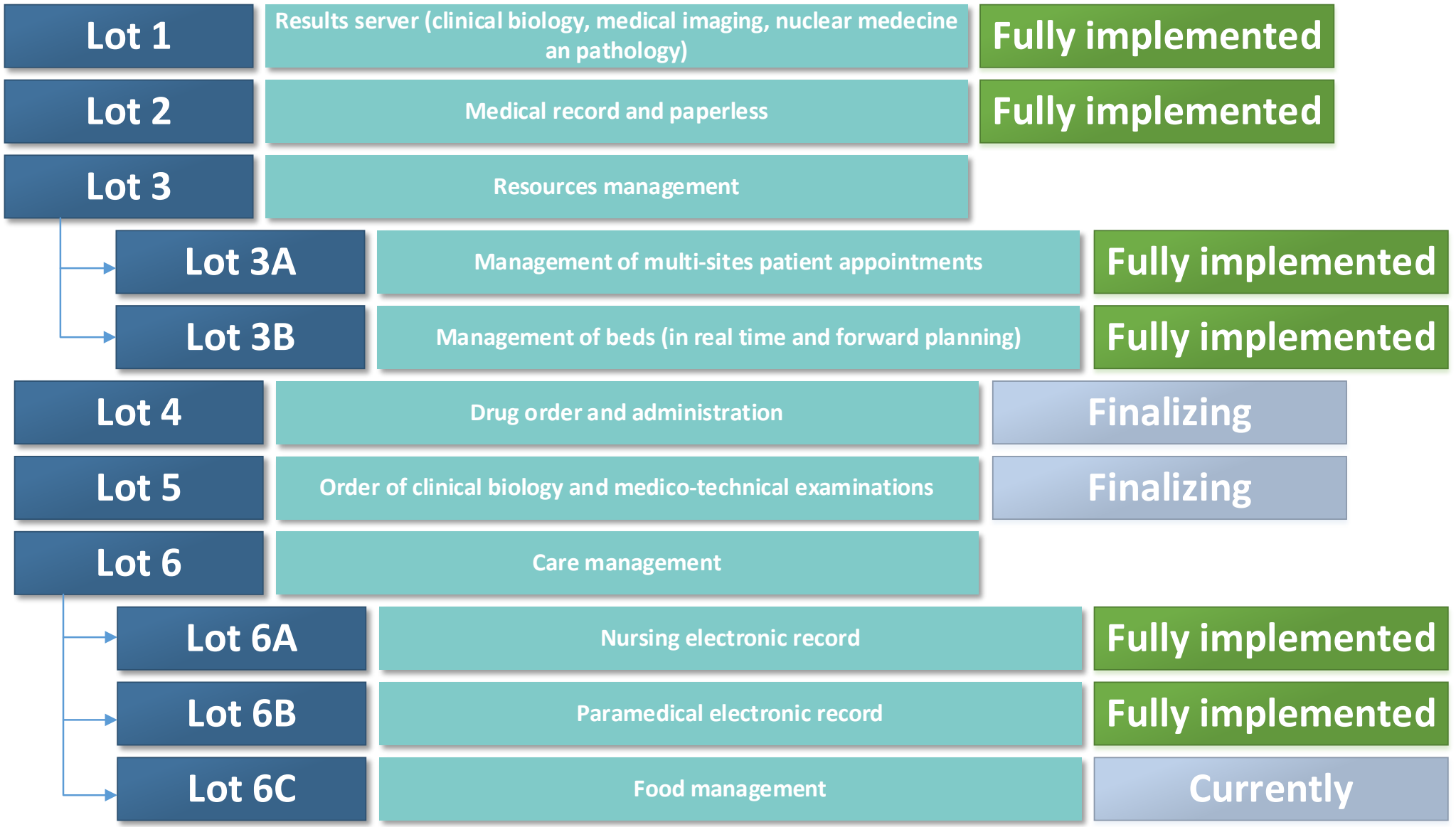
Level of computerization of EPR at CHU of Liège



Electronic Medical Record Adoption Model (EMRAM)

Stage 7

- Complete EMR; external HIE (Health Information Exchange); data analytics; governance; disaster recovery; privacy and security

Stage 6

- Technology enabled medication; blood products and human milk administration; risk reporting; full CDS (clinical decision support)

UH of Liège

Stage 5

- Physician documentation using structured templates; Intrusion/Device protection

Stage 4

- CPOE (computerized physician order entry) with CDS (clinical decision support); nursing and allied health documentation; basic business continuity

Stage 3

- Nursing and allied health documentation; EMAR (Electronic Medication Administration Records); role-based security

Stage 2

- CDR (Clinical Data Repository); internal Interoperability; basic security

Stage 1

- Ancillaries – laboratory: pharmacy and radiology/cardiology information systems; PACS (Picture Archiving and Communications System); digital Non-DICOM image management

Stage 0

- All three ancillaries not installed

https://www.himss.eu/healthcare-providers/emram

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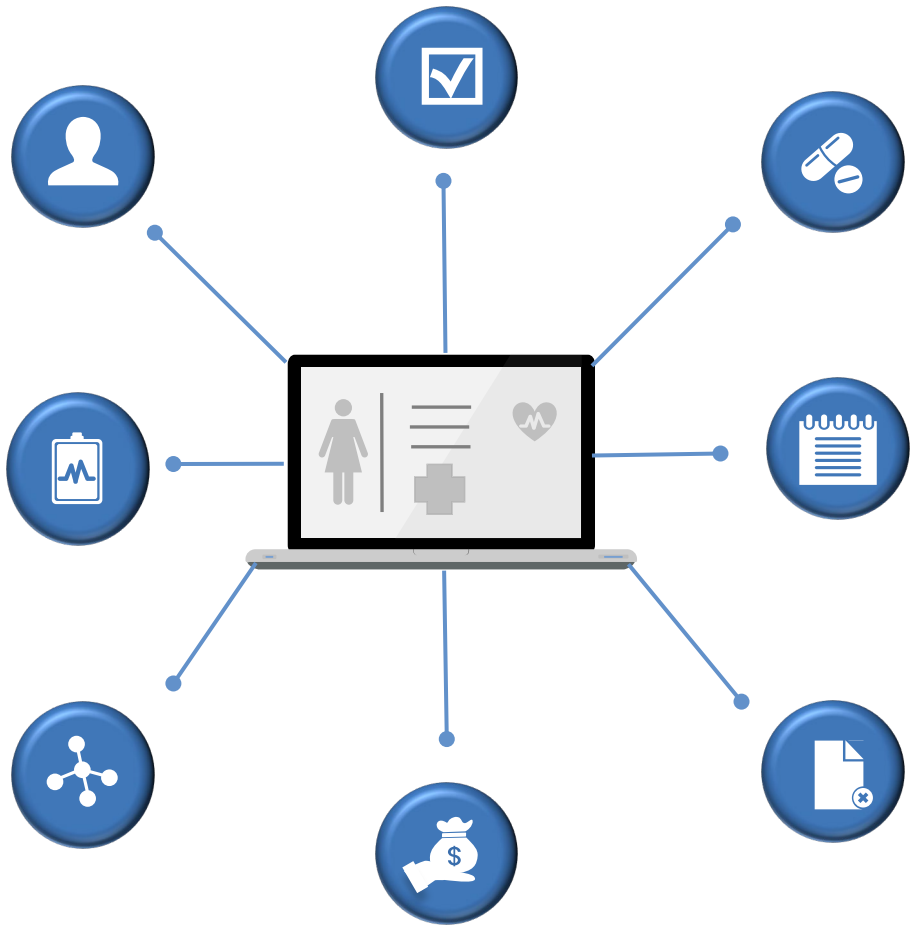
For what benefits?

A **quick** access to patients' records. Gathering all relevant information (lab results, etc.) **in one place**. Making it easier to consider all aspects of a patient's condition.

Always available, complete and **up-to-date** patient related information.

The possibility of **securely sharing** information with patients and care providers.

Reducing **duplication** of testing.



Streamlined coding and billing

Helping physicians to reach the correct diagnosis and to prescribe more accurately.
Providing built-in safeguards against prescribing treatments that would result in adverse events.

Possibility of online appointment scheduling, online bill payments, prescription refill requests, and sometimes even data update capabilities

Decreasing **paperwork.**
Improving aggregation, analysis, and communication of patient information.

