Catalan open innovation hub on ICT-supported integrated care services for chronic patients

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AGENDA

- ✓ Catalan Health and Social Care Systems
- ✓ Catalan Open Innovation Hub on ICT-supported Integrated Care Services
  - Health Plan 2011-2015
  - Health Plan 2016-2020
- ✓ NEXTCARE (2016 – 2019) – Five actions to foster digital transformation
- ✓ Future strategies

Catalonia

7.5 million inhabitants

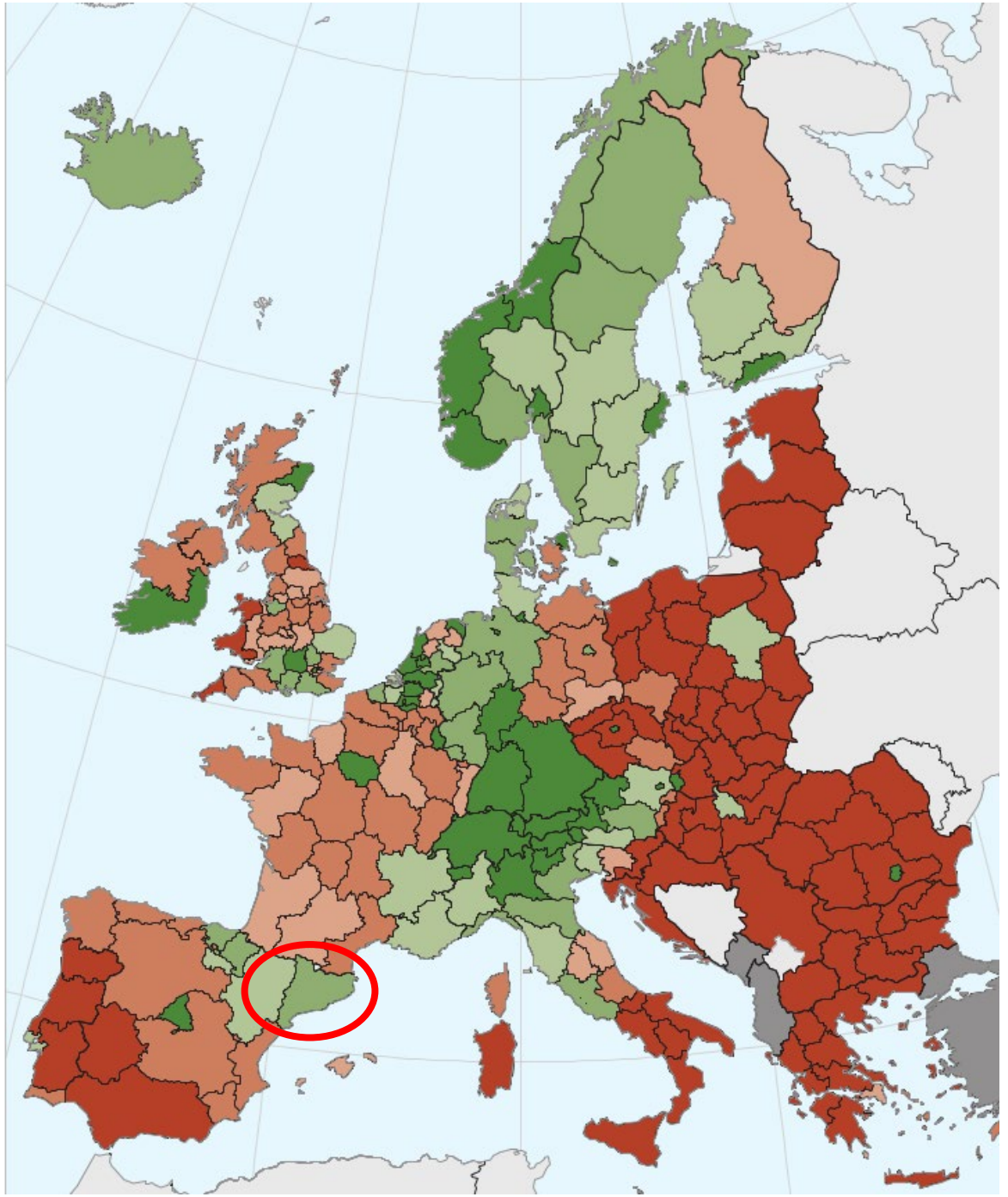
GDP 108%

Health expenditure ~ 6%

Expected survival

Men 80,8 yrs. & Women 86,3 yrs.

Gross Domestic Product (GDP) in purchasing power standards per EU regions in % EU28 average= 100

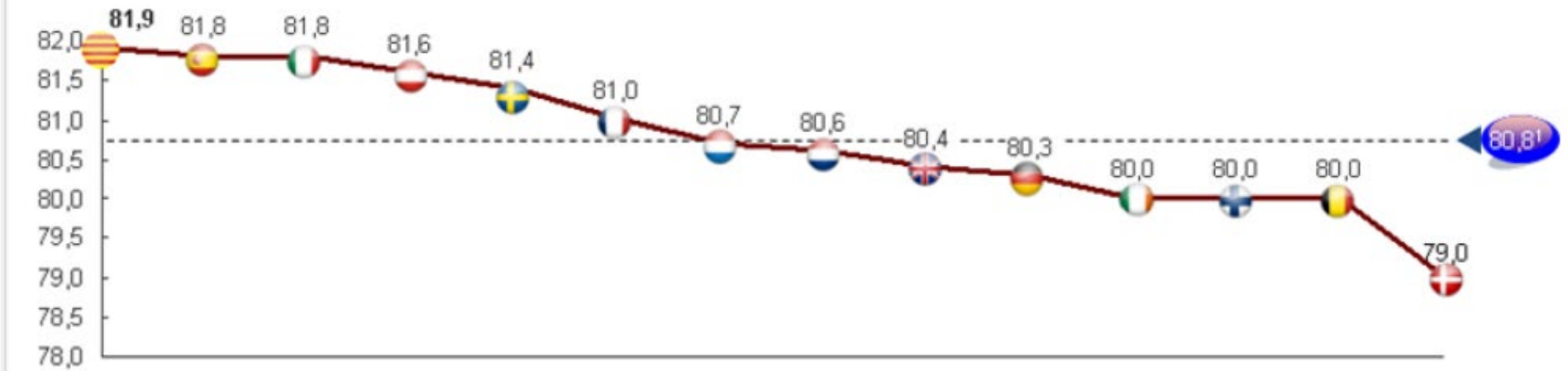


Catalan Health System

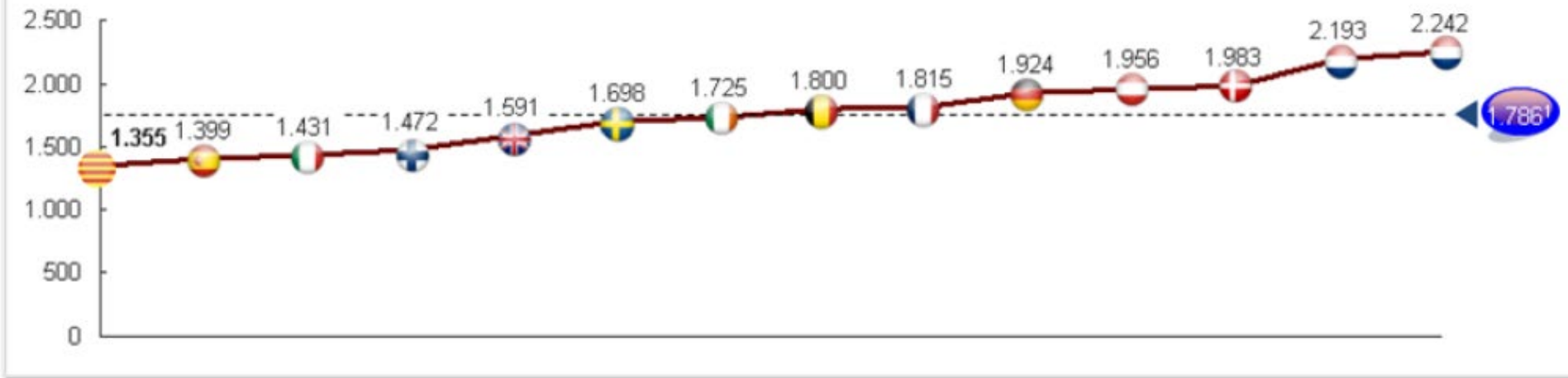
- ✓ Universal coverage
- ✓ Public financing of the services
- ✓ Single public payer *(separation between payer & provider)*
- ✓ Civil Society participation
- ✓ Access equity
- ✓ Continuity of care
- ✓ Integration and coordination

Catalonia is at the head in life expectancy and is one of the countries with less public health expenditure per capita

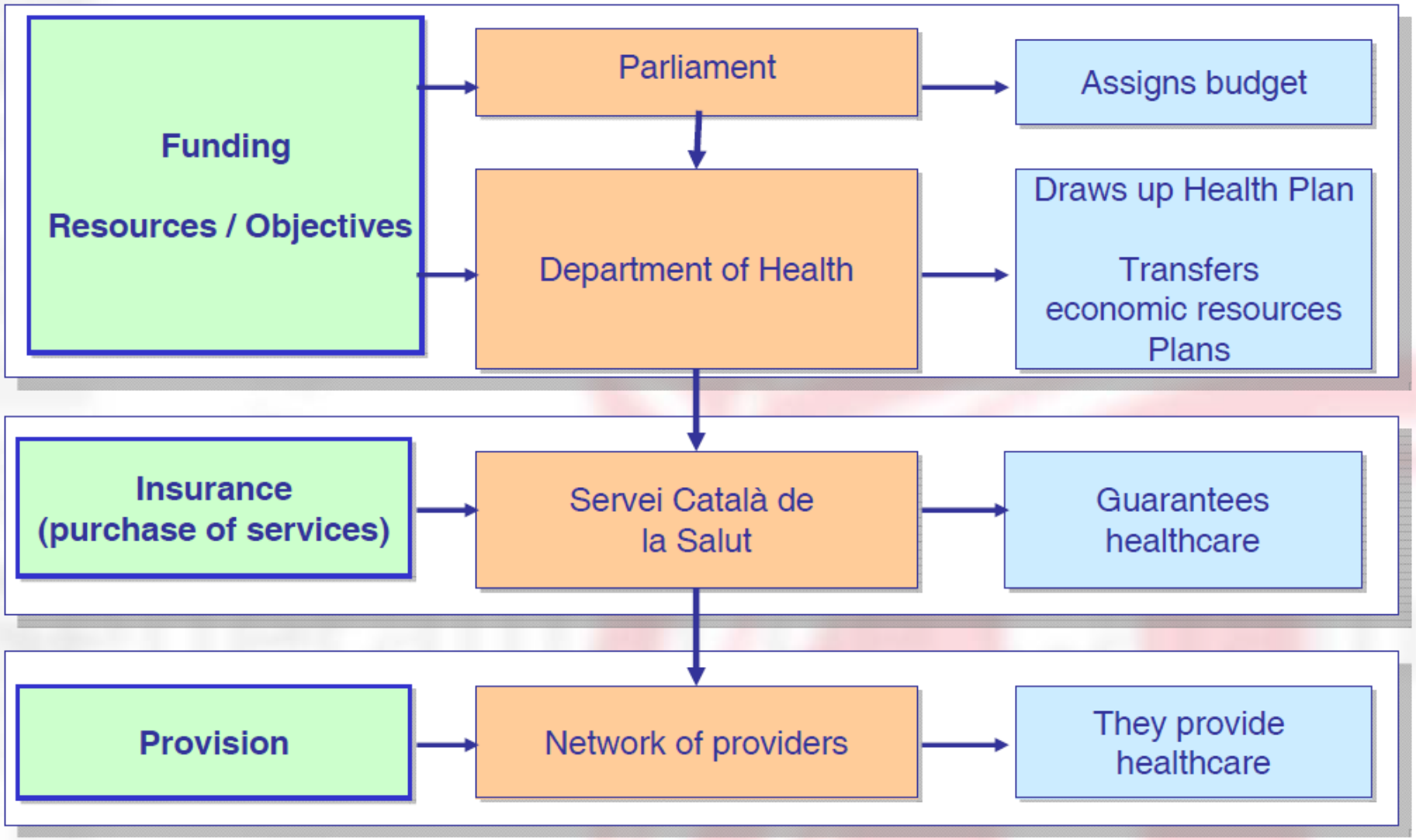
Life expectancy when born
2009. Years



Public Health expenditure per capita
2009. Euros per capita



Scope of functions



Health Regions

Three levels:

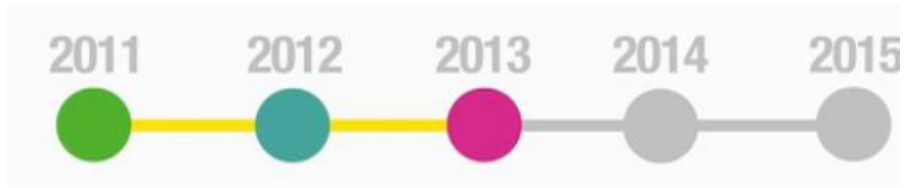
- 7 Regions
- Health districts
- 369 Primary Care Units (~ 20 k citizens)

Generalitat de Catalunya
Departament de Salut

Health Plan for Catalonia 2011-2015

Generalitat de Catalunya
Departament de Salut

Barcelona, 2012



The Catalan Health Care System in a Process of Change

Review of the 2011-2015 Health Plan for Catalon at the Halfway Point

Generalitat de Catalunya
Departament de Salut

Pla de Salut 2011-2015

Challenges

- **Demographic and cultural changes:**
  - Aging → Dependency
  - Immigration
  - Birth rates
- **Sociological and epidemiological changes**
- **Scientific and technological advances**
- **Economic sustainability**

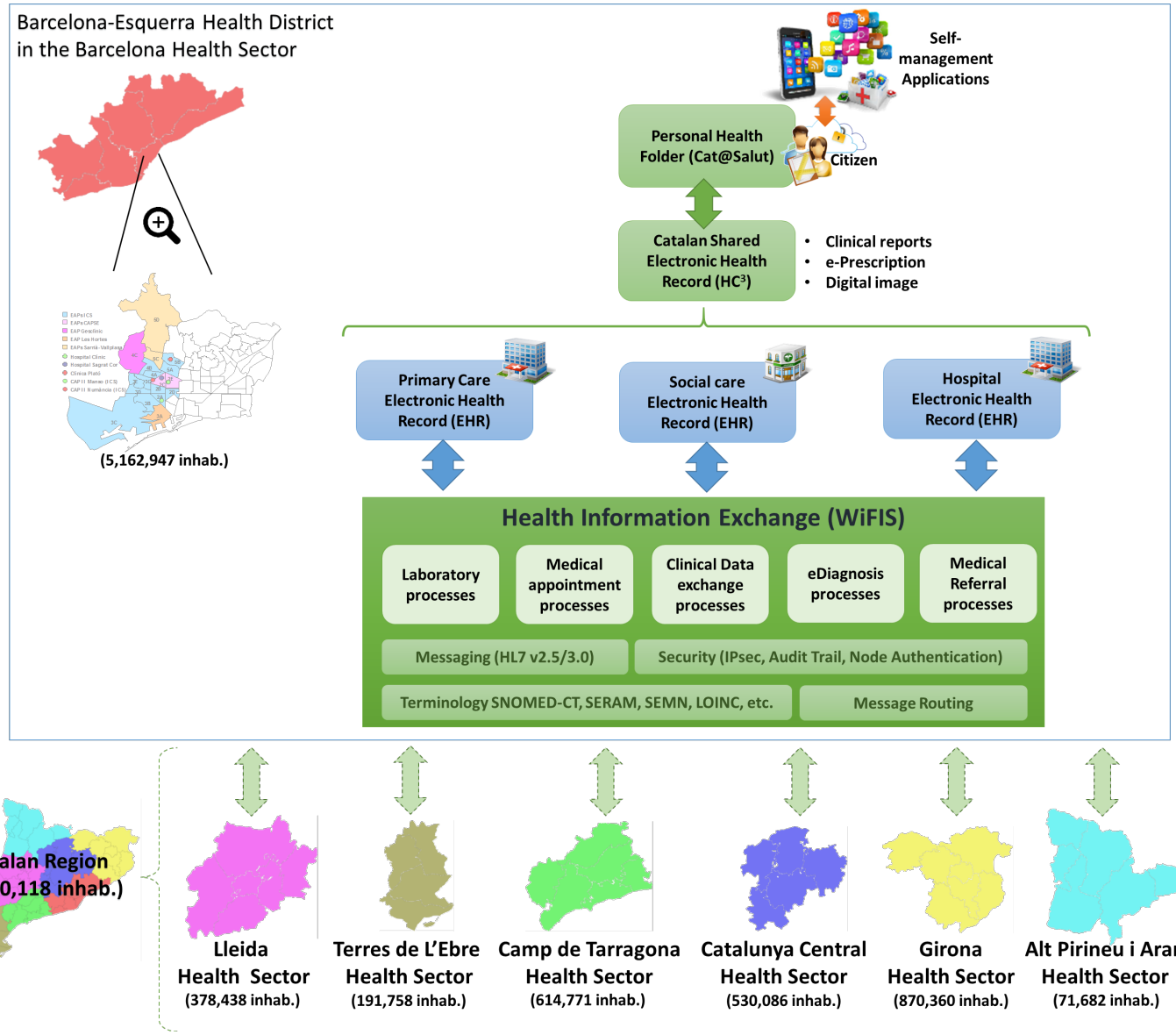
Catalan open innovation hub on ICT-supported integrated care services for chronic patients *(2011-2015)*

- ✓ Population-health approach
- ✓ Chronic patients with focus on multimorbidity management and on coordination with social support and dependence
- ✓ Focus on Complex Chronic Patients (CCP) and Advanced Care Disease (ACD)
- ✓ Encompasses both vertical (specialized vs. community-based care) and horizontal (healthcare vs. social support) integrations.

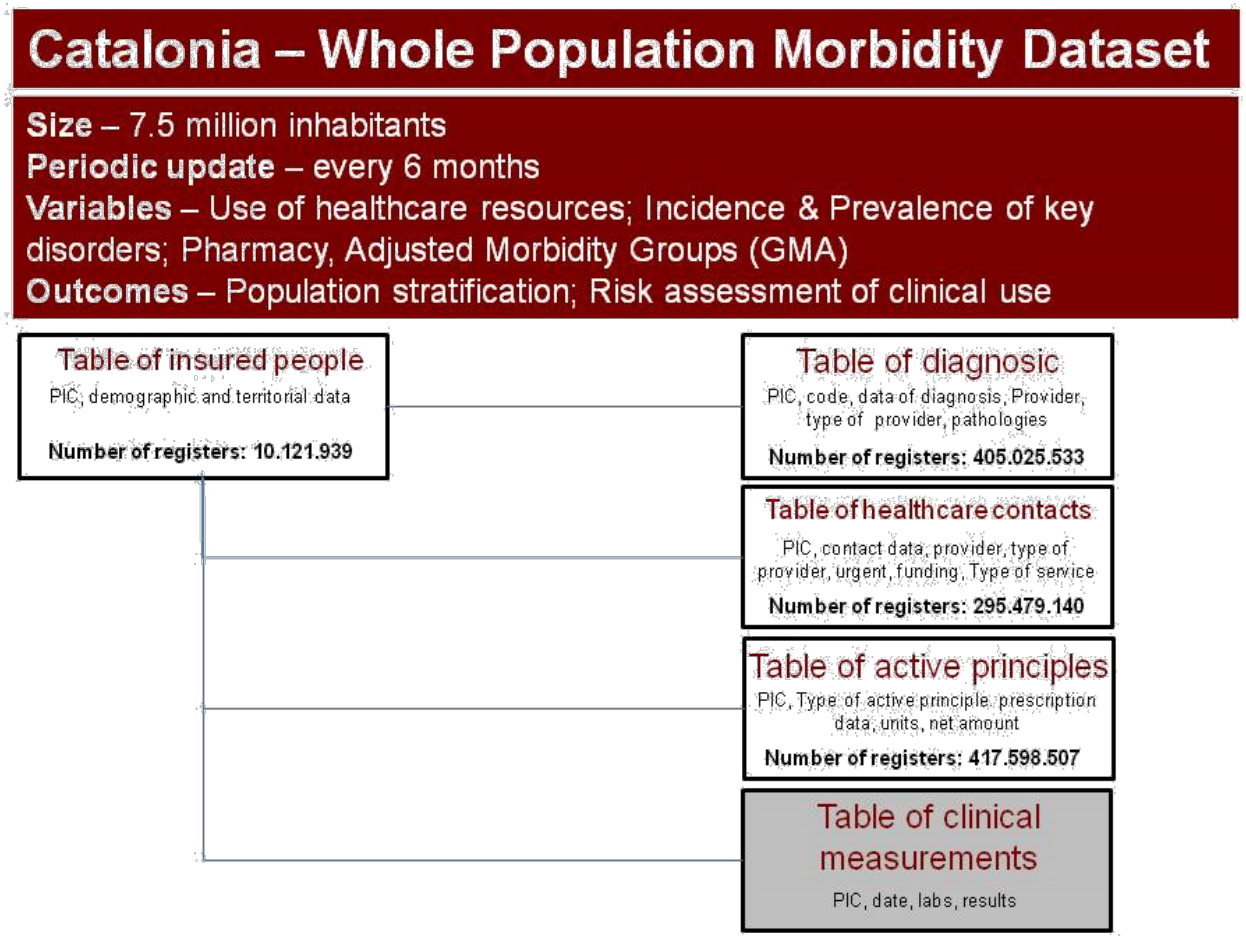
Catalan open innovation hub on ICT-supported integrated care services for chronic patients *(2011-2015)*

Fully deployed digital support

i) Regional Health Information Exchange platform (HC3)
ii) Personal Health Folder (La Meva Salut)
iii) ePrescription
iv) Population-based registries & GMA scoring system



Catalan open innovation hub on ICT-supported integrated care services for chronic patients *(2011-2015)*



Catalan open innovation hub on ICT-supported integrated care services for chronic patients *(2011-2015)*

- ✓ Health-preserved expect. survival to expect. survival ratio: Δ 4%
- ✓ Percentage reduction of referrals to specialized care: - 50%
- ✓ Reduction of hospitalisations: - 7,500 admissions
- ✓ Reduction of 30-d re-admission rate in chronic patients: -9% (13% cases)
- ✓ Reduction of emergency room admissions in chronic patients: -40%
- ✓ Reduction in mortality rate of cardiovascular and respiratory disorders: -15%
- ✓ Improvement of activity of home hospitalization: + 53% (12,600 cases/yr.)
- ✓ Improvement of activity of palliative care: 100% coverage
- ✓ Improvement of coverage of ePrescription: 97% population

Catalan open innovation hub on ICT-supported integrated care services for chronic patients

Core targets of the Catalan Health Plan 2016-2020:

i) maturity of digital health services

ii) consolidation of achievements of the period 2011-2015

iii) multilevel clinical risk assessment with a preventive approach considering Adjusted Morbidity Groups (GMA) as the population-health tool.

