Imagine 2029: Our data, our health, our care – 20th anniversary of EHTEL

EHTEL 2019 Symposium

Kindly hosted by TIC Salut Social
Technology, innovation and digital transformation.

10:45 – 12:00 [S2]

Aula 1
First Floor

EU, National and Regional Policies on "Our data, our health, our care"

Governance, policies and stakeholder perspectives on European, national and regional levels.

Session Chair: Peter Cuipers, IBM, Zürich, Switzerland

Catalan Government eHealth Strategy and Masterplan
Pol Perez Sust, Director of Information System, Department of Health, Barcelona, Spain

European Health Data Space – Next Steps for the New EU Commission
Ioana-Maria Gligor, DG Santé, European Commission, Brussels, Belgium

Industry View on AI, Big Data and Digital Therapeutics in Europe
John Crawford, Digital Health Consultant, CrawfordWorks, London, United Kingdom

Q&A and Conclusions by the Session Chair

Collaborating for Digital Health and Care in Europe

#EHTEL_Symposium #EHTEL_BCN @ehtel_eHealth

/Salut

Catalan Government eHealth Strategy and Masterplan

S/Sistema de Salut de Catalunya

3 December 2019
EHTEL 2019 Symposium, Barcelona

Pol Perez Sust
Health IT General Coordinator
polperezsust@gencat.cat

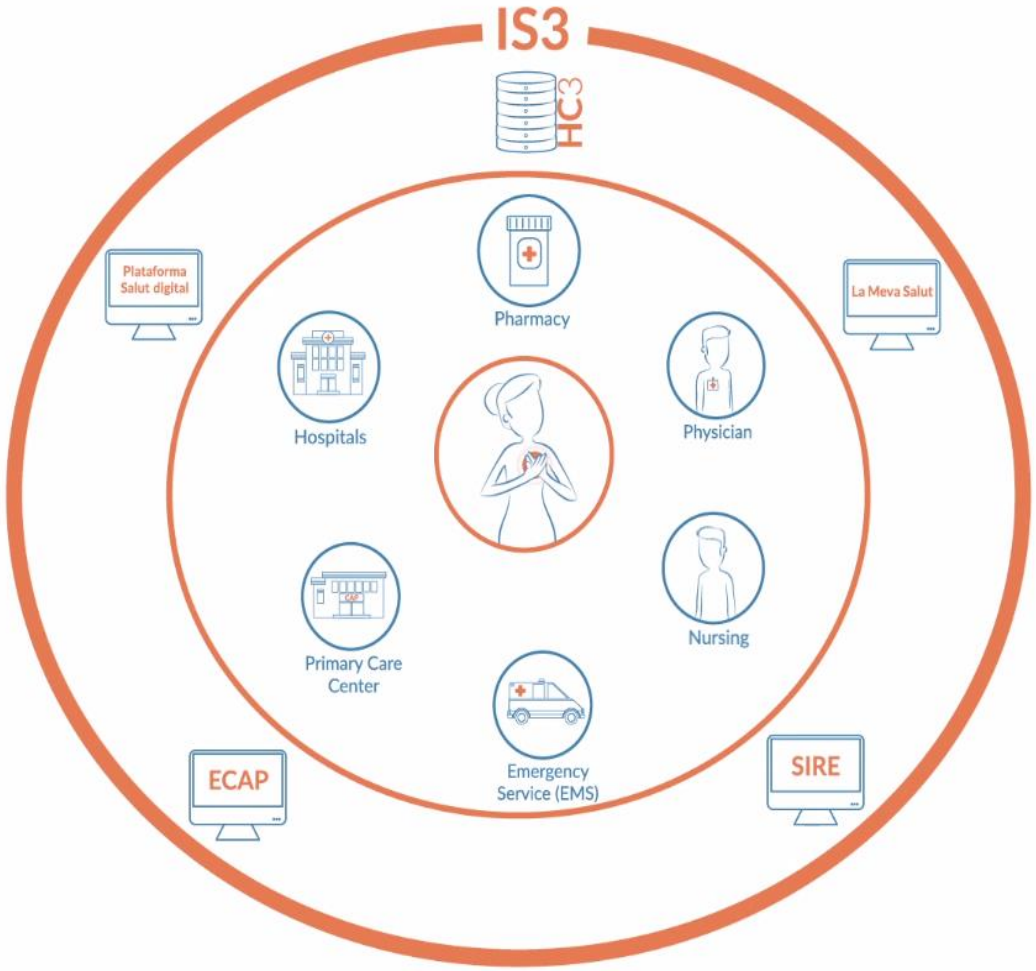
Outline

- Overview of e-health in Catalonia
- Why a new e-health strategy now?
- The Masterplan
- Key messages and questions

eHealth in Catalonia

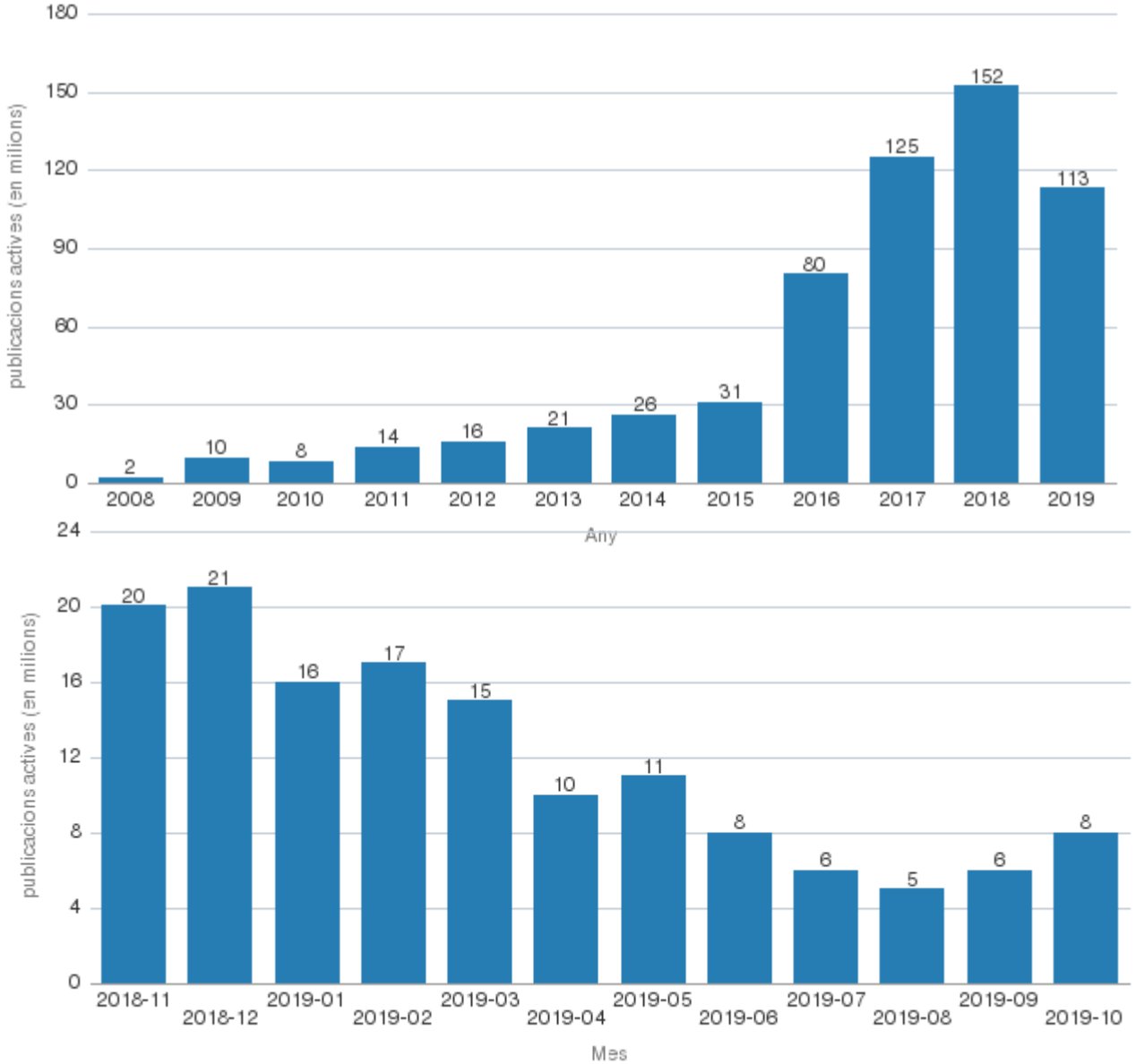
- ✓ Share EHR: HC3
- ✓ Personal Health Record: La Meva Salut
- ✓ Interoperability services: IS3