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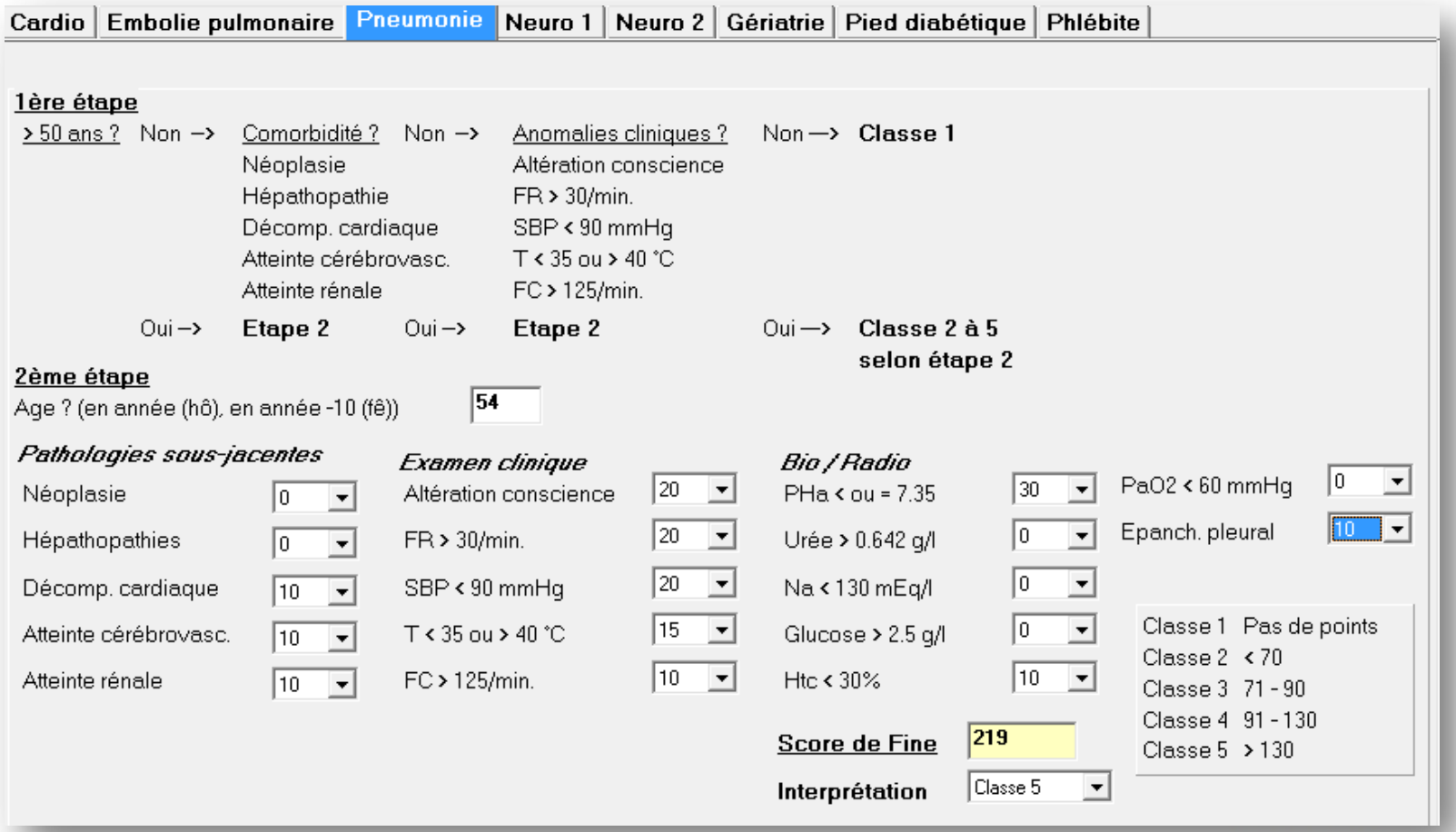
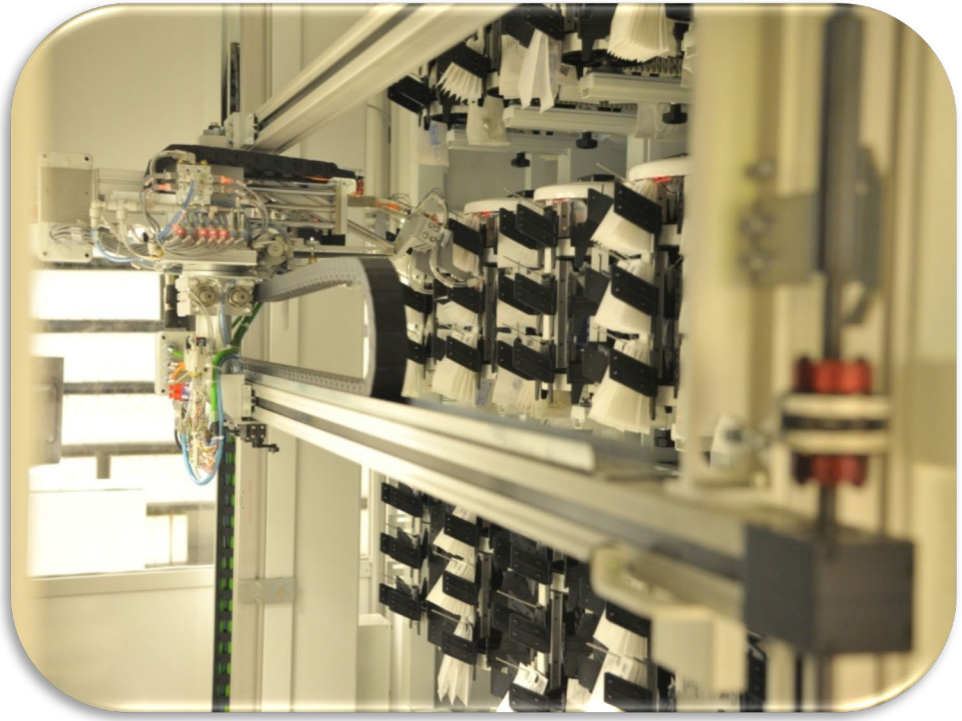
CDSS – EPR
Clinical Decision Support System Electronic Patient Record

Clinical decision support systems link health observations to clinician knowledge

Pneumonia Severity Index (PSI) of Fine score : estimates mortality for adult patients with community-acquired pneumonia

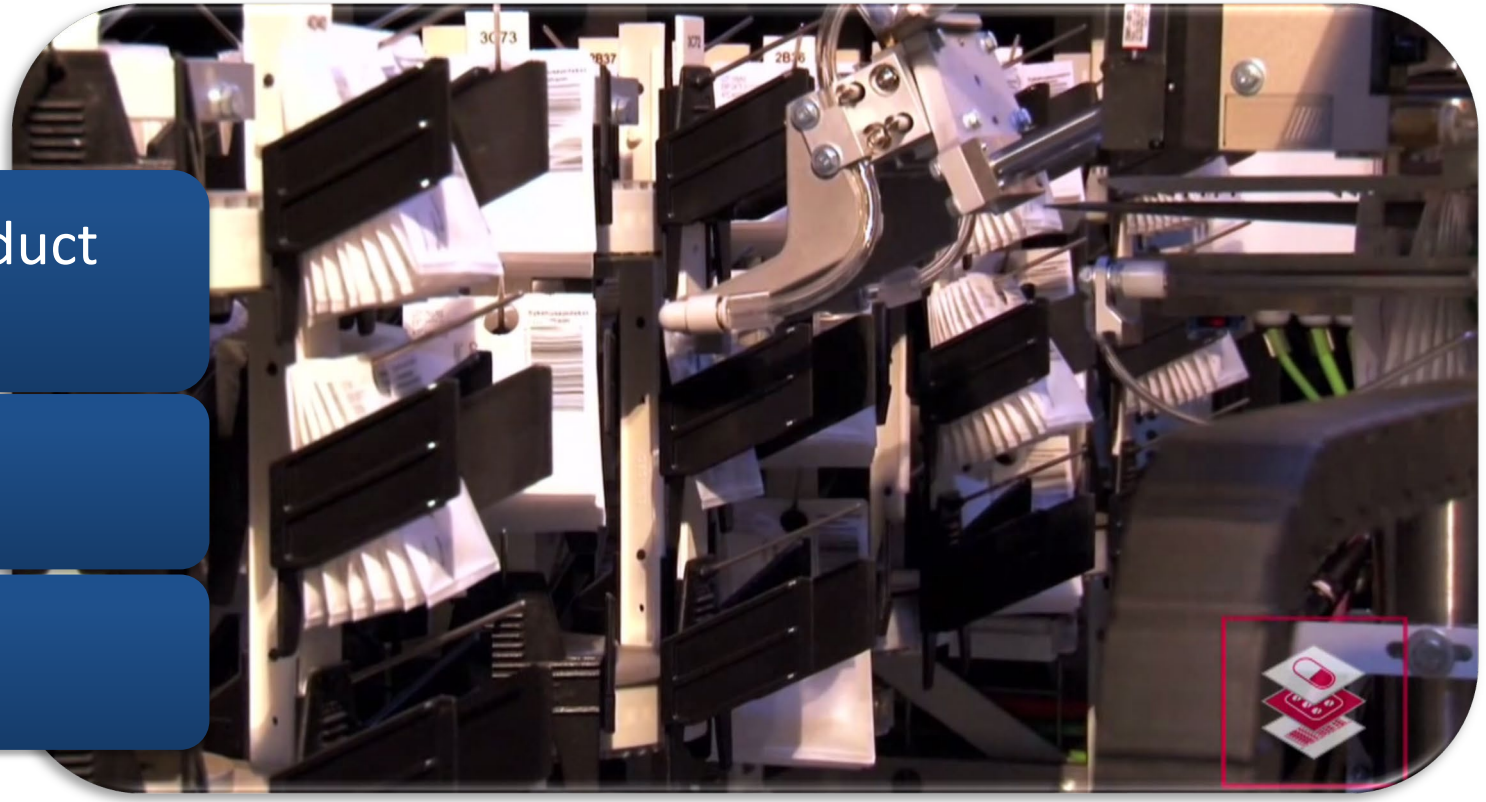


Order of clinical biology and drug administration plan



Pharmacy robots are driven by electronic prescription and drug inventory management system.