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NEXTC@RE

Regional deployment of ICT-supported integrated care services

design, evaluation and large scale implementation of five actions aiming at generating healthcare-value at system level

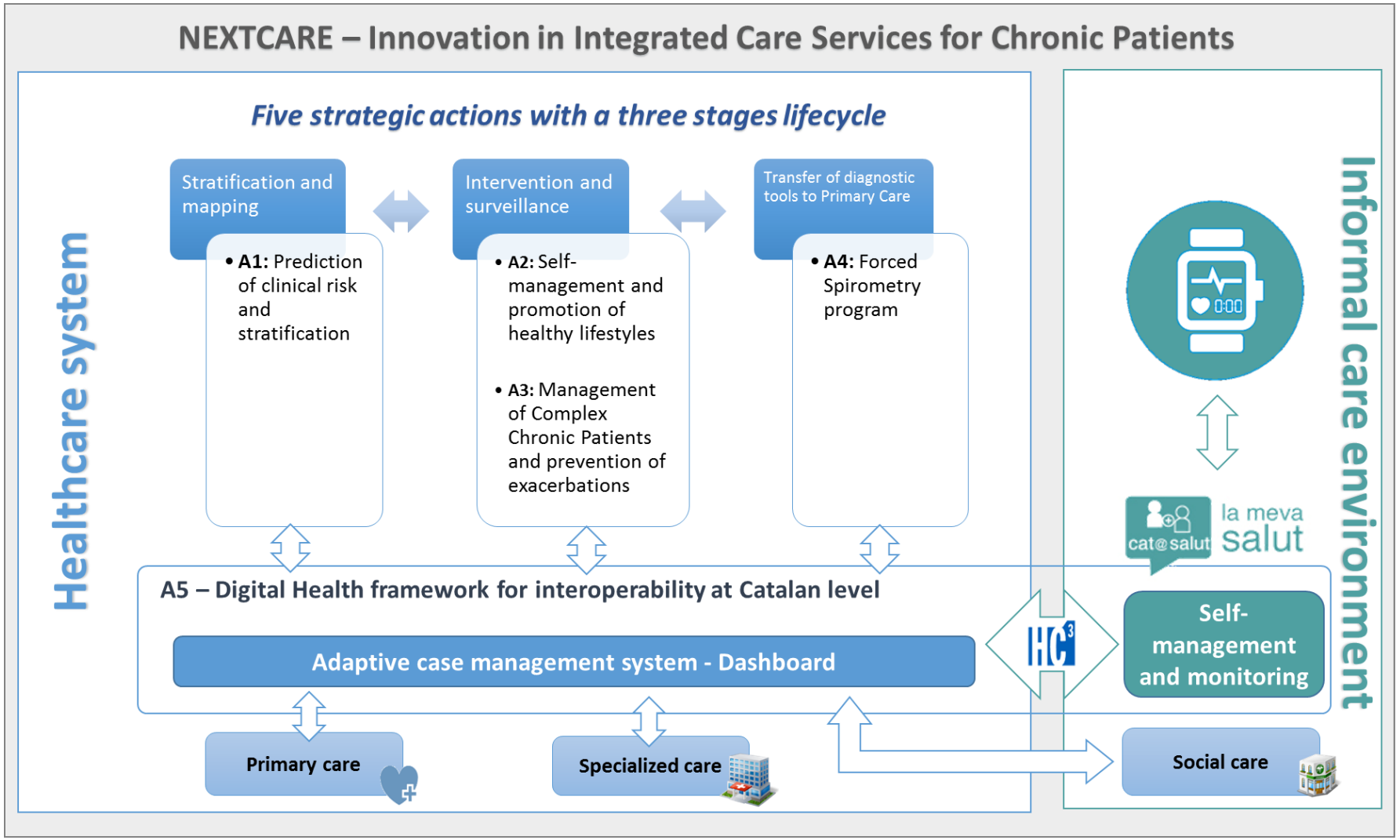
Multimorbidity

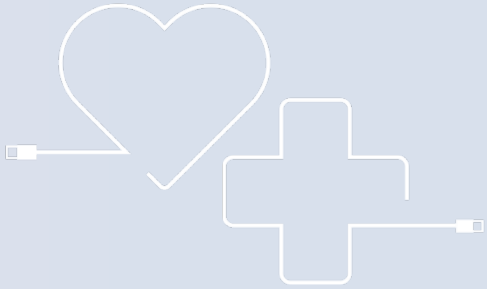
(cardiovascular diseases; COPD; diabetes type II and anxiety- depression)

NEXT C@RE

From current management of clinical episodes
to management of diseases
to collaborative management of cases through
clinical processes with a preventive approach

NEXTCARE graphical abstract





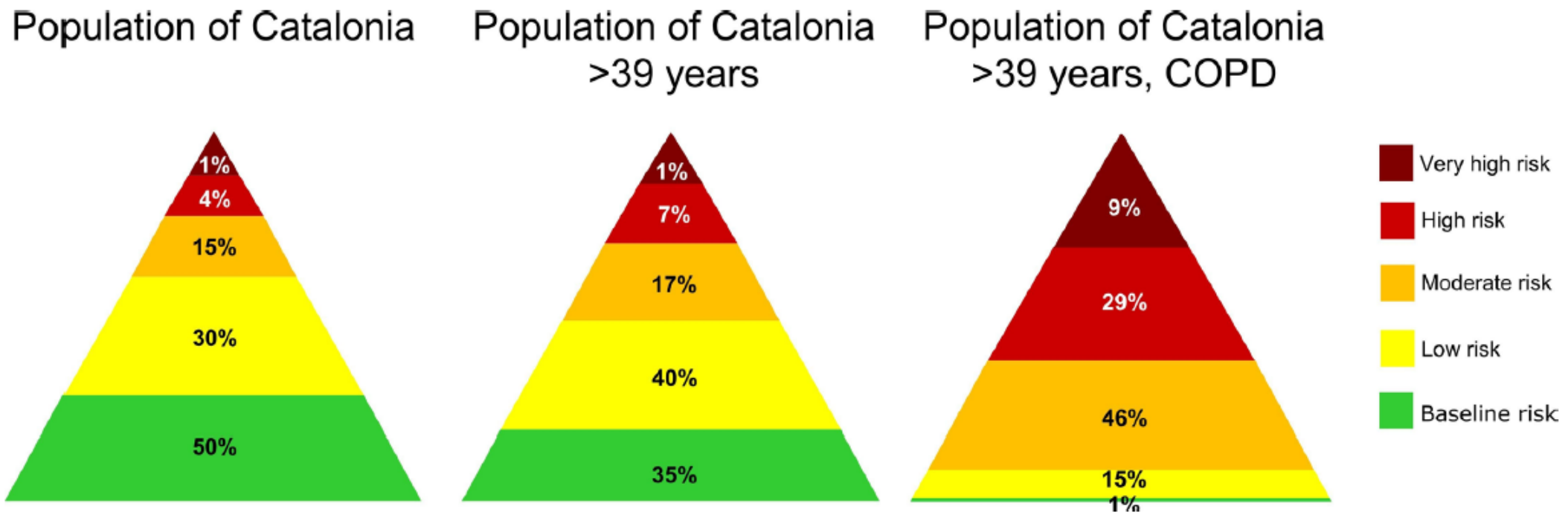
A1 – Prediction of Clinical Risk and stratification

COPD – Four Major Clinical Challenges

- Early diagnosis and progression of lung disease
- Patients with frequent exacerbations
- Co-morbidities and systemic effects
- Health risk assessment and service selection

All cases with COPD diagnosis in Catalonia

264,830 patients



Open Access Research

BMJ Open

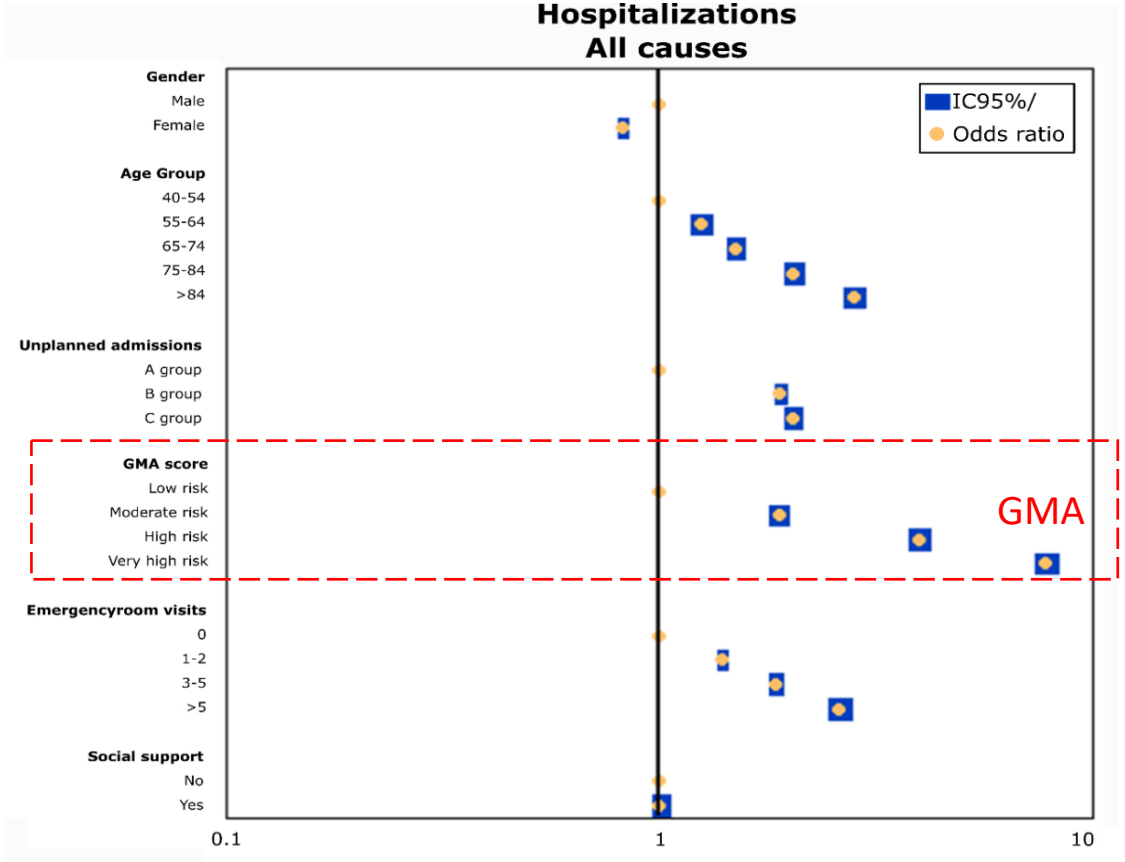
2018

Population-based analysis of patients with COPD in Catalonia: a cohort study with implications for clinical management

Emili Vela,[1] Ákos Tényi,[2,3] Isaac Cano,[2,3] David Monterde,[4] Montserrat Cleries,[1] Anna Garcia-Altes,[5] Carme Hernandez,[2,3] Joan Escarrabill,[2,6] Josep Roca[2,3]

- ✓ Use of healthcare resources
- ✓ Mortality
- ✓ Unplanned admissions
- ✓ Multiple admissions