All three initiatives have been steps in the right direction towards data integration.



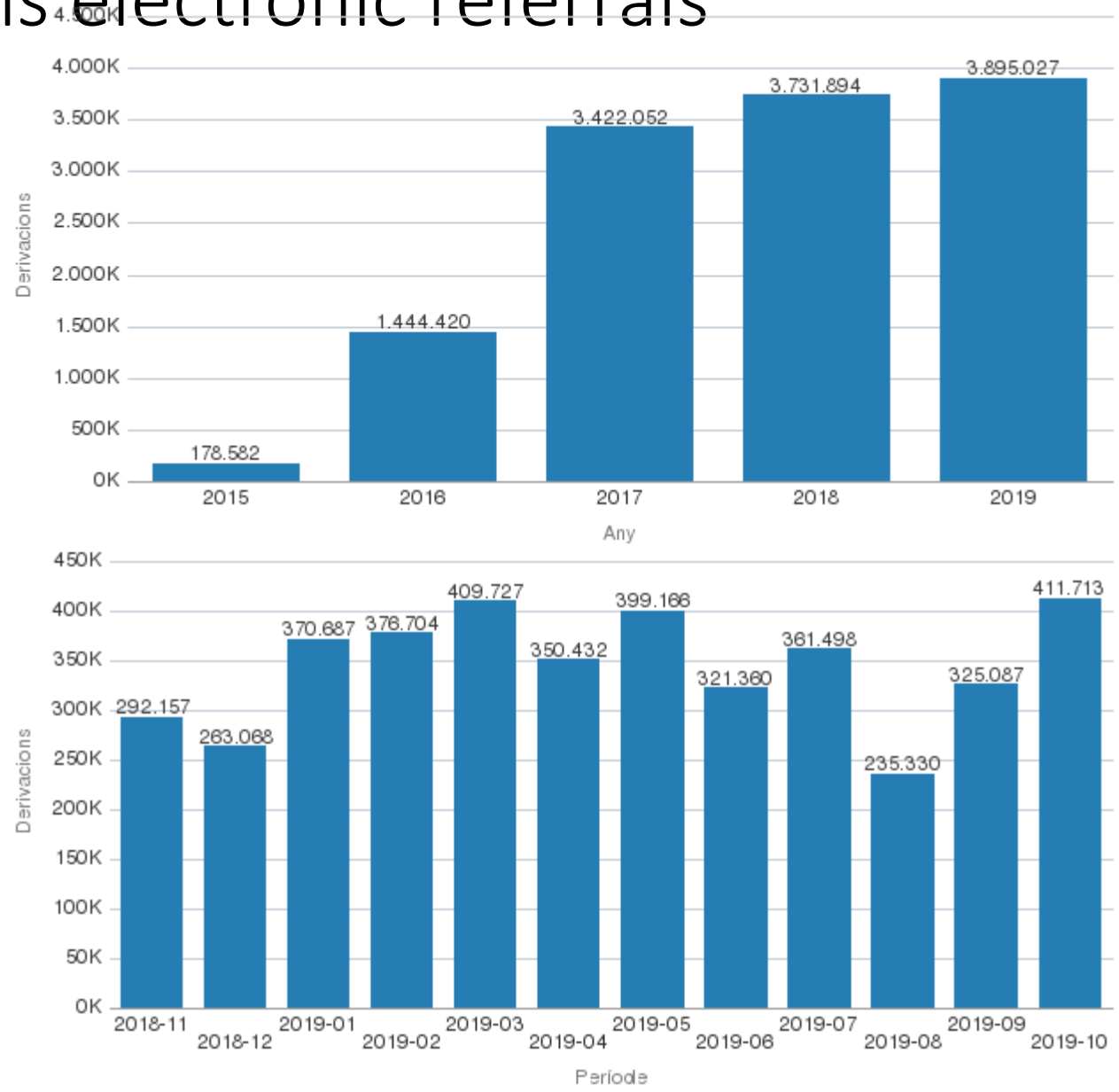
Free choice of health providers' HIS contributed to the success of first wave of digitization.