CLMA
Closed Loop Medication Administration



Identification of each medicinal product individually

Link to computerized prescription

Association of each identifier to:

- A patient
- A drug dosage
- A drug-administration route
- A time

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CLMA
Closed Loop Medication Administration

Automated medicine cabinets are also linked to the computerized prescription of drugs and only issue prescribed drugs.

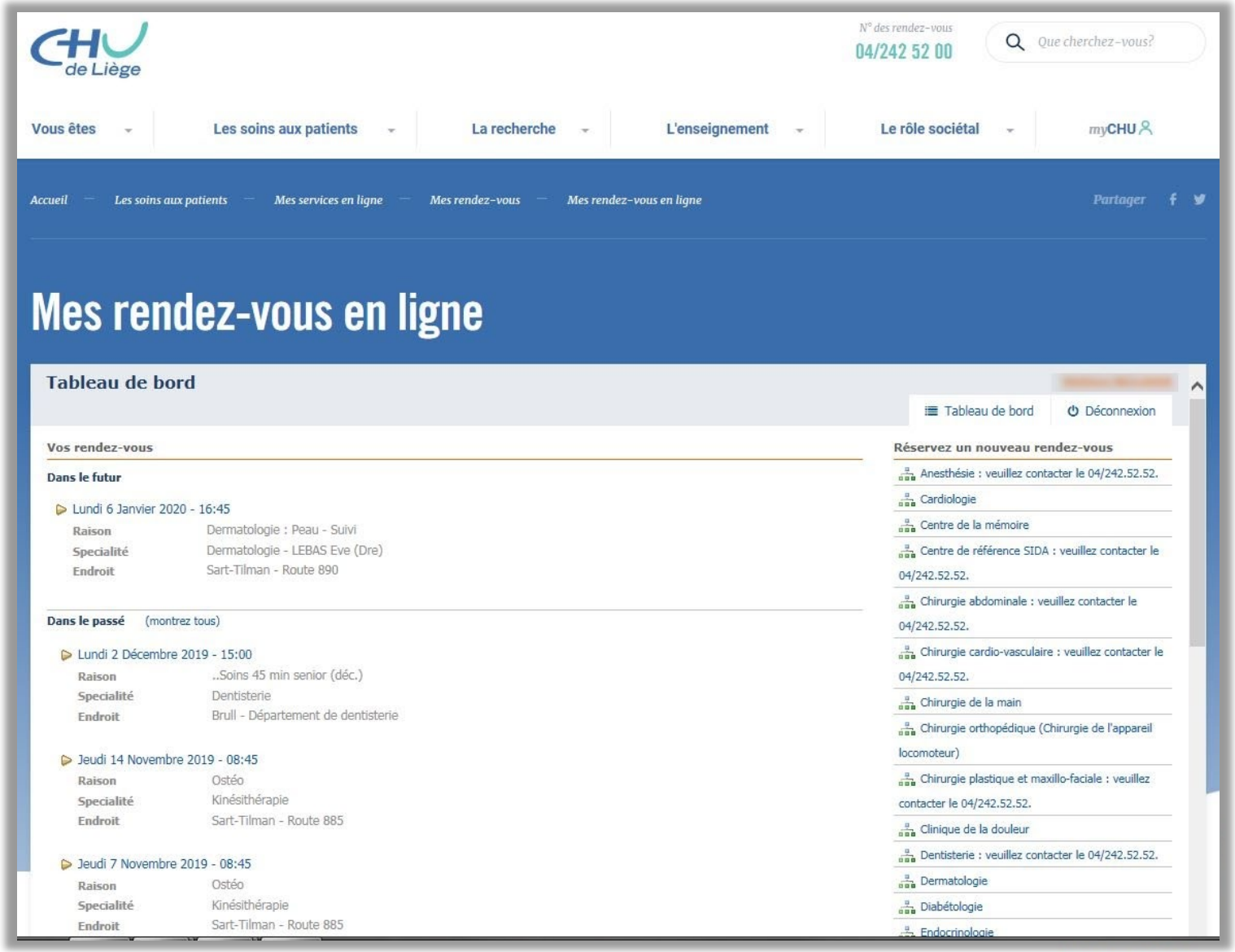
CDSS – CPOE

Clinical Decision Support System
Computerized Physician Order Entry

Data sharing with external care providers

Access to the online appointment booking portal (for patients and external physicians).

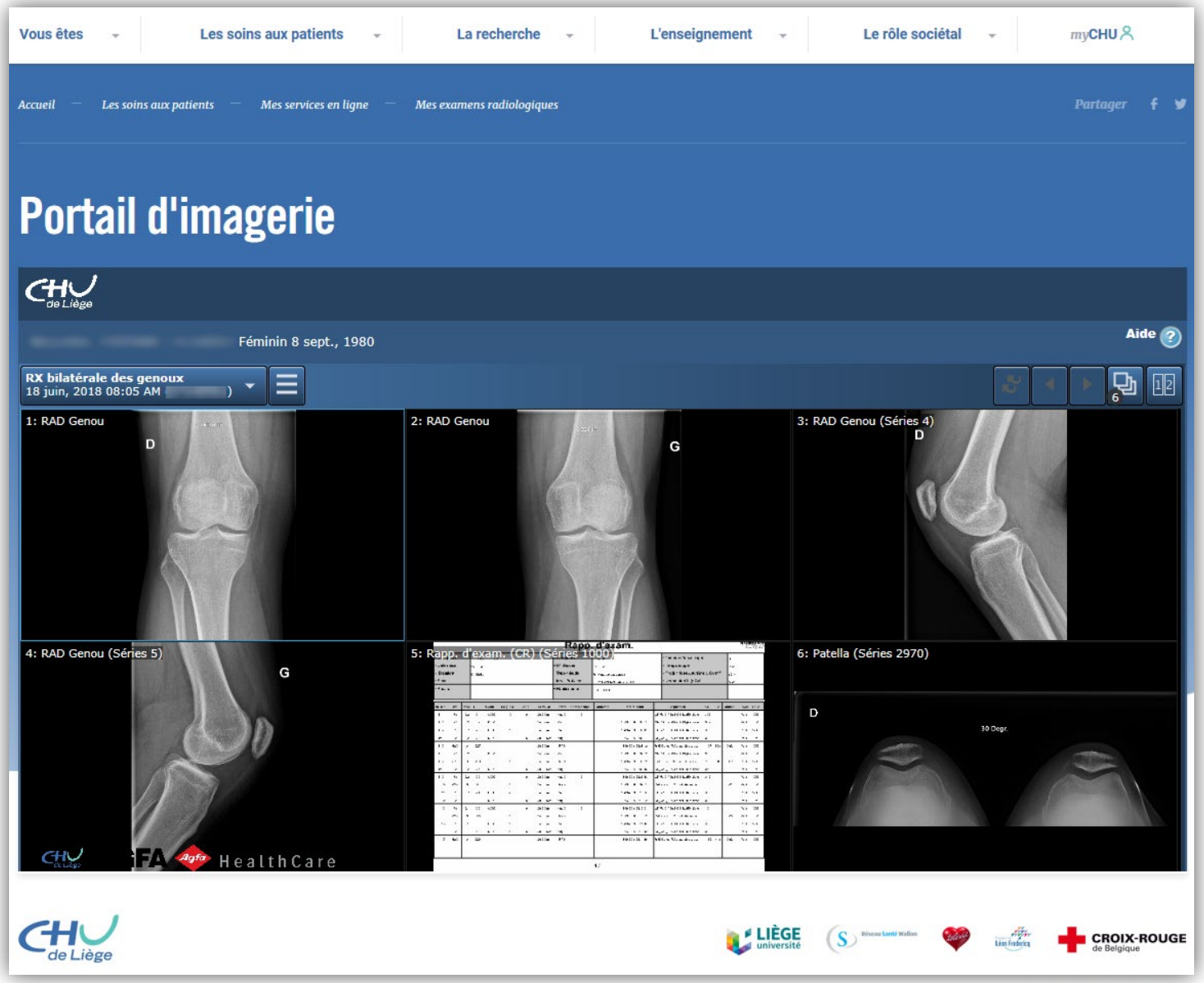
www.chuliege.be



Data sharing with external care providers

Access to the CHU medical imaging portal via a strong authentication system (for patients and external physicians).

www.chuliege.be



Data sharing with external care providers

Access to CHU shared documents via the « Réseau Santé Wallon »

The Wallon Health Network allows an exchange of computerized health documents (examination results, medical reports, letters, etc.) between healthcare providers working for the same patient.