	AUC
	0.76
	0.83
	0.77
	0.80



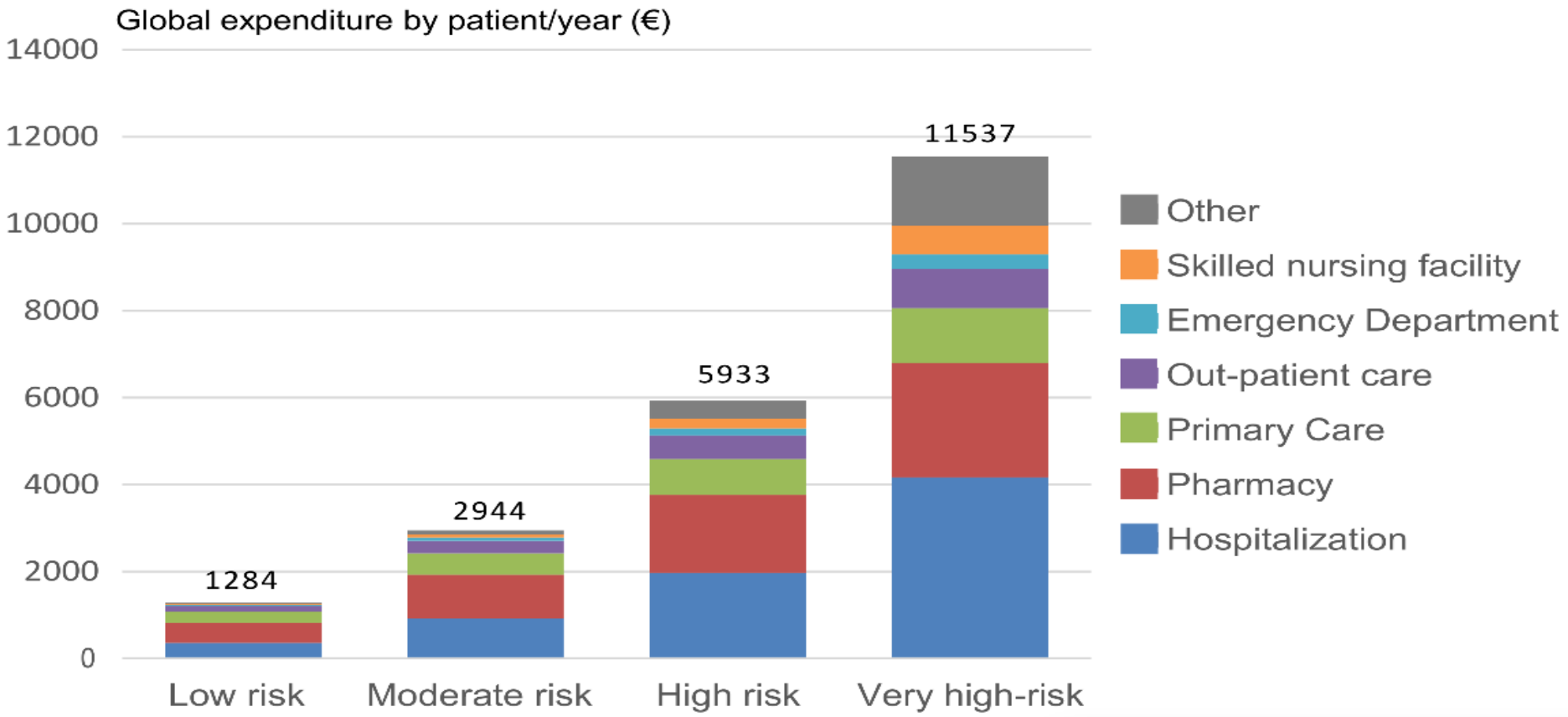
Open Access Research

BMJ Open Population-based analysis of patients with COPD in Catalonia: a cohort study with implications for clinical management

Emili Vela,[1] Ákos Tényi,[2,3] Isaac Cano,[2,3] David Monterde,[4] Montserrat Cleries,[1] Anna Garcia-Altes,[5] Carme Hernandez,[2,3] Joan Escarrabill,[2,6] Josep Roca[2,3]

Expenditure by patients with COPD/year by GMA scoring

GMA – Adjusted Morbidity Groups



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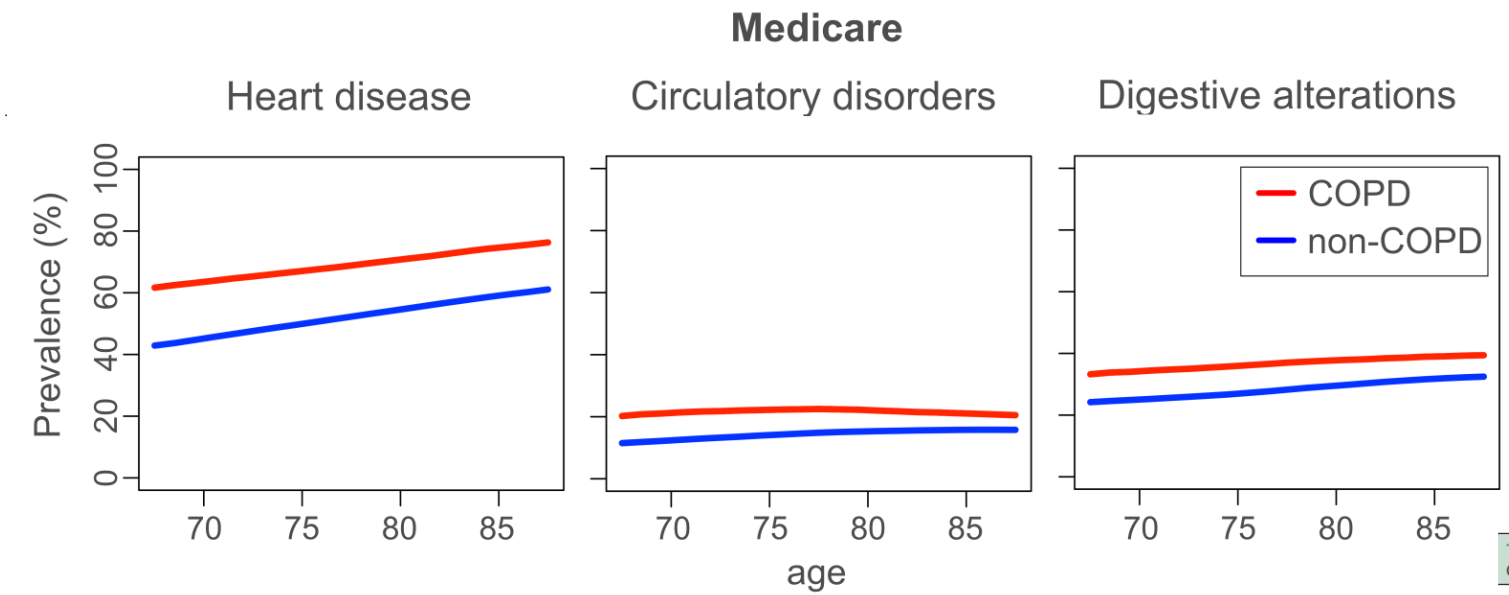
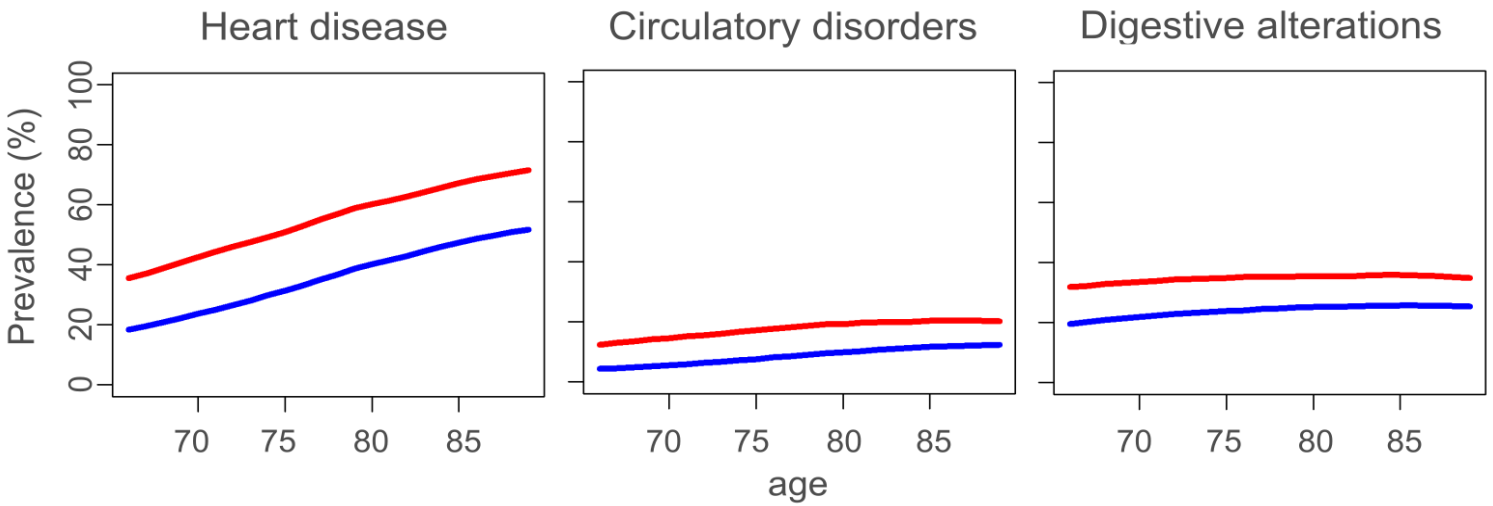
Co-morbidity clustering





The Author(s) *BMC Bioinformatics* 2016, **17**(Suppl 15):441
DOI 10.1186/s12859-016-1291-3

BMC Bioinformatics

RESEARCH Open Access

From comorbidities of chronic obstructive pulmonary disease to identification of shared molecular mechanisms by data integration

David Gomez-Cabrero[1,2,3,4,12*], Jörg Menche[5,9,10], Claudia Vargas[6,7], Isaac Cano[6,7], Dieter Maier[8], Albert-László Barabási[5,9,10,11], Jesper Tegnér[1,2,3,4], Josep Roca[6,7*] and on behalf of Synergy-COPD Consortia

Table 1 Description of the datasets and methodological considerations of the current study and the previous study of Gomez-Cabrero and colleagues[8]

	Study population	Study period	Scope of data	Diseases considered
Current study	1.4 million (CHSS)	2016 +diagnosis history	Primary care, hospital claims, social care, others	Chronic
Gomez-Cabrero *et al*[8]	13 million (Medicare)	1990–1993	Hospital claims	Chronic, acute

CHSS, Catalan Healthcare Surveillance System.

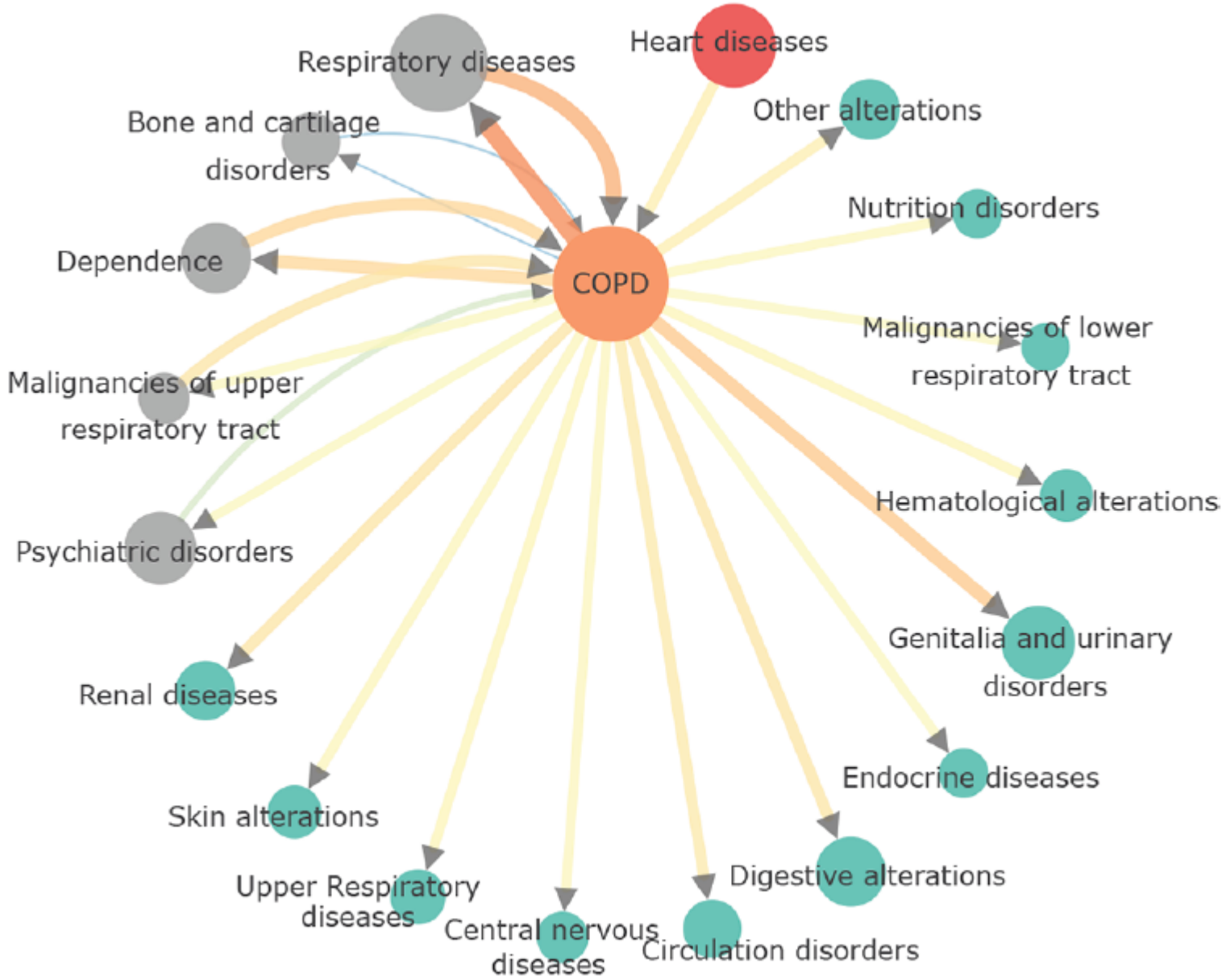
Chronic obstructive pulmonary disease

BMJ Open Respiratory Research

Risk and temporal order of disease diagnosis of comorbidities in patients with COPD: a population health perspective