Publicacions actives a HC3 : 598 milions

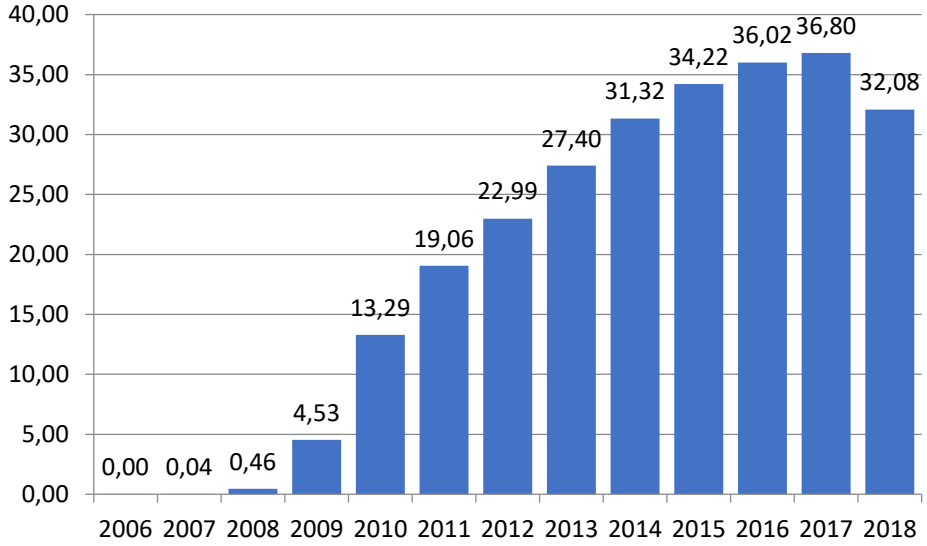


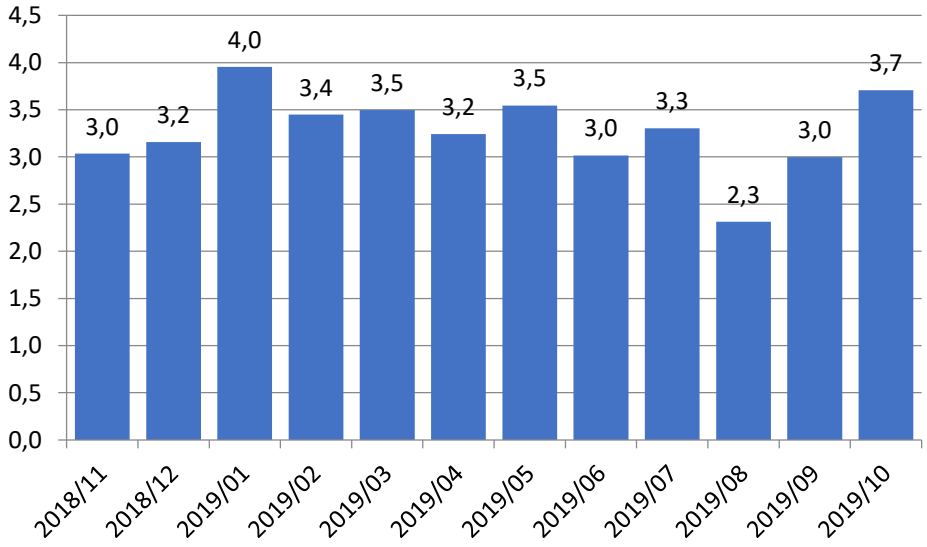
Interoperability services: IS3

: 12,6 milions electronic referrals

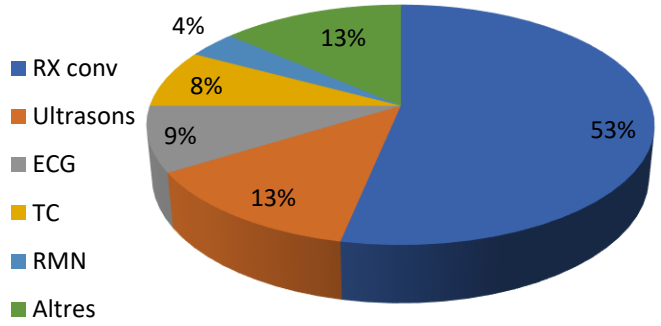


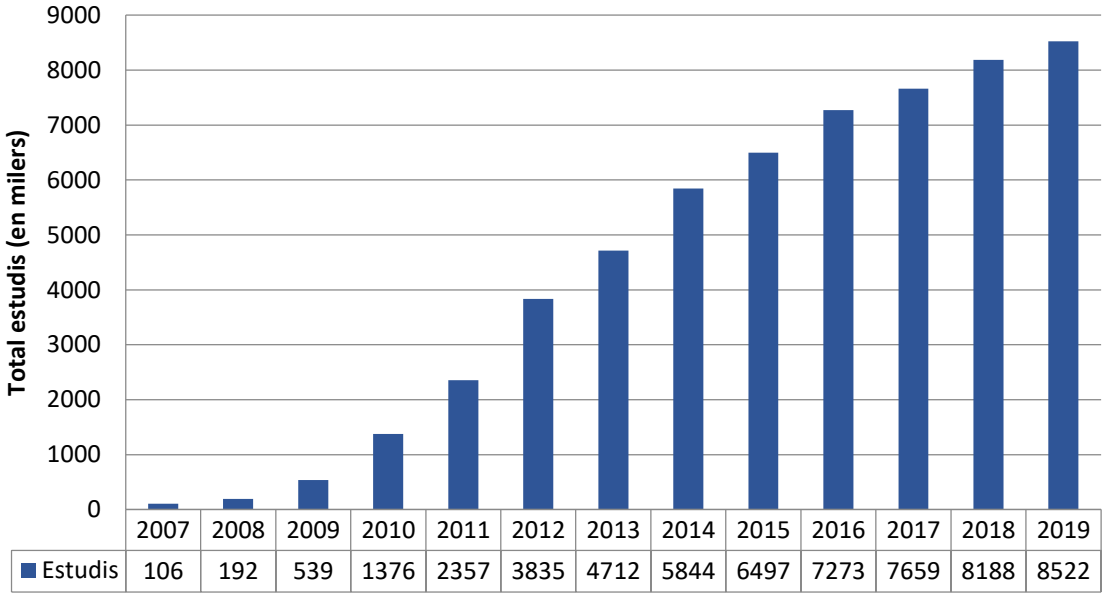
E prescription: 258 milions





SIMDCAT: 57 milions d'estudis





	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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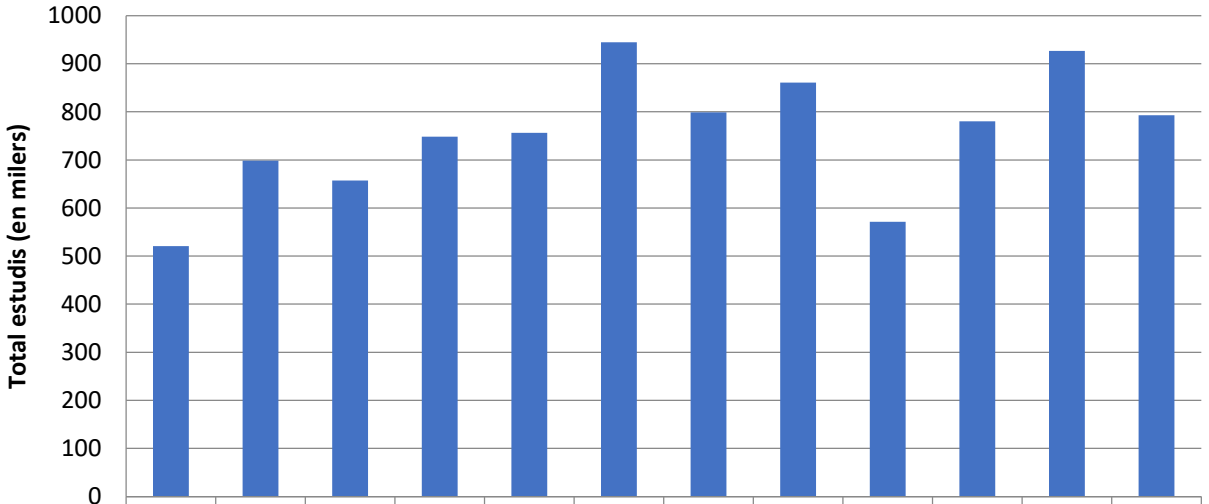

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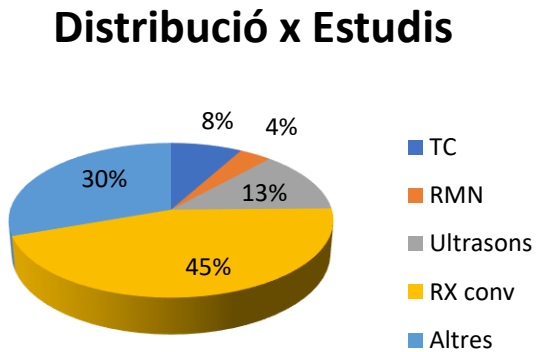


Why a New E-health strategy now?

Our health information system landscape is too fragmented, generating high maintenance costs, hampering innovation to scale-up and creating health inequities.

	Aplicació						
Producte	ECM	ECI	FAC	DF	GA	AP	QC
SAP	10	6	14	5	10	3	3
SAVAC	7	6	6	10	7		1
HCIS	4	3		1	5		
GACELA		5					
TESIS	2	2	2				
Gespath						5	
PATWIN						6	
SILICON				3			
MINERVA ANALISI							4
Business Objects							5
QLIKVIEW							7
OFIMATIC							3
NOVOPATH						3	
PATWIN						6	
SILICON				3			
DESENV PROPI	3	2	4	4	2		5
Altres 40 productes	8	10	8	8	10	11	6

Número d'implantacions

27 different HIS for 65 acute hospitals

Why a New E-health strategy now?