All health care providers involved in these situations may have access to information about themselves. This exchange of information between healthcare providers facilitates its management.

In order for a healthcare provider to have access to the patient's health data, a therapeutic link must be established.

www.rsw.be

Réseau Santé Wallon

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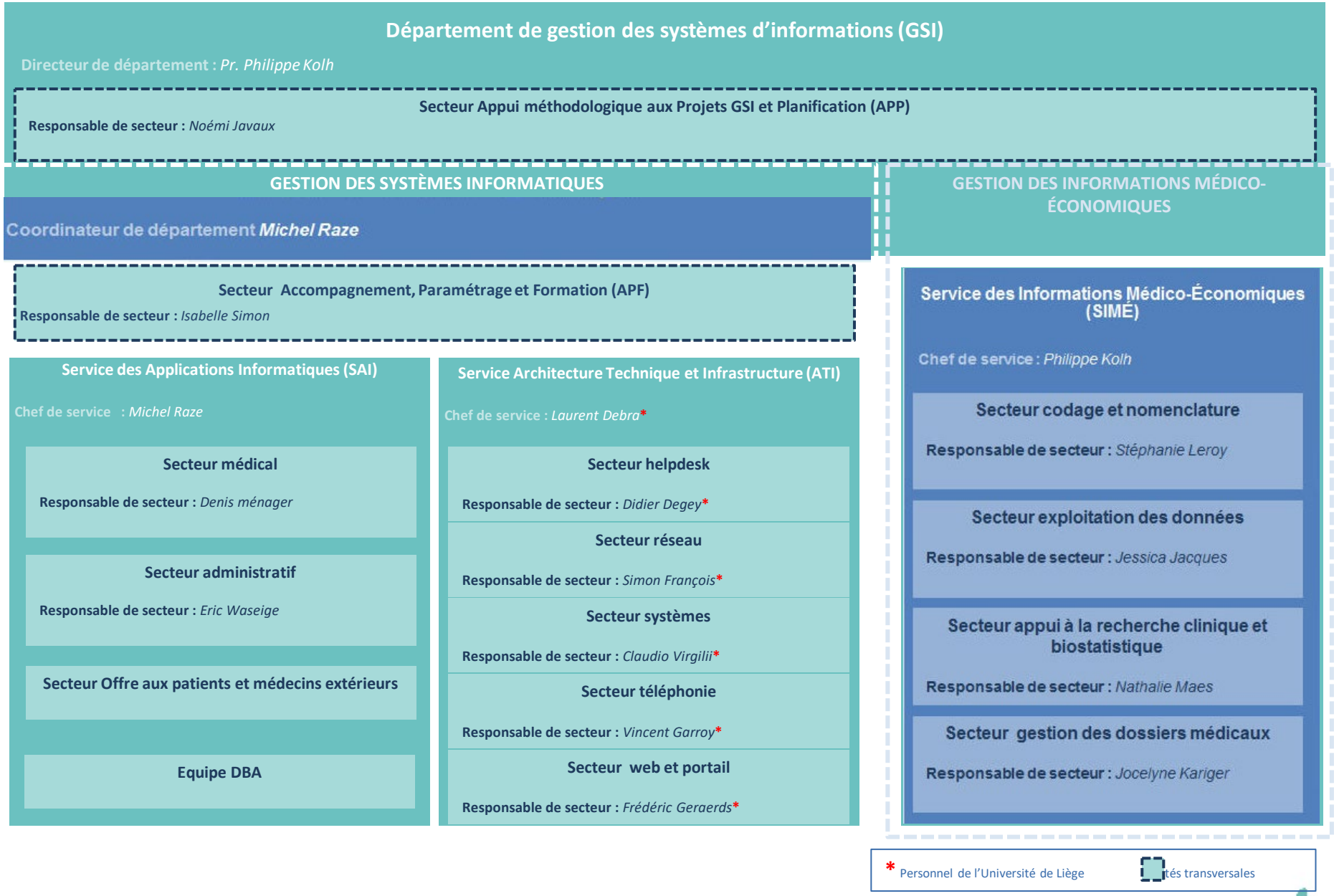
The SIME's Missions

- making patient's clinical data available, whether they are stored under paper or electronic format
- coding medical information and ensure consistency with the patient's identification
- analyzing the institution's activity and its medical and economic components
- offering methodological support to clinical research, including the biostatistical aspects

86 agents – 78,5 FTE




GESTION DES INFORMATIONS MÉDICO-ÉCONOMIQUES
Service des Informations Médico-Économiques (SIME)
Chef de service : Philippe Kolh
Secteur codage et nomenclature
Responsable de secteur : Stéphanie Leroy
Secteur exploitation des données
Responsable de secteur : Jessica Jacques
Secteur appui à la recherche clinique et biostatistique
Responsable de secteur : Nathalie Maes
Secteur gestion des dossiers médicaux
Responsable de secteur : Joëlyne Kariger

Data Analysis Area

Two main missions

1. Provide medical data

2. Analyze the medico-economic situation

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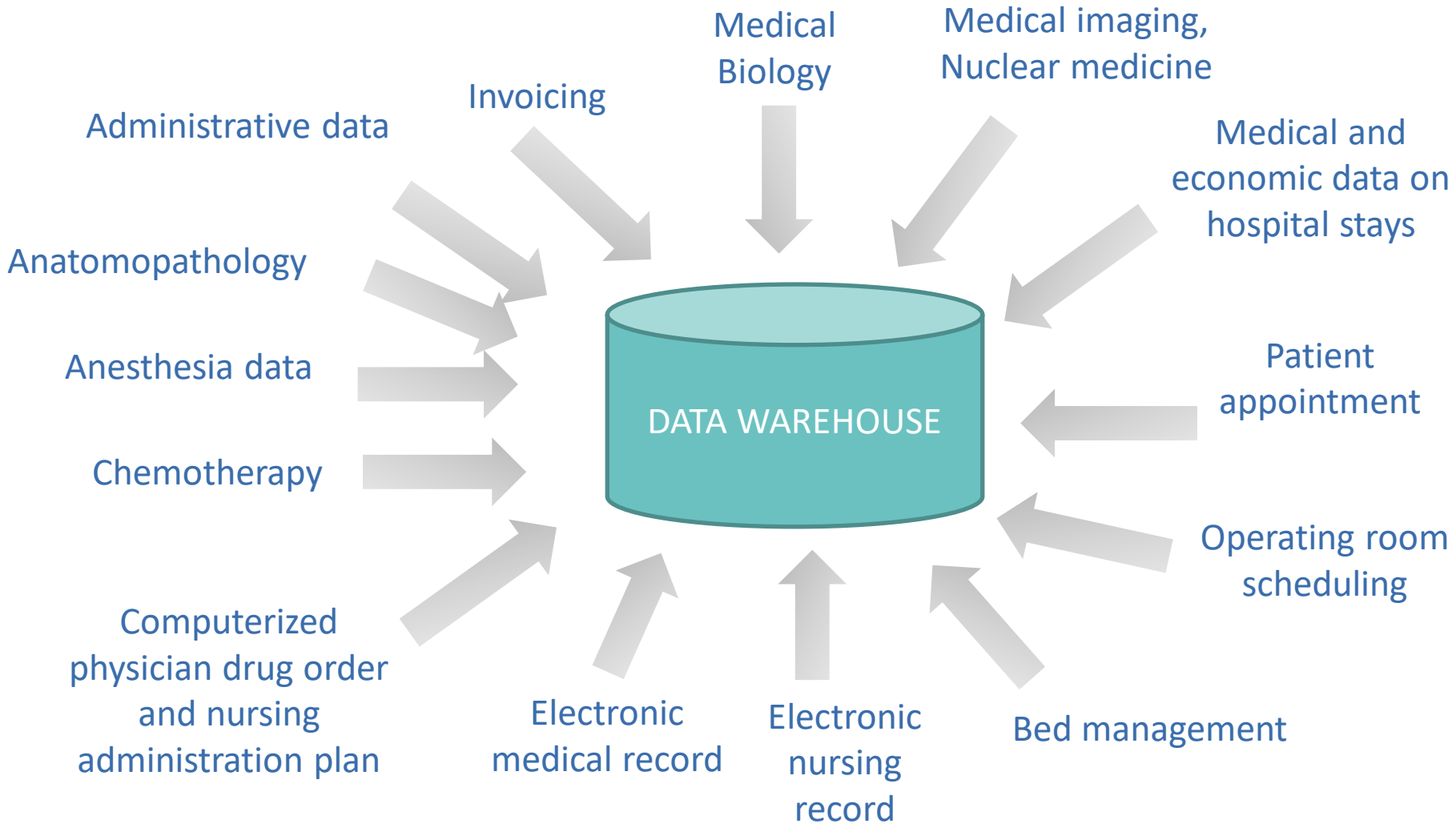
DataWareHouse Content