Ákos Tényi,[1,2] Emili Vela,[3] Isaac Cano,[1,2] Montserrat Cleries,[3] David Monterde,[4] David Gomez-Cabrero,[5,6,7] Josep Roca[1,2]

May 2018



Chronic obstructive pulmonary disease

BMJ Open Respiratory Research

Risk and temporal order of disease diagnosis of comorbidities in patients with COPD: a population health perspective

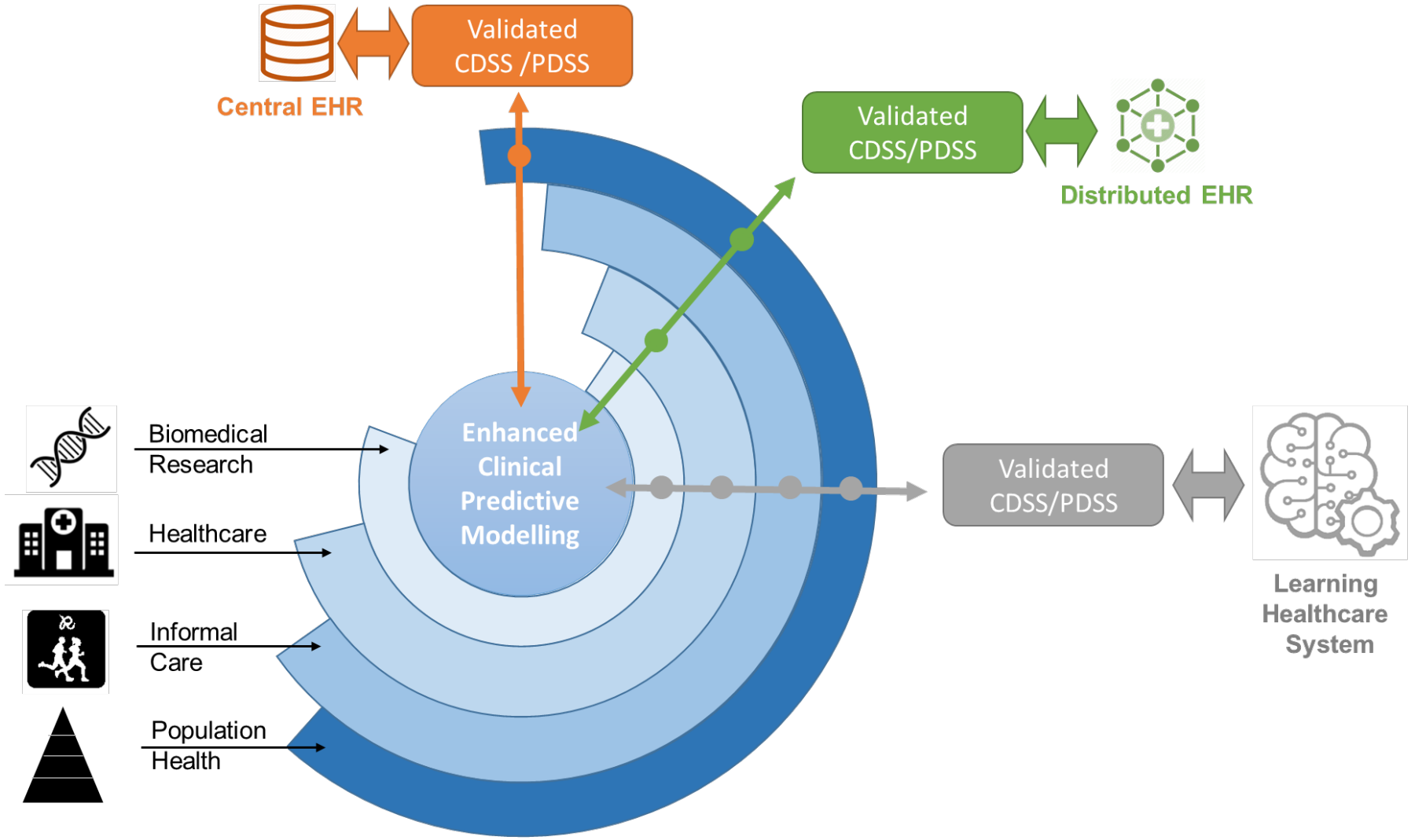
Ákos Tényi,[1,2] Emili Vela,[3] Isaac Cano,[1,2] Montserrat Cleries,[3] David Monterde,[4] David Gomez-Cabrero,[5,6,7] Josep Roca[1,2]

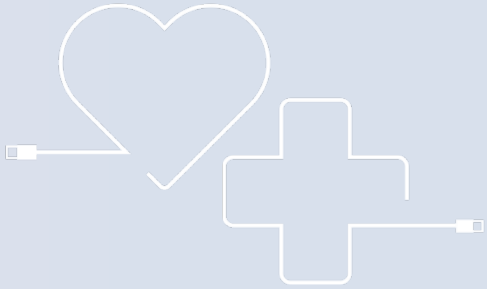
May 2018

Lessons learnt

- COPD related hospitalizations represents only 25% of all hospitalizations.
- Comorbidities in COPD increase risk of healthcare related events.
- GMA is a good predictor of future clinical events.
- Multilevel predictive modeling, combining registry and clinical data, shows high potential for risk assessment and service selection

Health risk prediction and service selection





A2 – Self-management and promotion of healthy lifestyles

TRImodal preHAB

- Personalized training program
- Nutritional intervention
- Emotional support

ACCIÓ Generalitat de Catalunya
biocat
Unió Europea
Fons europeu de desenvolupament regional

Promotion of physical activity in chronic cases

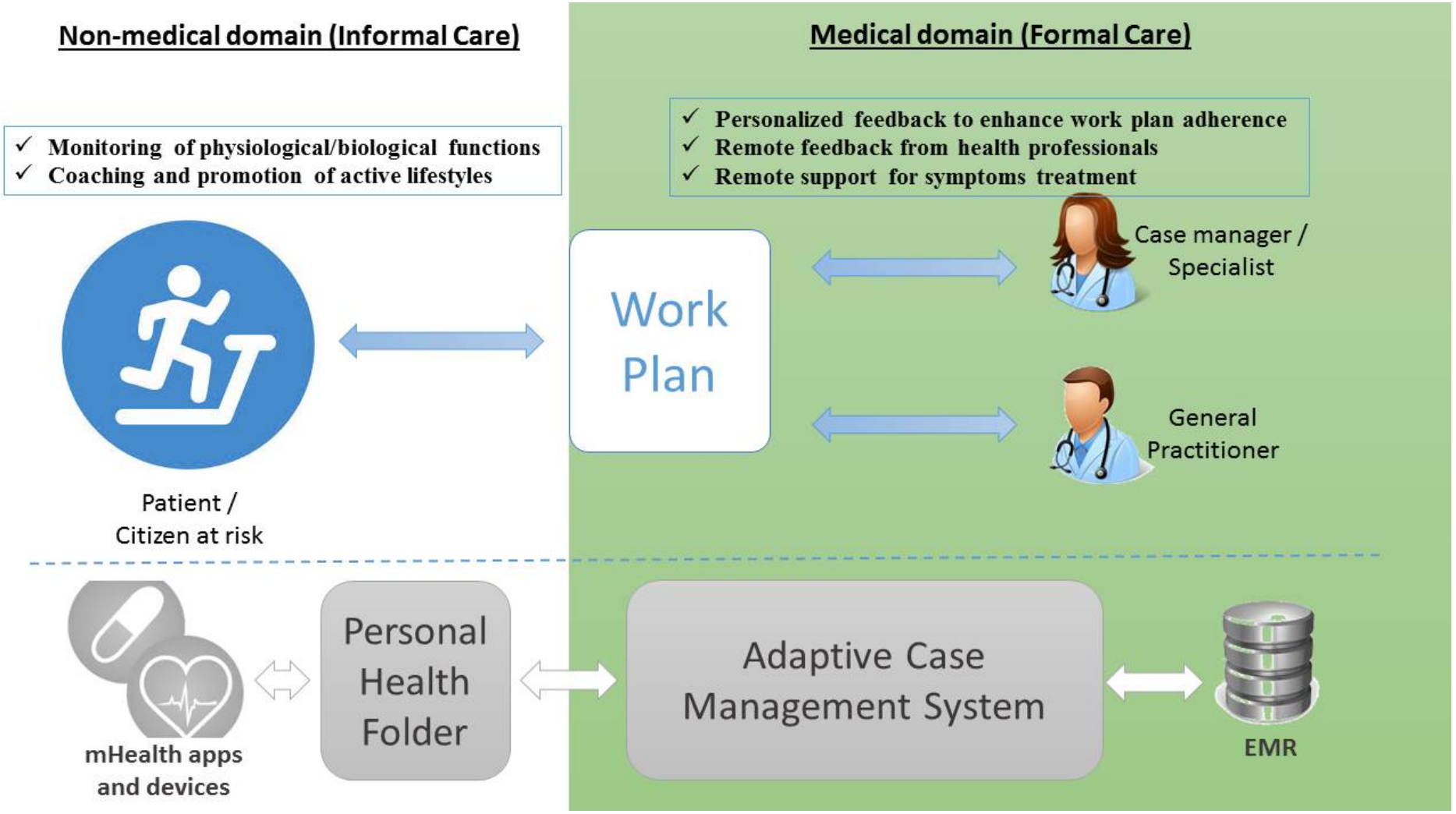
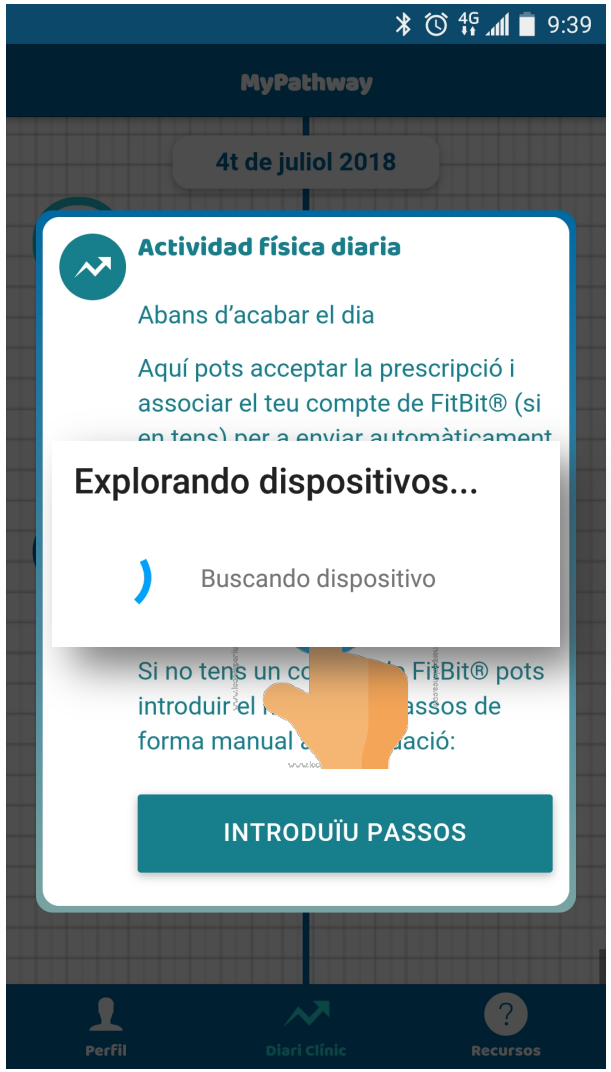
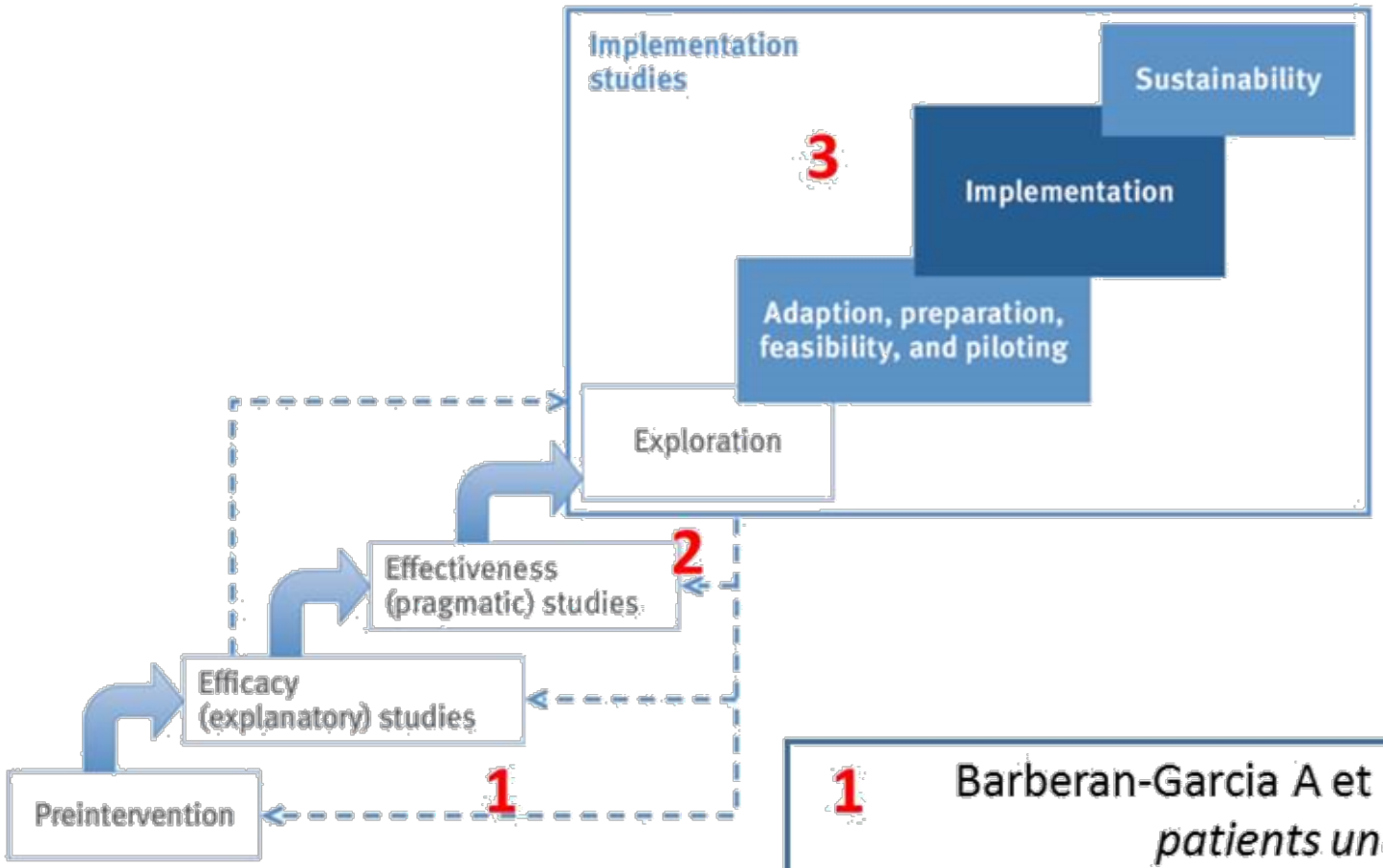