Future-proof health systems need to:

- Respond to demographic change and *promote healthy ageing*
- Move focus from treatment to prevention

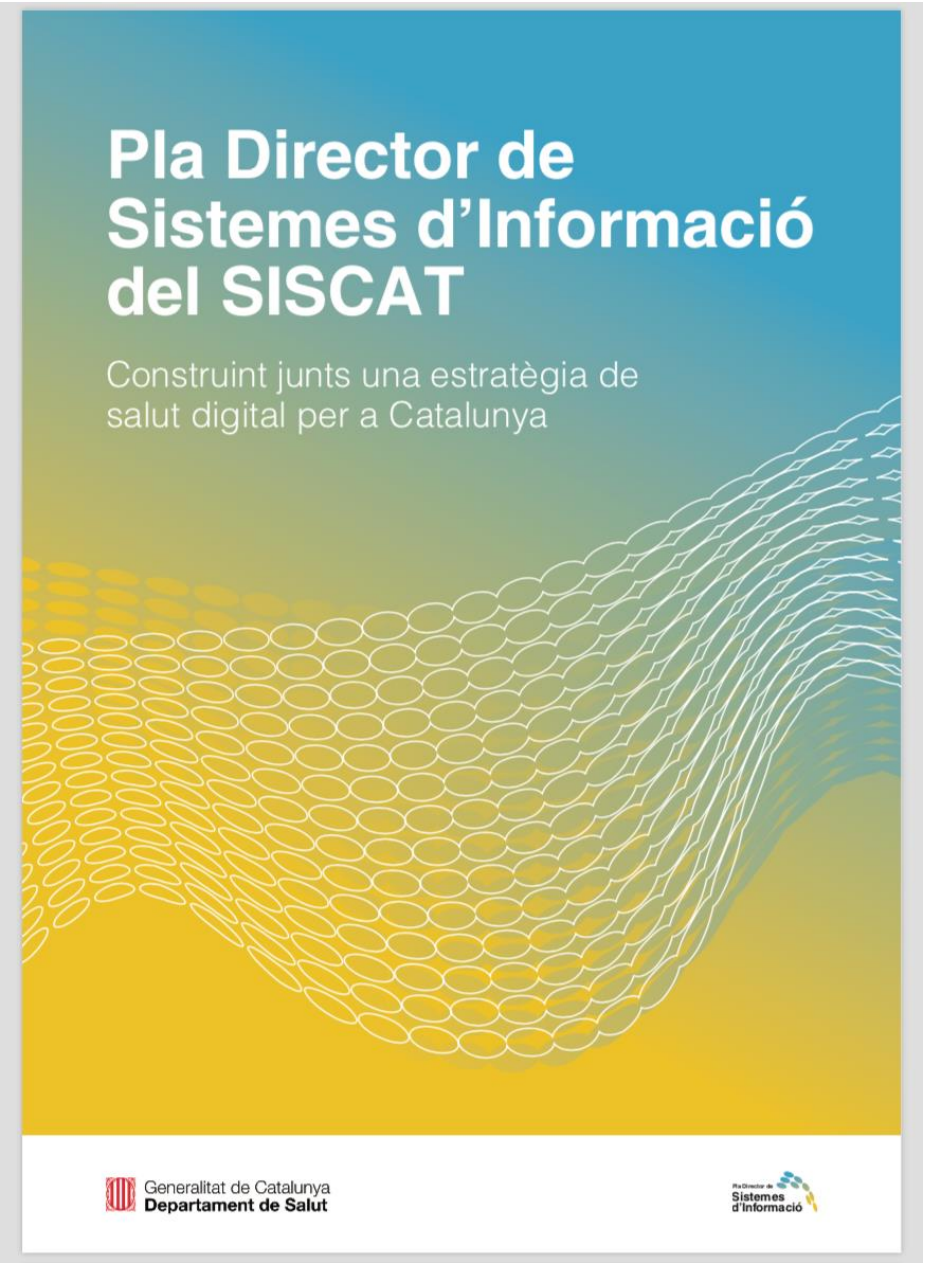
patients

- Maximize contribution of care: h*arness data and avoid information overload*
- Guide decision making and *employ artificial intelligence*

physicians

- Support managing and planning in a digital health system - *timely access to aggregated data*

managers



SISCAT Information Systems Masterplan

Building together a digital health strategy for Catalonia

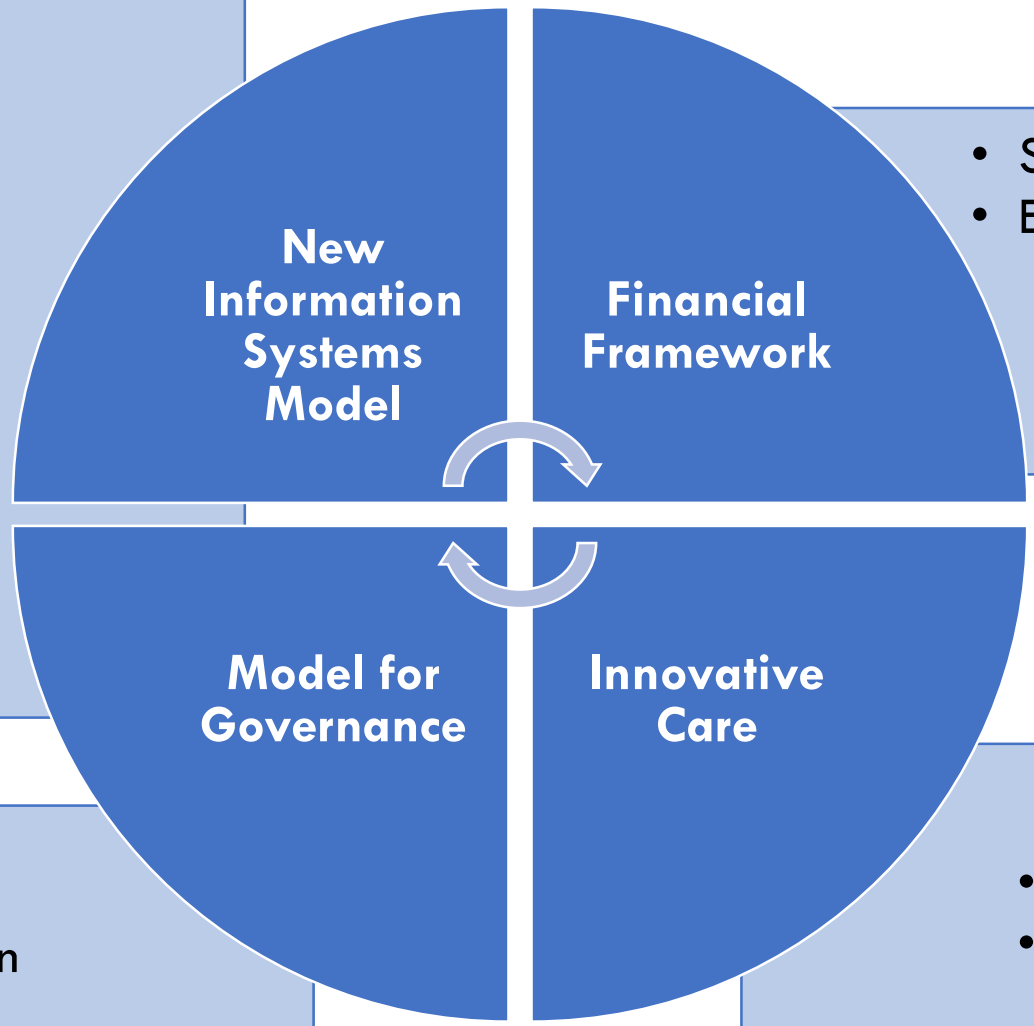
Generalitat de Catalunya
Departament de Salut