Data cover patient history since 1999 and are updated daily

Source	Tables	Champs
Patient et administrative	75	1300
Suivi budgétaire	20	400
Dossier médical	15	250
Facturation	45	1250
GIFA	32	650
QDOC	10	125
RCM	15	140
RHM	33	750
Radiothérapie	22	250
Ultragenda	20	225
Ressources humaines	37	550
Paie	10	100
ERP	180	8000
APO	15	375
UNILAB	25	300

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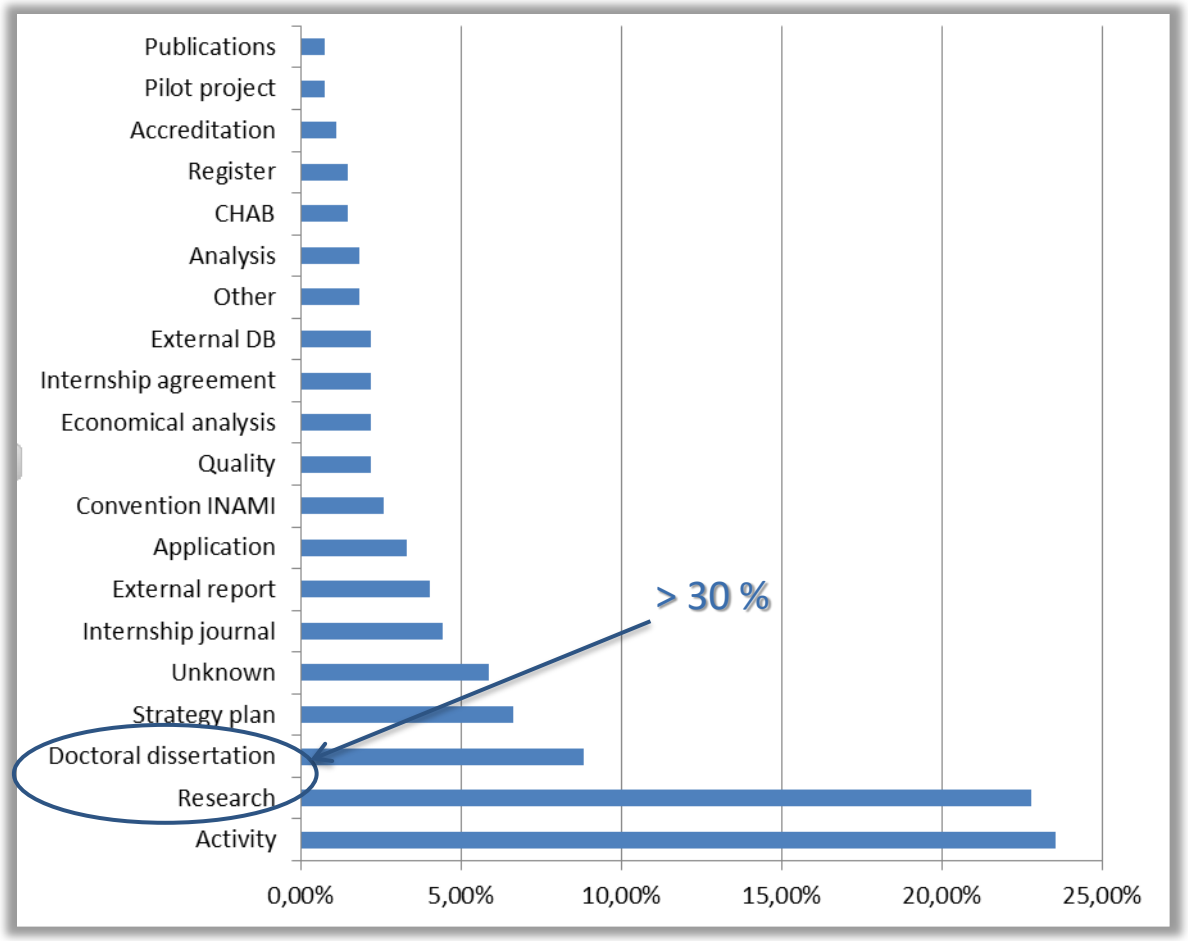
Making clinical data available



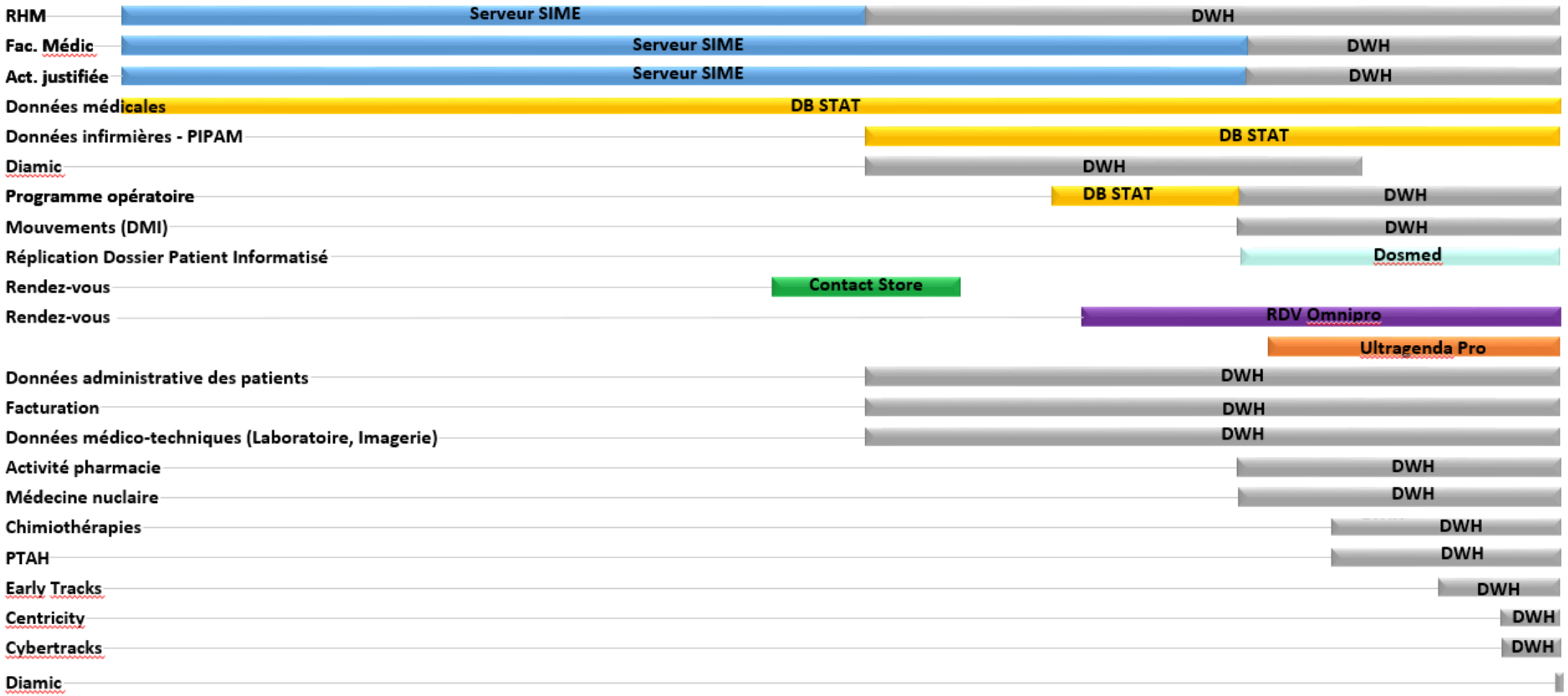
Over half of the medical services have at least once asked the SIME for data

More than 30% of all demands are related to research activity

What data are clinicians interested in?