Diagrama Funcional – MYPATHWAY APP & LIFEVIT



Prehabilitation



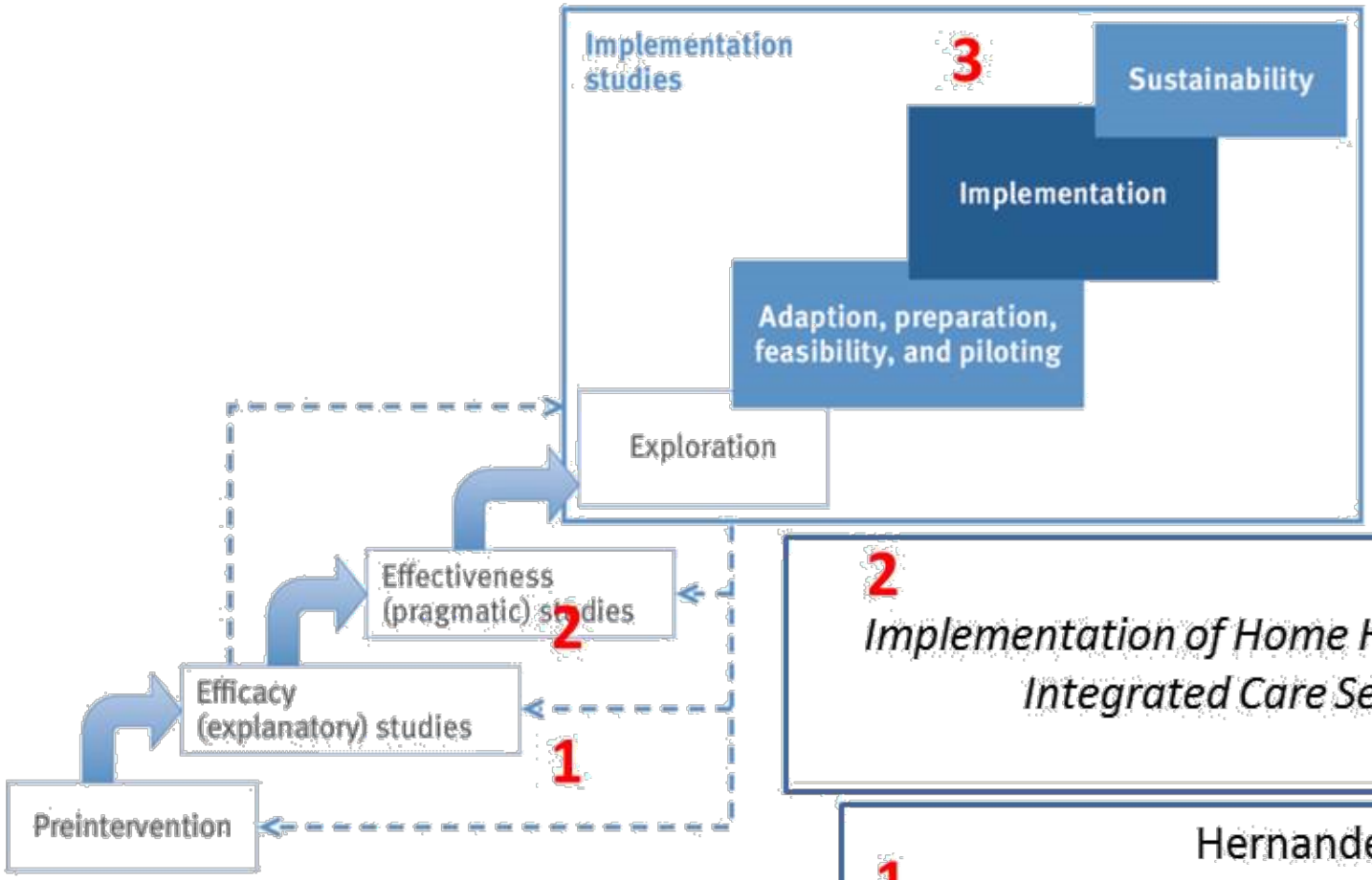
3 *Barberan-Garcia A et al. Protocol for regional implementation of collaborative self-management services to promote physical activity BMC Health Services Research* 2018

1 Barberan-Garcia A et al. *Personalized Prehabilitation in High-risk patients undergoing elective major abdominal surgery* Ann Surg. 2017 May 9. doi: 10.1097

NEXTCARE

A3 – Management of Complex Chronic Patients and prevention of exacerbations

Home hospitalization & Transitional care



Isaac Cano et al.
Protocol for Regional Implementation of Community-based Collaborative Management of Complex Chronic Patients *NPJ Prim Care Respir Med. 2017;27(1):44*

3

2

Hernandez C et al.
Implementation of Home Hospitalization and Early Discharge as an Integrated Care Service: a ten years pragmatic assessment IJIC (submitted 2017)

1

Hernandez C et al. *Eur Respir J. 2003;21(1):58-67.*
Casas A et al. *Eur Respir J. 2006;28(1):123-30.*
Hernandez C et al. *NPJ Prim Care Respir Med 2015; 25: 15022*
Hernandez C et al. *Int J Integr Care 2015:15: e006.*

NEXTCARE

A4 – Transfer of diagnostic tools to Primary Care: Forced Spirometry as use case

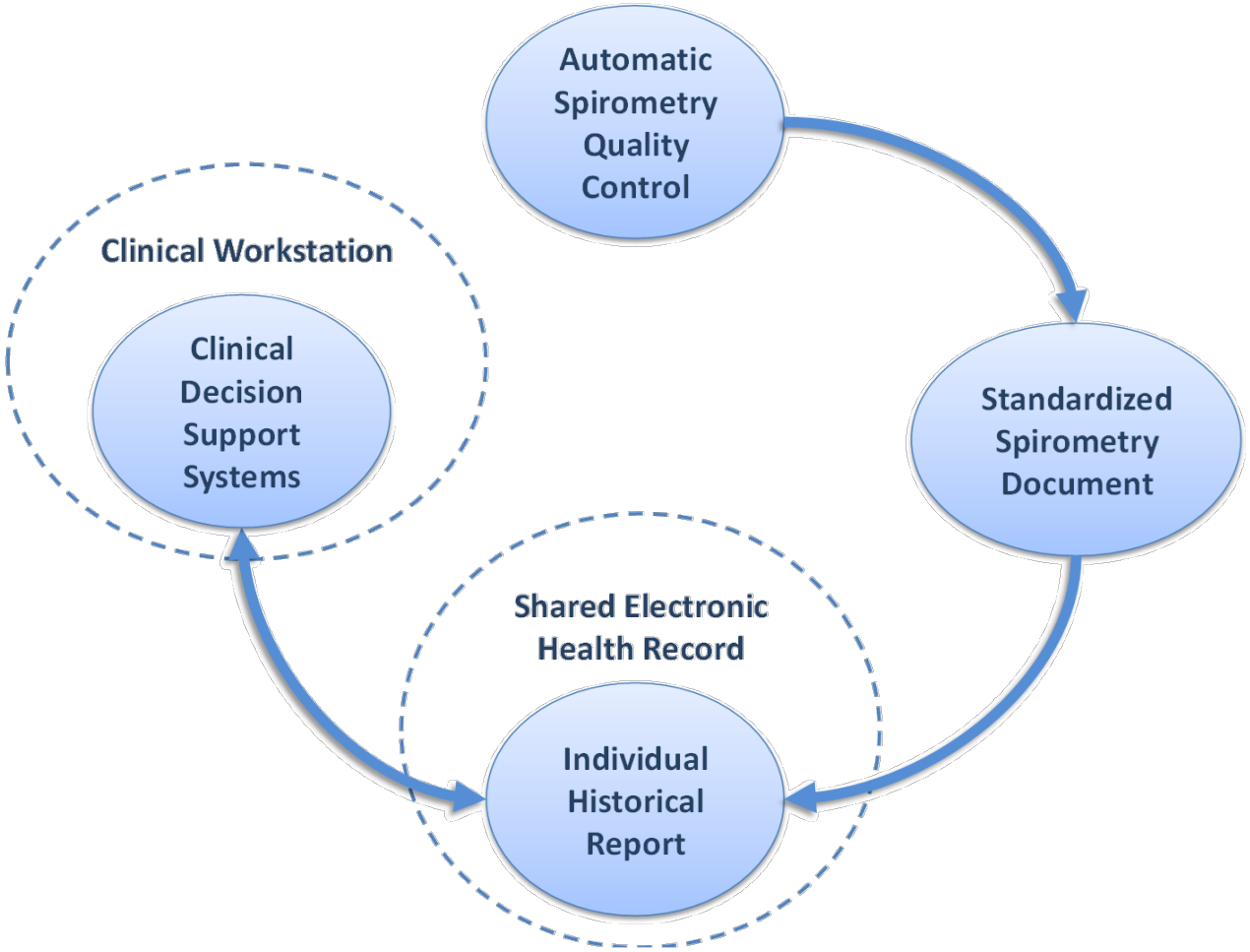
A4 –TRANSFER OF DIAGNOSTIC TOOLS TO PRIMARY CARE

The Forced Spirometry Program

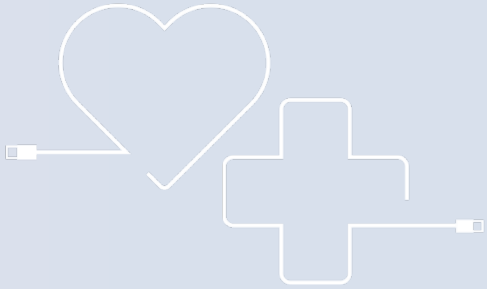
Aim: access to forced spirometry testing (raw data, clinical results, quality control and historical data) from any clinical work-station of any healthcare provider.