May 2018

/Salut

Health Information Systems Masterplan: Goals

- Make healthcare decisions throughout the chain of care
- Responsive
- Be sustainable and scalable
- Robust



- Sustainable
- Economies of scale

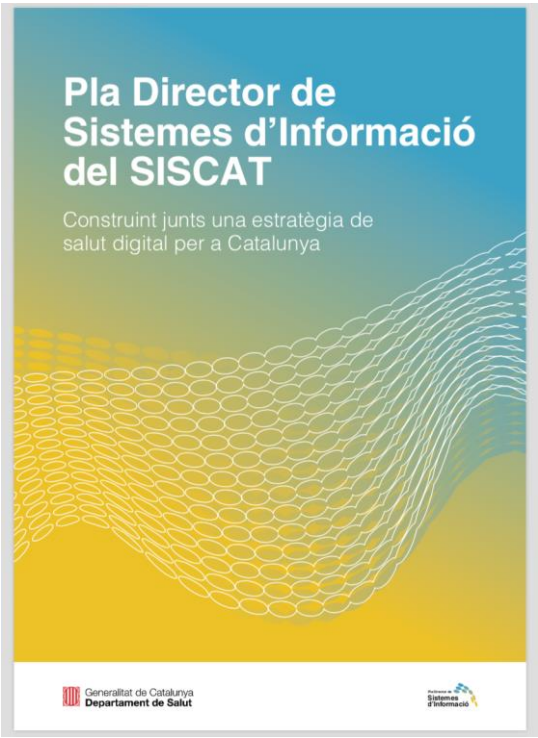
- Facilitate cooperation of different actors

- Citizen centric
- New opportunities to implement ICT

Masterplan 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.

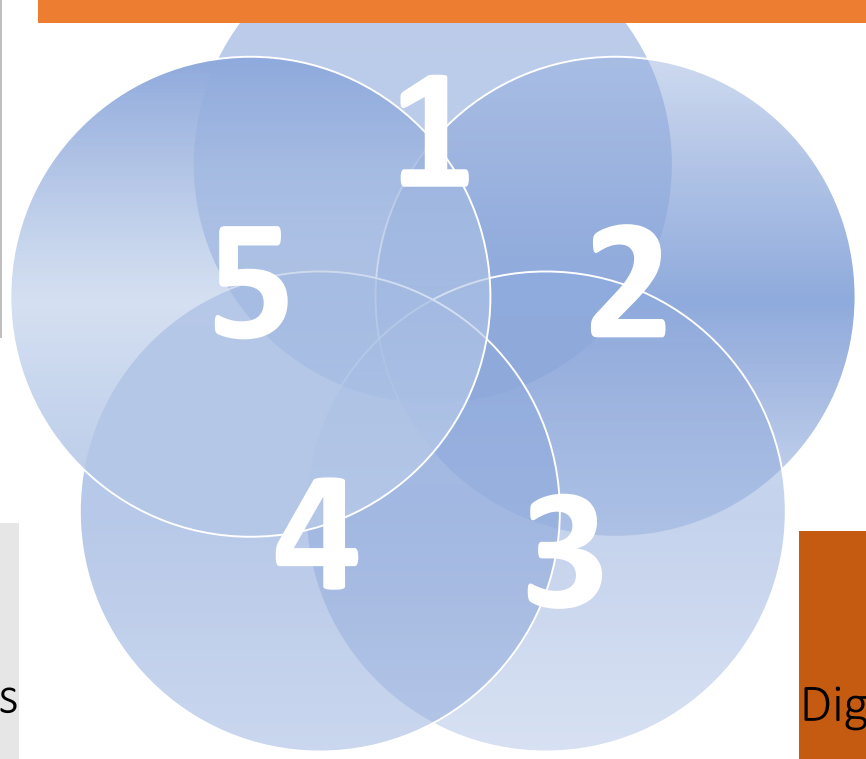


Health Information Systems Masterplan: *5* priorities

A Common Electronic Health Record

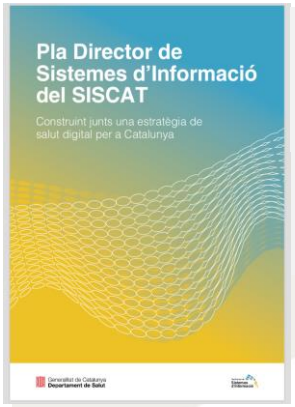
Workstation

New Healthcare Applications



Sectoral plans

Digital transformation



Information System Model

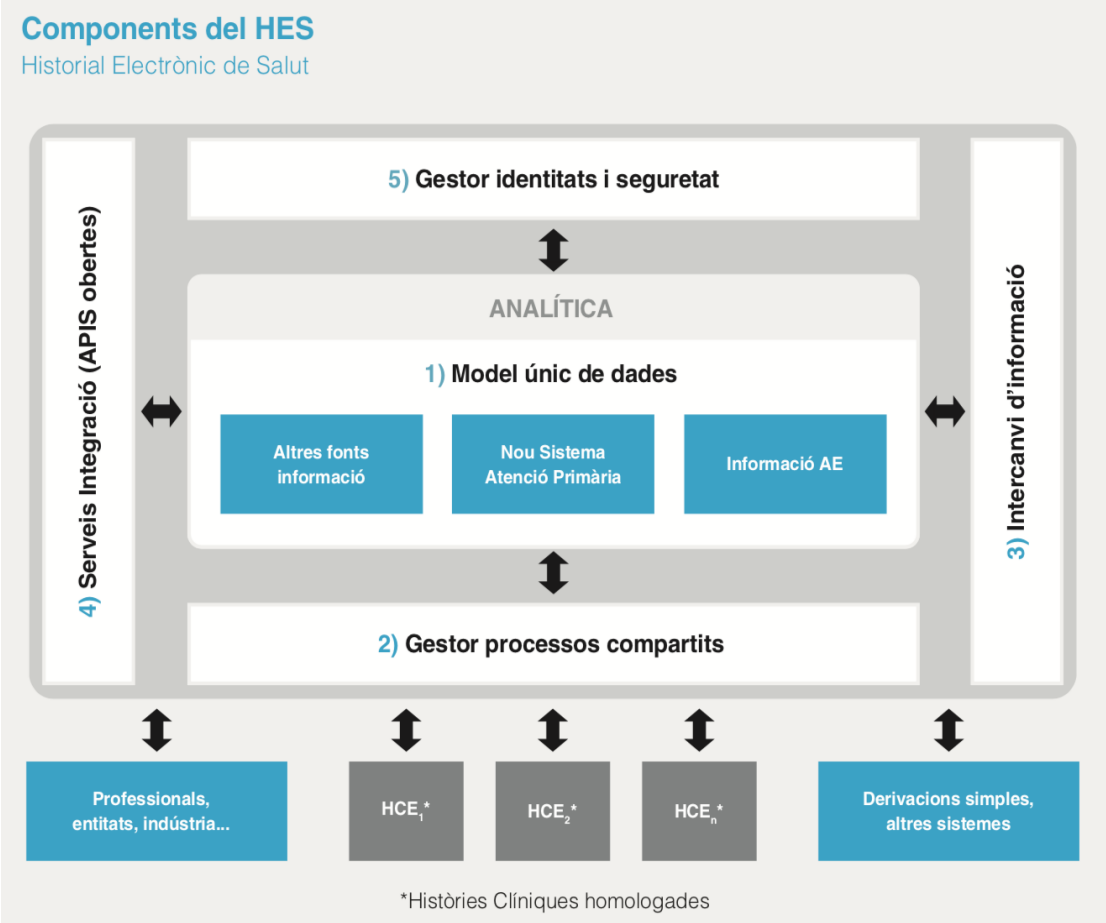
- **HES:** Electronic Health Record for all citizens
- **RCDS:** Information for operational decision-making
- **Workstations:** rationalization, certification and renovation (PHCIS-ECAP and HIS); digital transformation.
- **Governance:** structural, normative and participatory within the SISCAT network of providers

HES: Electronic Health Record

HES is the functional and technical repository of all relevant personal information which requires to be recorded and shared along the healthcare system.