Electronic patient record	40%
Patients' characteristics and whereabouts	39%
Invoicing	16%
Administrative and medical data	15%
Laboratory	6%
Medical imagery	3%

A keyword : patience …



2021

Success factors

- ✓To have a successfull EMR experience !
  - ✓Large use in hospital, in most of context/API, with a single Patient Identificator
- ✓Define roles
  - ➢ - IT for DWH ETL
  - ➢ - Data Analysts for exploitation of the clinical data
- ✓Close synergy between IT and Data Analysts
- ✓Data analysts must have a scientific background
- ✓The possibilities depend on the maturity of the EMR
- ✓Data analysts must have access to the finest data

VALIDATE – VALIDATE – VALIDATE !

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Perspectives in the Exploitation of clinical data

1. Dashboard Reporting
2. Provision of COVID clinical data
3. Sharing clinical data with pharmaceutical industries
4. Re Use of the clinical data for the research

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1. Dashboard reporting: focus on oncology

The main difficulty is to define the oncological patient

1. Define the data source
    - Based on the Belgian Cancer Registry
    - Or RHM/MKG
    - Or Radiotherapy Data
2. Determine the date of incidence
3. Open a 5-year-sliding window taking into account recurrence or new cancer

Oncologie

Menu

Population onco | Activité clinique | Financier | Prestations onco | Traitements

Patients nouveau diag (evol)	Nouveaux patients (evol)	Patients actifs (evol)	Patients potentiels (evol)
2.890 (+4,7%)	3.395 (+1,1%)	13.757 (+2,9%)	18.979 (+2,8%)

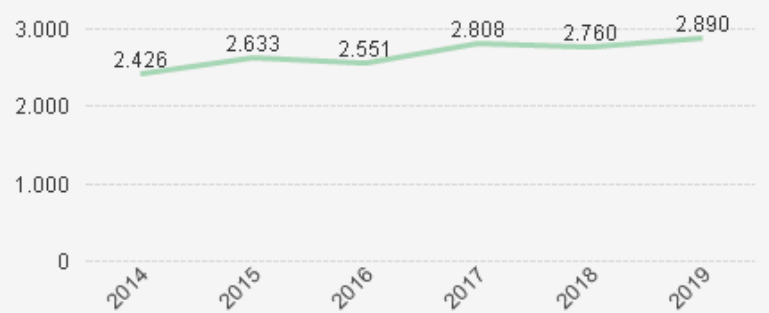
2014 2015 2016 2017 2018 2019

Catégorie cancer

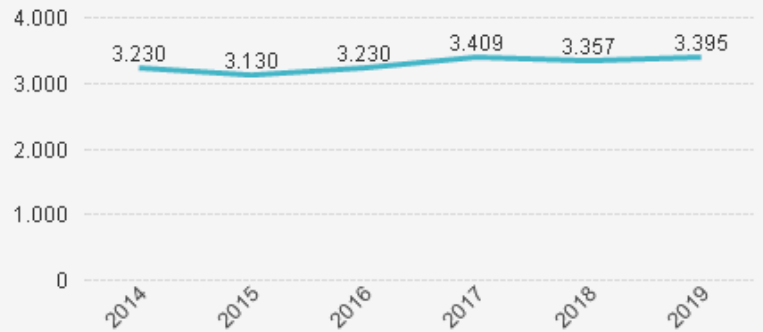
Sous-cat cancer

Patients | Registres/COM | Stat RBC

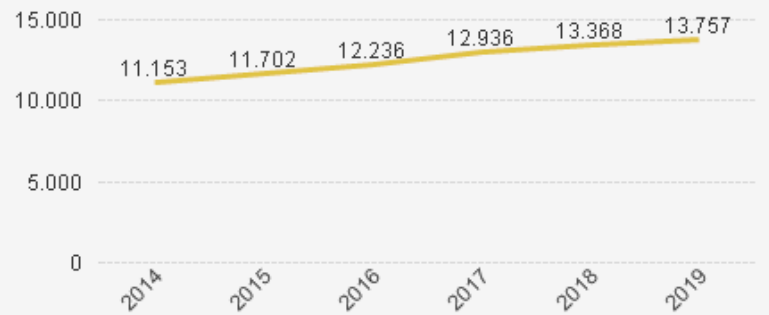
Nombre de patients avec un nouveau diagnostic onco