After the first year, transferability of the model to other healthcare environments and other diagnostic techniques will be analyzed.

The new system will allow the future implementation of "data analytics" with impact on case management.

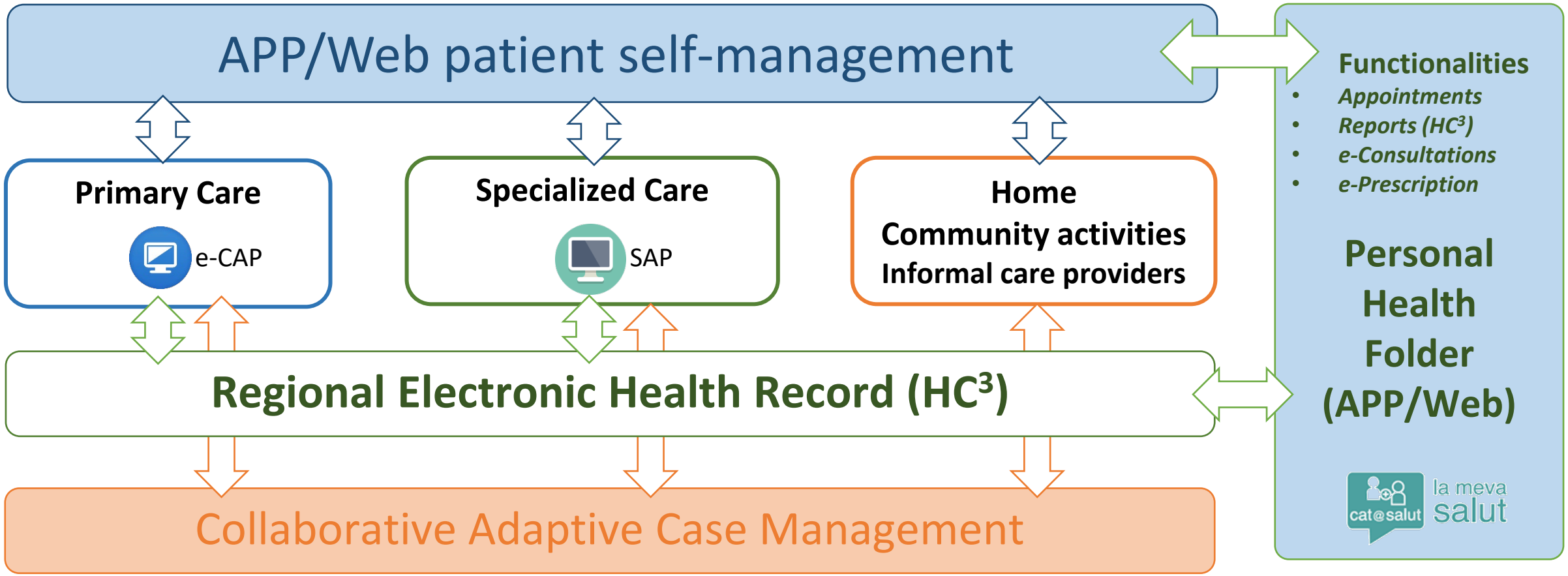


Vargas C et al. *NPJ Prim care Respir Med* 2016;26:16024.



A5 – Digital Health Framework for Interoperability at Catalan level

A5 –INTEROPERABILITY – DIGITAL HEALTH FRAMEWORK



2018-2019 goals

A1
a) Complete predictive modelling for home hospitalization
b) Launch multimorbidity program
c) Roadmap toward multilevel clinical predictive modelling

A2
a) Evaluation and regional deployment of the pre-habilitation service
b) Roadmap for the peri-surgical care program
c) Roadmap for enhanced rehabilitation for chronic patients

A3
a) Innovative assessment of integrated care services for complex chronic patients
b) Expand ICT-supported collaborative work
c) ICT-supported services for community-based services (home-NIV; interplay specialized vs community-based care)

A4
a) Complete regional deployment of the forced spirometry program & transferability

A5
a) Deployment of apps-supported services through La Meva Salut
b) Development of Adaptive Care Management functionalities in Action 2 (Camunda®)
c) Deployment of the Open Innovation Hub for ICT-supported health services

- Four challenges:
    - Technology: cloud-based architecture & services
    - Enhanced clinical predictive modelling
    - Evaluation & adoption of Decision Support Systems (DSS)
    - Regulatory & privacy issues. Financial sustainability

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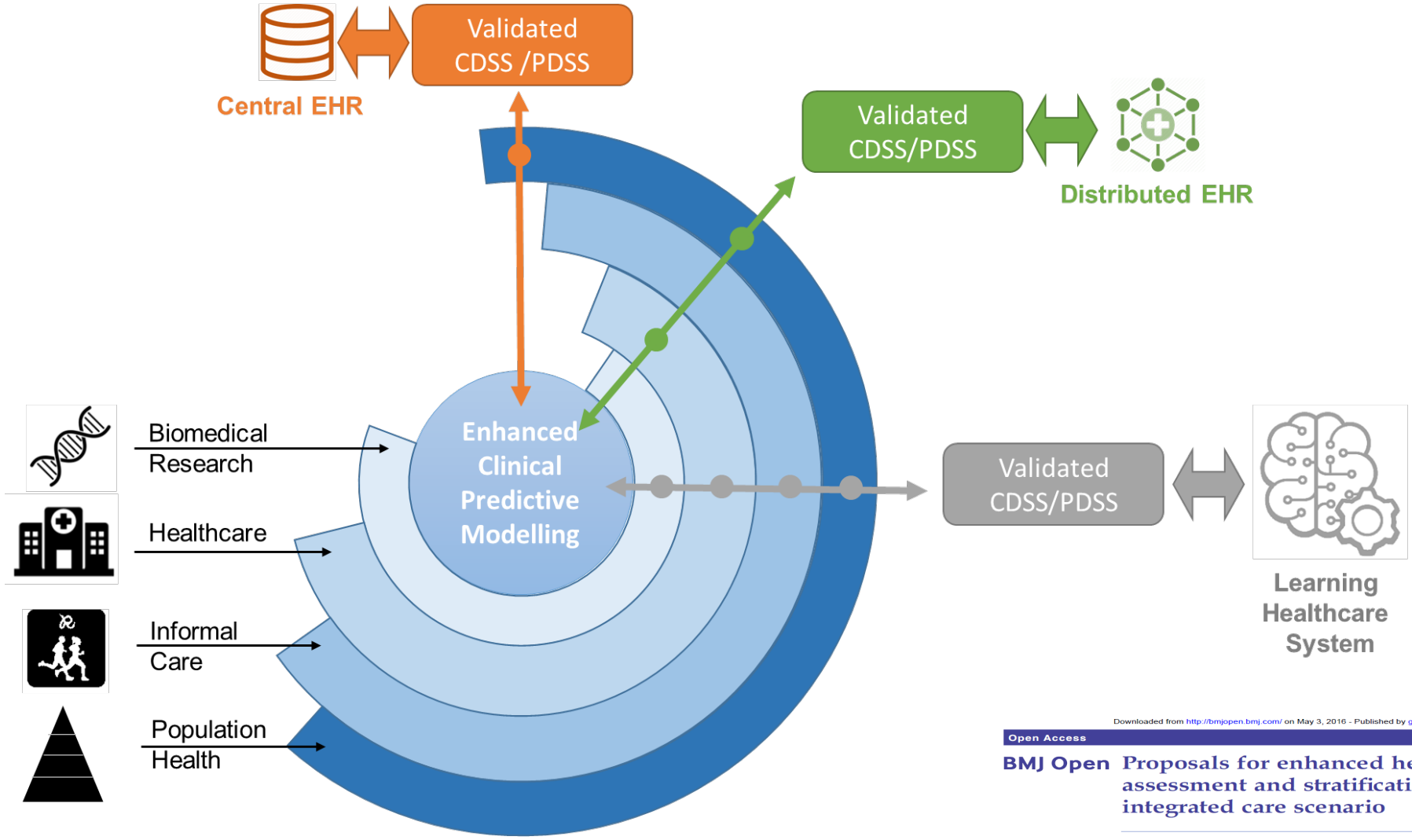
Health risk prediction and service selection



Open Access Research

BMJ Open

Proposals for enhanced health risk assessment and stratification in an integrated care scenario

Ivan Dueñas-Espín,[1,2] Emili Vela,[3] Steffen Pauws,[4] Cristina Bescos,[5] Isaac Cano,[1] Montserrat Cleries,[3] Joan Carles Contel,[6] Esteban de Manuel Keenoy,[7] Judith Garcia-Aymerich,[2] David Gomez-Cabrero,[8] Rachelle Kaye,[9] Maarten M H Lahr,[10] Magí Lluch-Ariet,[11,12] Montserrat Moharra,[13] David Monterde,[14] Joana Mora,[7] Marco Nalin,[15] Andrea Pavlickova,[16] Jordi Piera,[17] Sara Ponce,[7] Sebastià Santaeugenia,[17] Helen Schonenberg,[5] Stefan Störk,[18] Jesper Tegner,[8] Filip Velickovski,[11,19] Christoph Westerteicher,[5] Josep Roca[1]

Cloud-based computing & Data analytics

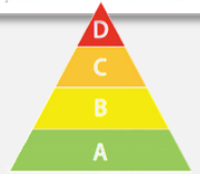
Data producer

Healthcare Sector

Clinical data

Patient's self-tracked data

Population Health data



Research data

Health Information Systems

Clinical Workflows

Data Harmonization

- **FAIR data principles**
  - ✓ Findable
  - ✓ Accessible
  - ✓ Interoperable
  - ✓ Re-usable
- **Data quality**
  - ✓ Validity
  - ✓ Accuracy
  - ✓ Consistency
  - ✓ Integrity
  - ✓ Timeliness
  - ✓ Completeness
- **Data governance**
  - ✓ Executive leadership
  - ✓ Data stewards
- **Knowledge management**