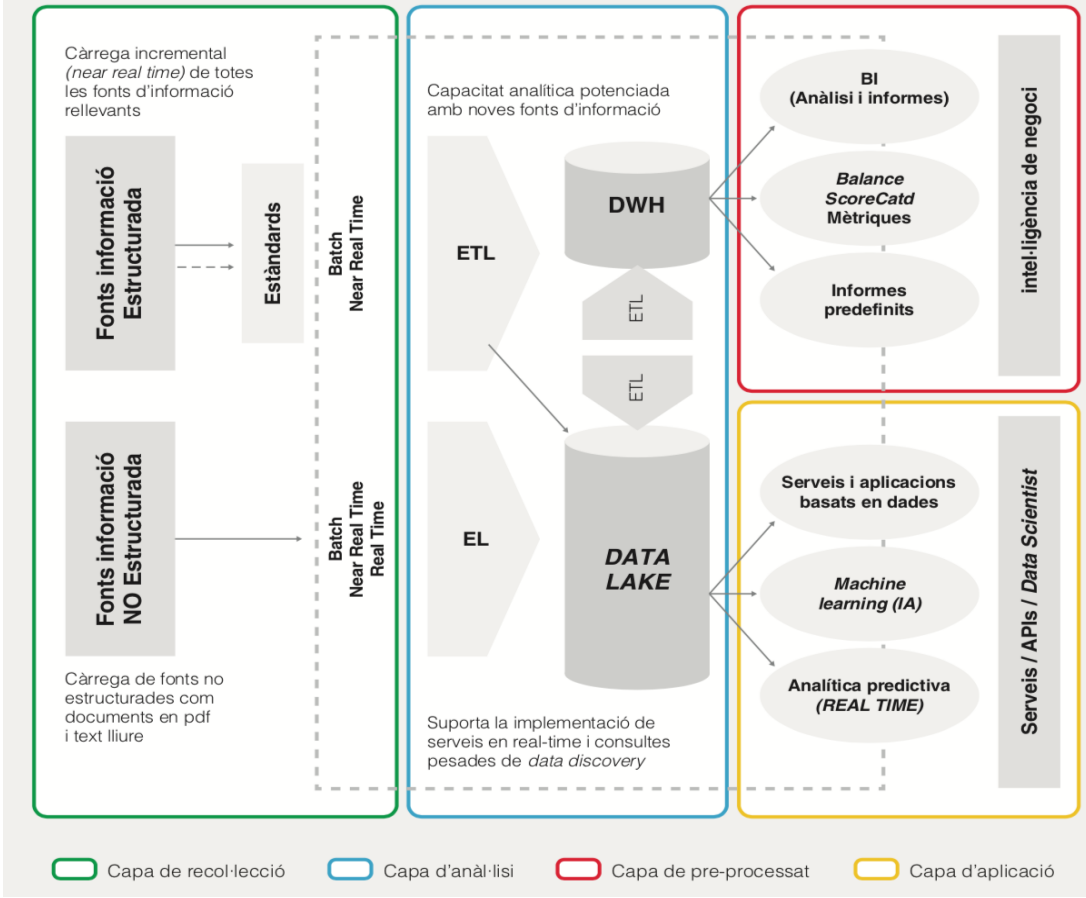
It is a conceptual and technological evolution of clinical records, currently stored in the various healthcare providers' information systems and without interconnection.

This repository will be built around the PHCIS-ECAP and will progressively replace the current information systems based on interoperability (HC3 and IS3).



RCDS: Central Repository of Healthcare Data

RCDS updates in real-time the information recorded in HES



- Unified support of structured and non-structured data
- Flexible schemes designed to adapt to frequent changes
- Unlimited data volumes management
- Support to all types of data load: interactive, batch, real-time and analytical
- Extensibility of functionalities
- Horizontal scalability of resources at limited cost
- Ground for applying AI algorithms
- Open-data policy for SISCAT members

Key messages

Fragmentation of health information systems is a chief obstacle for the digital transformation of health and care.

Developing a shared data and information systems architecture steered by the Department of Health is our digital strategy

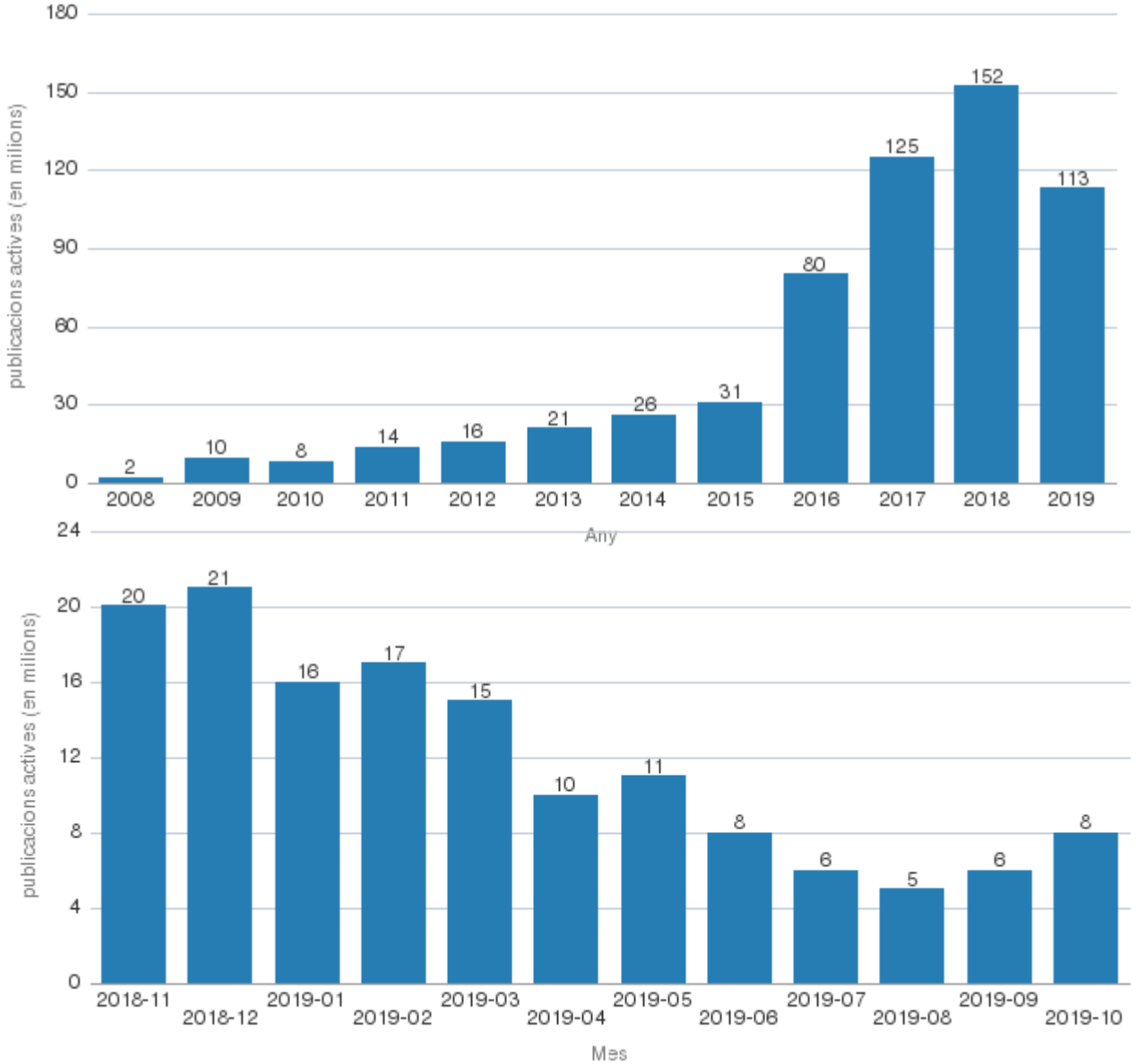
Three initiatives are key in this process:

1. A common electronic health record (EHR)
2. An integrated analytical repository (data and technological model) (RCDS)
3. Transformation and convergence of electronic medical records (EMR) (Primary Health Care and Hospitals)

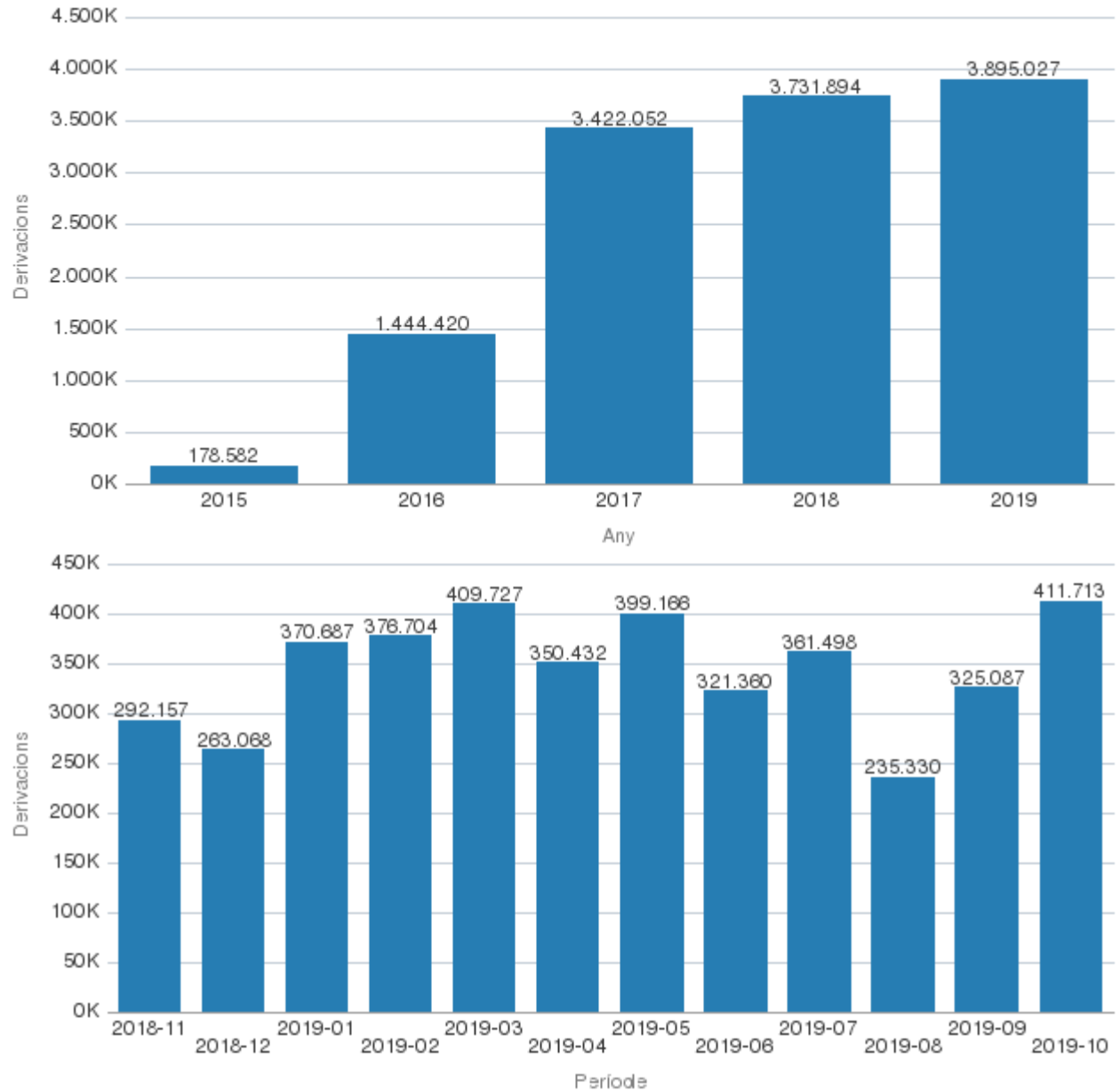
S/Sistema de
Salut de Catalunya

Thank you

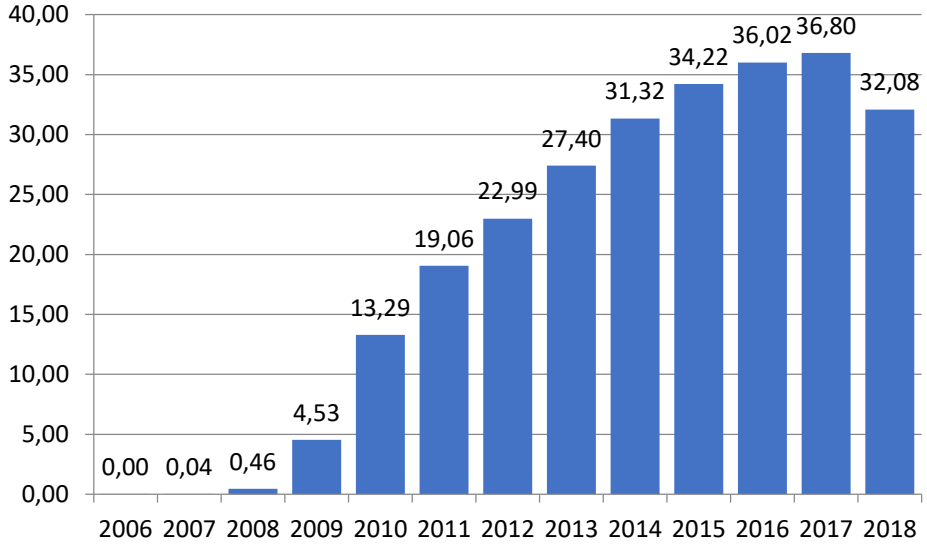
Publicacions actives a HC3 : 598 milions