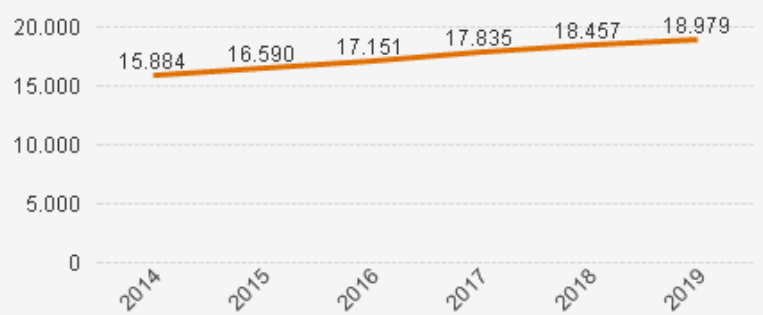
Nombre de nouveaux patients onco



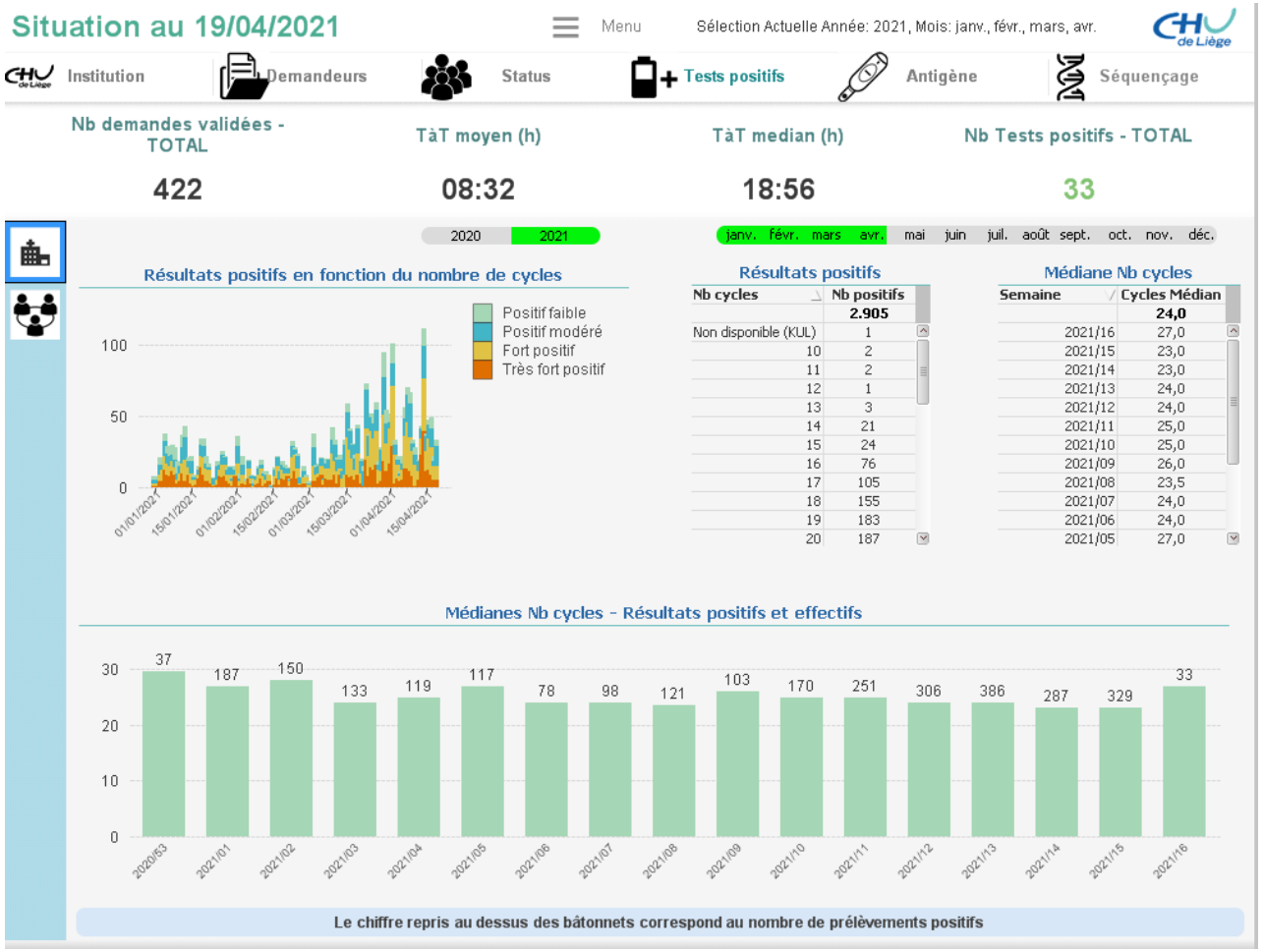
Nombre de patients onco actifs

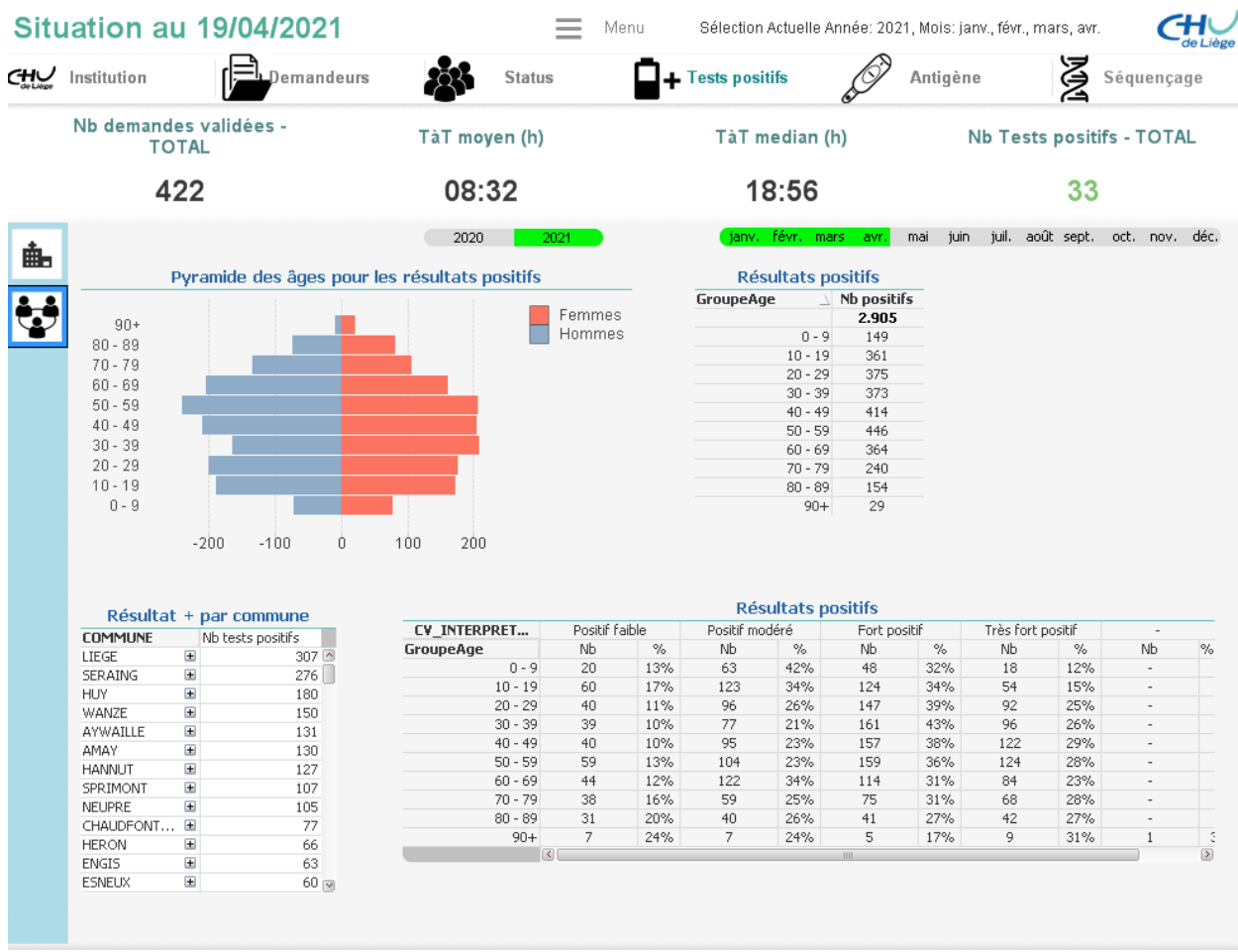


Nombre de patients onco potentiels



Dashboard reporting: Focus on Testing COVID





2.Provision of Clinical COVID Data

- Unique database, developed around several disciplines
- Weekly update for clinical research
- Content
  - Patient characteristics (including risk factors)
  - Symptoms at admission
  - Treatment
  - Biological values
  - Pathway and ICU Data
- Available to more than 30 researchers in 10 disciplines

- More than 10 published publications for the analysts

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3. Sharing clinical data with pharmaceutical industries: The Insite/Trinetx Projet

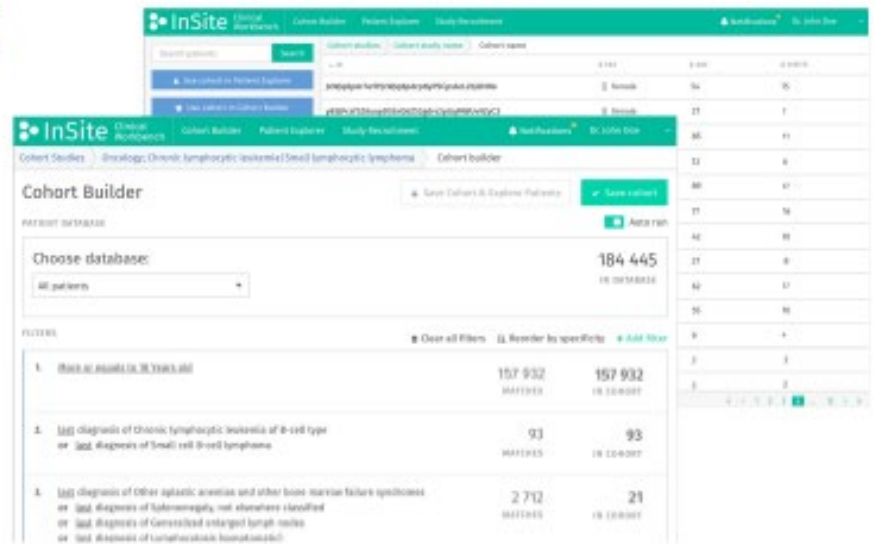
Challenges To Perform Clinical Trials

- Loosing time with inefficient communication.
- Almost 50% of all trial delays caused by patient recruitment problems
- Missing out on clinical trials because of not being informed
- Limited resources to spend on patient recruitment
- Confronted with inefficiently designed clinical trials
- Not compensated for general feasibility assessment

InSite Empowers Trial Sites

- A platform for trustworthy re-use of EHR data to support innovation in clinical research and healthcare operations
- InSite Local Platform – detailed data exploration for healthcare professionals
- Communication with multiple sponsors

InSite



AMGEN AstraZeneca BAYER Boehringer Ingelheim

ICON janssen Roche SANOFI

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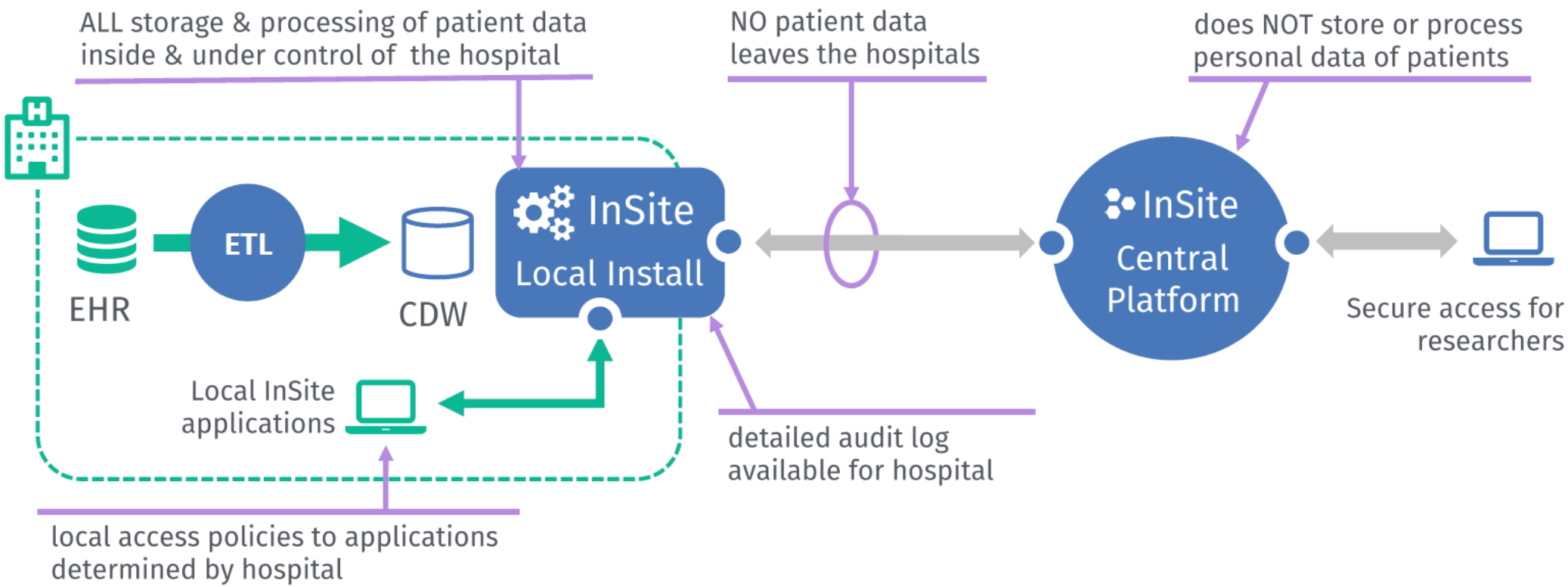
Technical Overview - Platform