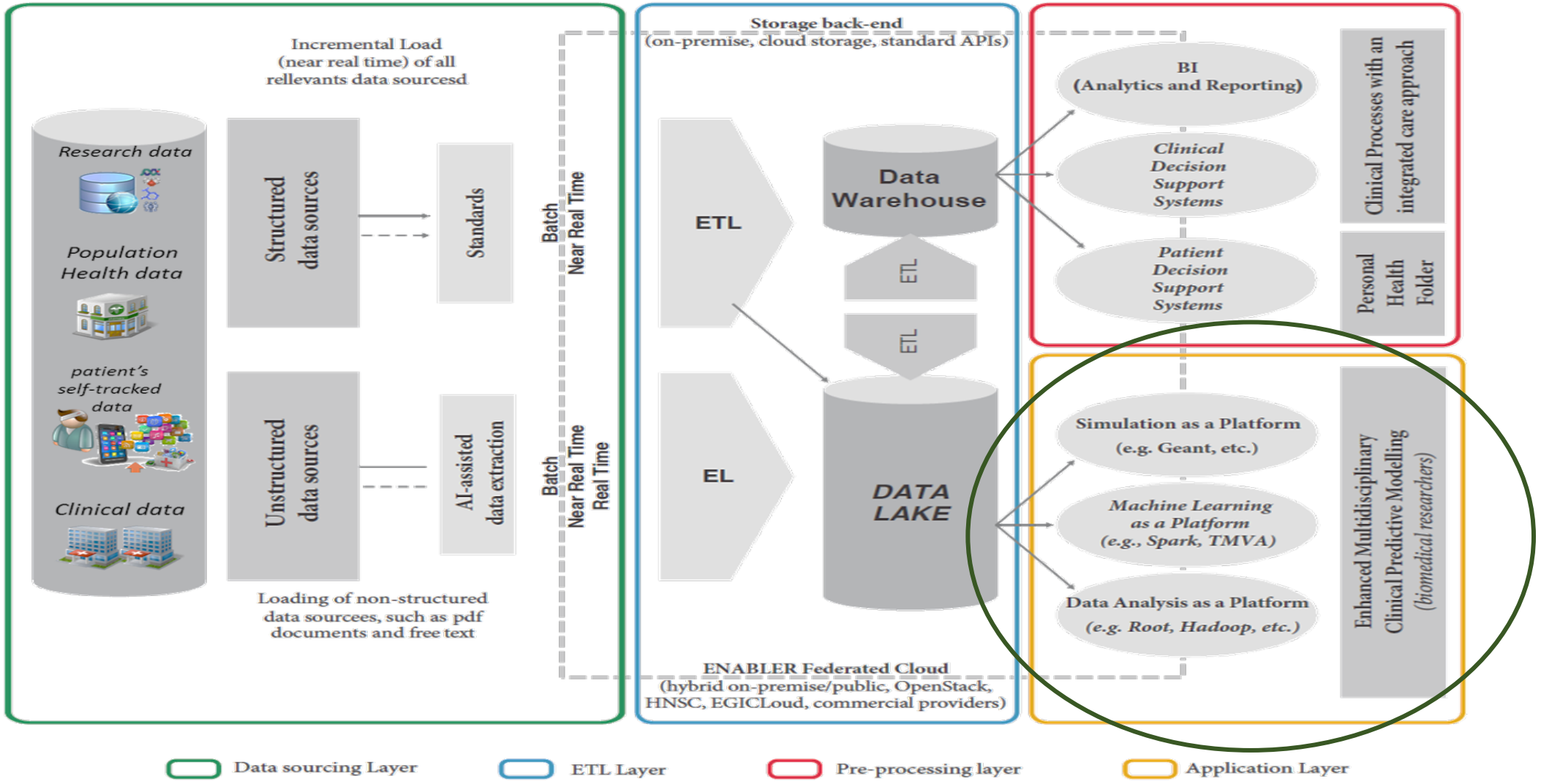
Data Processing

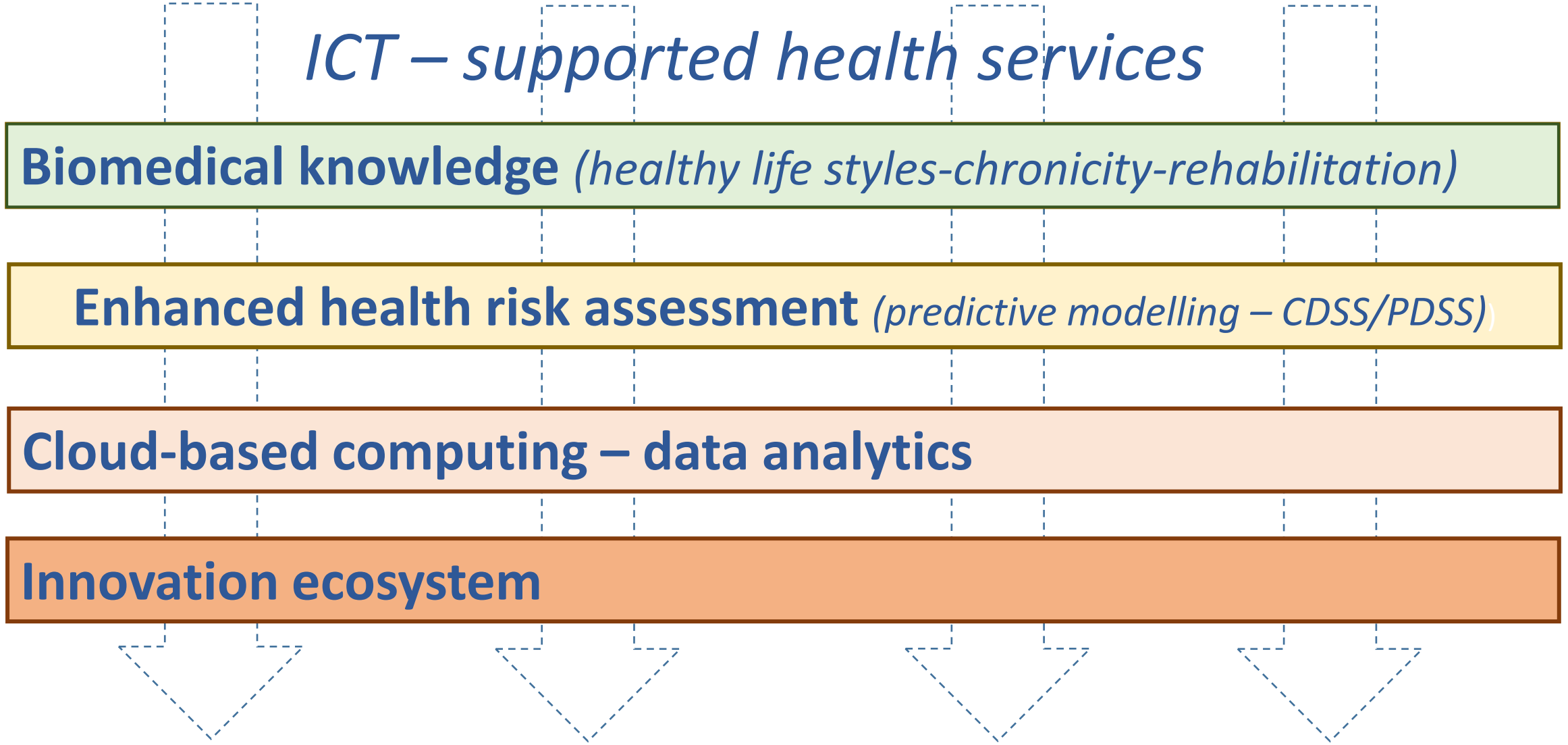
In-silico modelling

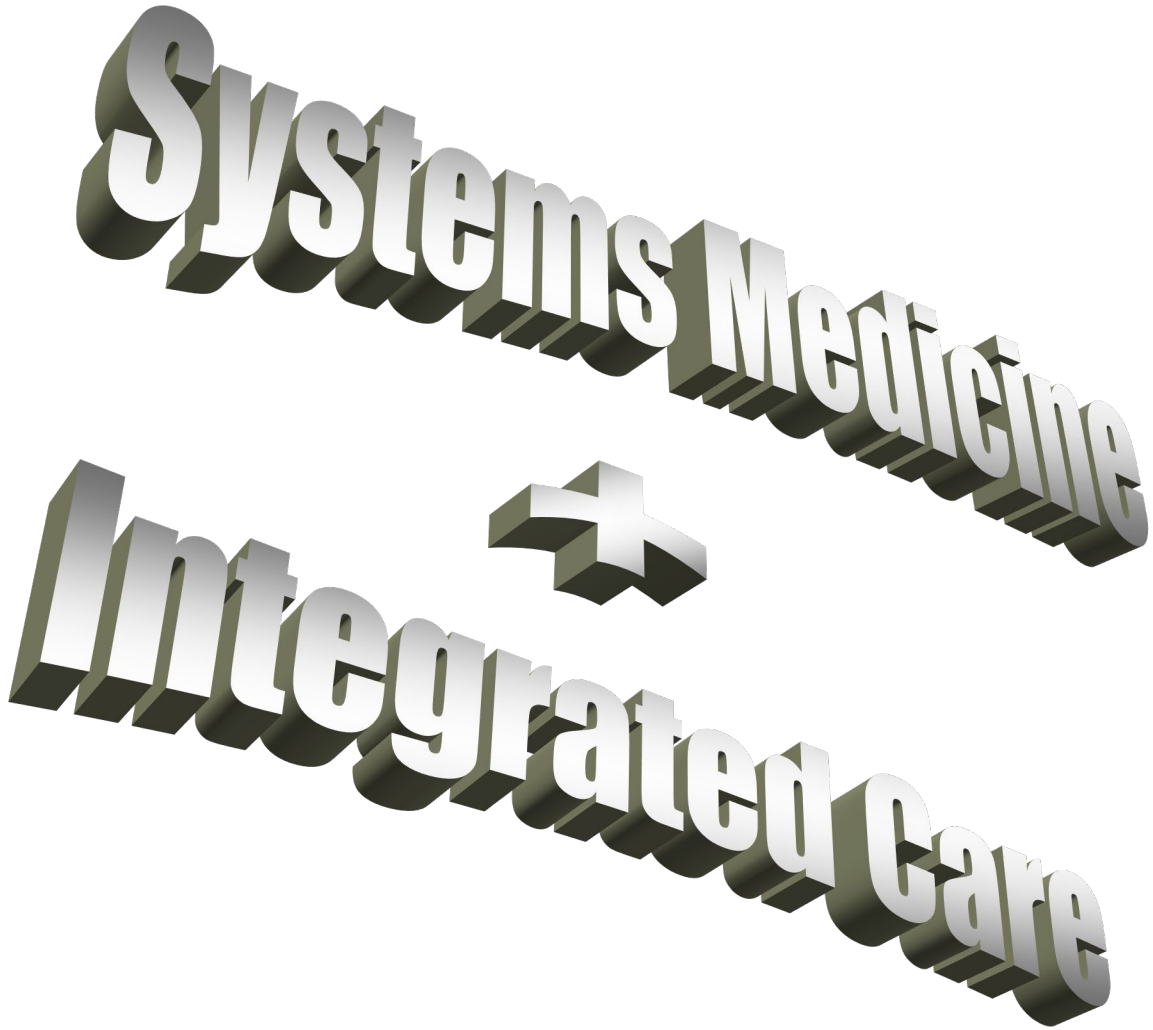
Step 1	Step 2
Models (1..n)	**Enhanced**
Models (1..n)	**Clinical**
Models (1..n)	**Predictive**
Models (1..n)	**Modelling**

Decision Support Systems

Decision support systems




ICT – supported health services
Biomedical knowledge (healthy life styles-chronicity-rehabilitation)
Enhanced health risk assessment (predictive modelling – CDSS/PDSS)
Cloud-based computing – data analytics
Innovation ecosystem


Systems Medicine
+
Integrated Care

Catalan open innovation hub on ICT-supported integrated care services for chronic patients

LESSONS LEARNT

- ✓ Promote ICT-supported value-generating services with a preventive focus
- ✓ Develop & apply innovative evaluation methods in real world settings
- ✓ Develop multilevel subject-specific risk predictive modelling feeding CDSS/PDSS
- ✓ Develop & implement cloud-based computing environments
- ✓ Refine application of the regulatory frame for evaluation in real-world settings.

Catalan open innovation hub on ICT-supported integrated care services for chronic patients

THANKS

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