The InSite Partner Hospital Network

InSite is a pan-European network, with a healthy ambition to expand beyond EU

11 Countries in which InSite is active

20M Patient records on the InSite network in 2017

>100M Patient records in the InSite partner network in 2019

InSite partner Health Care Organisations (HCOs) include

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Insite join Trinext in 2019

Global collaboration

+20 Countries
+130 HCOs
+300M Patients

4. Re Use of the clinical data for the research

- **WearIT4Health**
- **InteropEHRate**
- **PERSIST**
- **HosmartAI**
- Dragon

Research projects - Interreg WearIT4Health

Interreg Euregio Meuse-Rhine

Wearable Integrated Technology for health monitoring of hospitalised patients in the Euregio Meuse-Rhine

Programme: Interreg Euregio Meuse-Rhine

Lead partner: University of Liège

Consortium: Research centers, Hospitals from Belgium and The Netherlands

Objective: Developing a multi-sensors, wearable, secured and wireless monitoring system for inpatients in medium care wards.

Timeline: 2018 till October 2021

Roles of CHU Liège:

- Co-creation & concept design
- Integration into the EMR of the hospitals
- Clinical validation study

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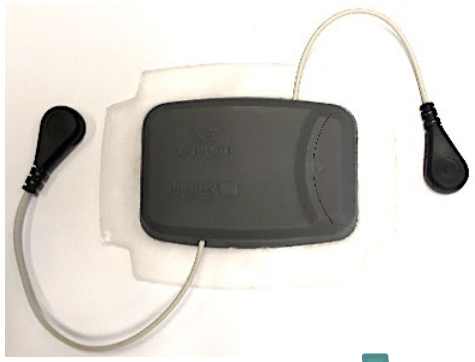
Research projects - Interreg WearIT4Health

Interreg
Euregio Meuse-Rhine
EUROPEAN UNION

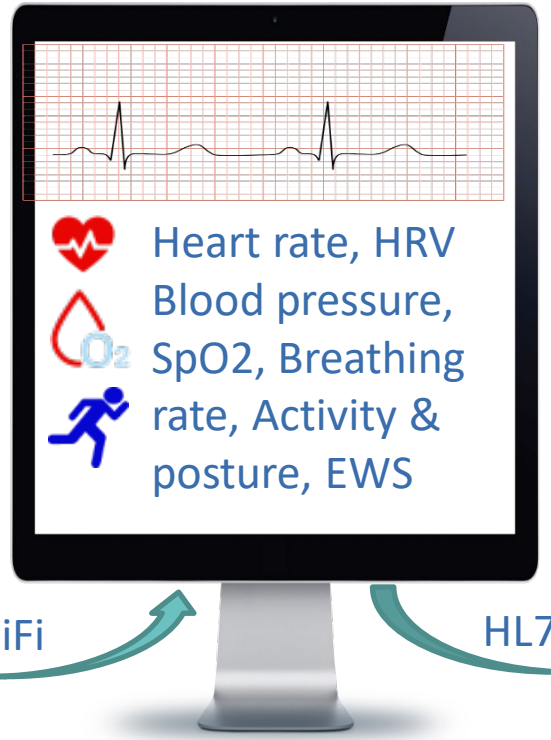
Wearable Integrated Technology
for health monitoring of hospitalised patients
in the Euregio Meuse-Rhine

ECG, PPG,
Temperature
Accelerometers



Device on
the chest

WiFi



HL7 FHIR

- Data processing
- AI predictive Early Warning Score

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Research projects –InteropEHRate

Programme: Horizon 2020

Lead partner: Engineering, Rome, Italy

Consortium: Italy, Greece, Belgium, Romania, Germany

Objective: Empower patient to aggregate his/her health data and share them during medical visit, emergency and for research purposes.

Timeline: 2019 till June 2022

Roles of CHU Liège:

- Requirements definition
- Co-creation of patient and health care practioners applications
- Data provider and data conversion rules
- Clinical validation study

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Research projects - Interreg InteropEHRate

InteropEHRate

Horizon 2020 Programme

Electronic Health Record
- Medical history
- Laboratory results
- Vital signs
- …

Patient Summary
- Current medications
- Allergies
- Family history
- - …

- Medical visit (possibly abroad)
- Emergency case (possibly abroad)
- EU Research center

Smart EHR – Patient acts as a broker of his/her health data

Research projects –PERSIST

Programme: Horizon 2020

Lead partner: Gradiant, Spain

Consortium: Spain, Austria, Belgium, Turkey, Germany, Slovenia, Switzerland, Latvia

Objective: Improve the quality of life of cancer survivors with the help of artificial intelligence and Big Data.

Timeline: January 2020 till March2023

Roles of CHU Liège:

- Clinicians expertise in oncology
- Data standardization, Data anonymization, Data provider
- Clinical study site

Research projects - PERSIST

InteropEHRate

Horizon 2020 Programme

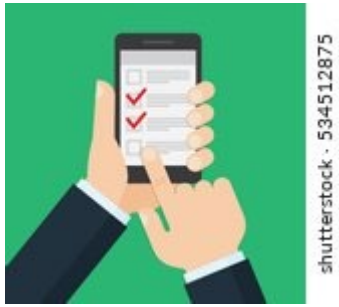
- Electronic Health Record
- Cancer registry

FHIR repository

EHR enrichment
Patient stratification

Retrospective

Prospective



PROMs / PREMs/Psychological and physiological data

CDSS

Research projects –HosmartAI

HOSMARTAI

Horizon 2020 Programme

Progamme: Horizon 2020

Lead partner: Intrasoft International

Consortium: Belgium, Greece, Slovenia, Spain (countries involved in radiotherapy pilot)

Objective: Improve the scheduling of radiotherapy appointments using AI chatbot and digital twin.

Timeline: January 2021 till April 2024

Roles of CHU Liège:

Domain expertise, Concept definition and Validation

Data standardization, Data anonymization, Data provider

Clinical validation study

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Research projects – HosmartAI

- Electronic Health Record
- Scheduling system
- Oncology Information System

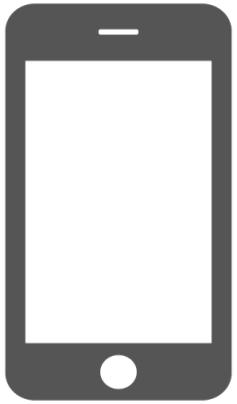
FHIR repository

Horizon 2020 Programme

Smart scheduling
Digital twin

Retrospective

Prospective



Speech enabled chatbot

Research projects – Dragon

Programme: IMI2 – Call 21
Lead partner: OncoRadiomics S.A., Liège, Belgium
Consortium: Belgium, United Kingdom, The Netherlands, Italy
Objective: **Rapid and secure AI imaging based diagnosis, stratification, follow-up, and preparedness for coronavirus pandemics**
Timeline: 10/2020 till 09/2023

Research projects – IMI2 – DRAGON

- **Roles of CHU Liège**:
  i. Multicentric data harmonization development
  ii. Imaging and non-imaging biomarkers exploration
  iii. Diagnosis and prognosis tools designing based on clinical evidence
  iv. Data provider
  v. Clinical validation study

- **Data journey**

  DICOM & CSV files generated by CHUL

  - Data harmonization process
  - Imaging and non-imaging biomarkers assays
  - Design of specific AI-based models for diagnosis and prognosis purpose
  - Patient empowerment through the development and validation of mobile phone application

- **CHU Liège coordinator**

Dr. Julien Guiot - Pneumologist

Thank you!

@PhilippeKolh

@UniversiteLiege

@CHULiege

@CHULiege