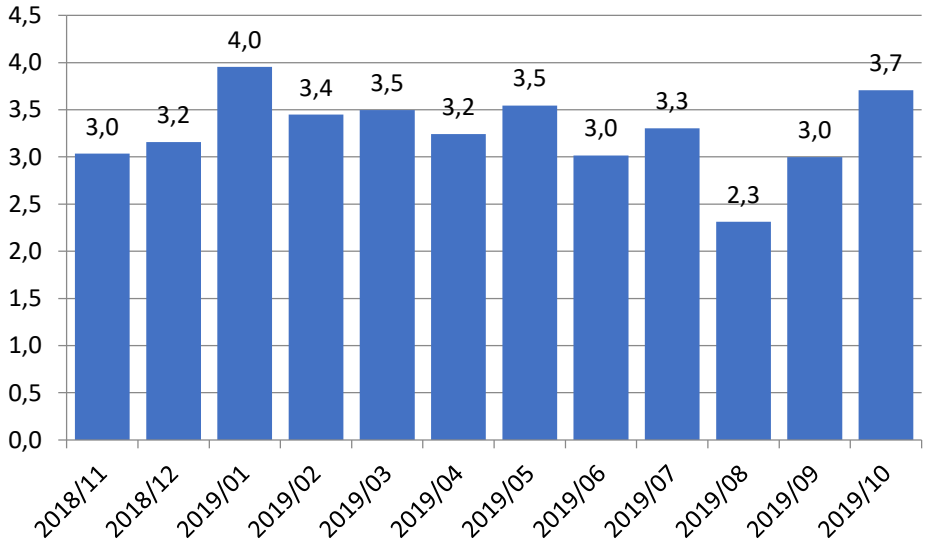


Derivacions x IS3 : 12,6 milions

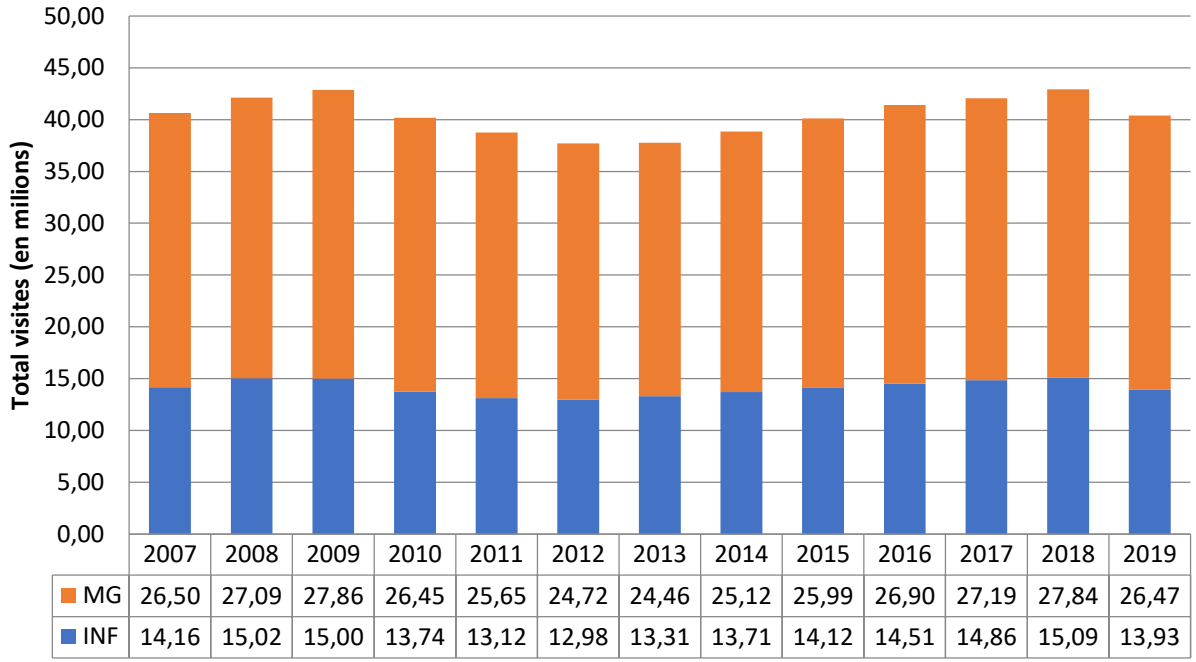


Recepta electrònica : 258 milions





Visites Atenció Primària: 183,5 milions



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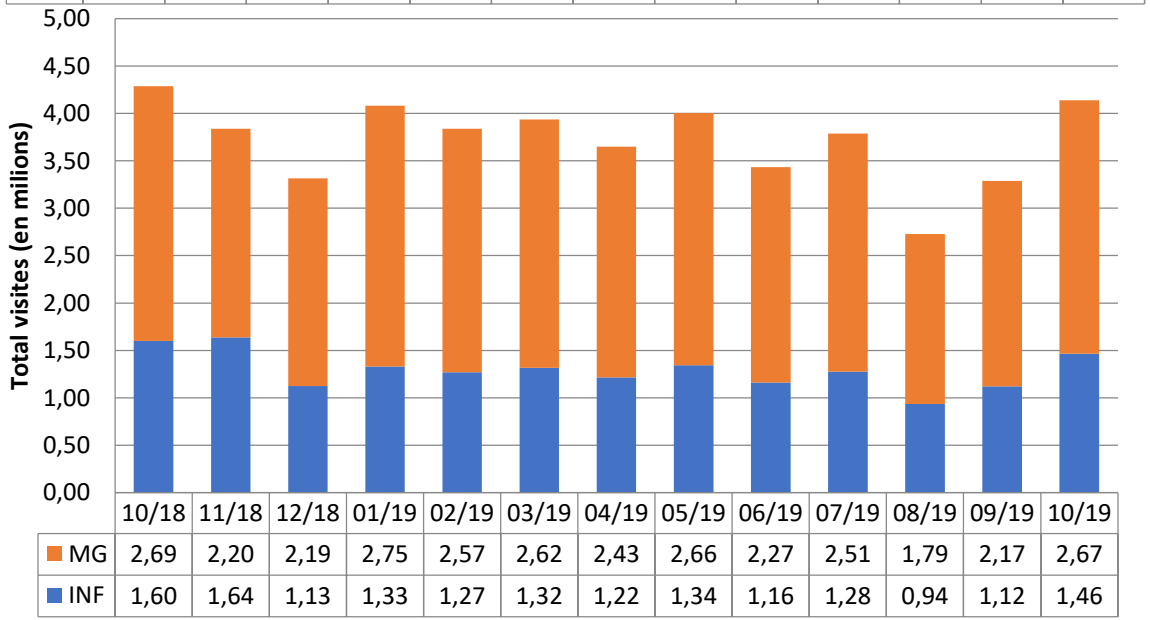
MG	26,50	27,09	27,86	26,45	25,65	24,72	24,46	25,12	25,99	26,90	27,19	27,84	26,47
INF	14,16	15,02	15,00	13,74	13,12	12,98	13,31	13,71	14,12	14,51	14,86	15,09	13,93



	10/18	11/18	12/18	01/19	02/19	03/19	04/19	05/19	06/19	07/19	08/19	09/19	10/19
MG	2,69	2,20	2,19	2,75	2,57	2,62	2,43	2,66	2,27	2,51	1,79	2,17	2,67
INF	1,60	1,64	1,13	1,33	1,27	1,32	1,22	1,34	1,16	1,28	0,94	1,12	1,46

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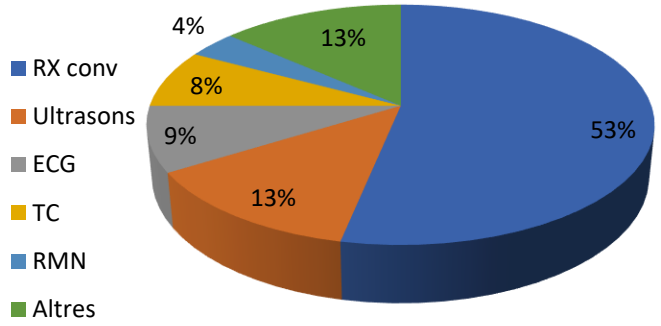

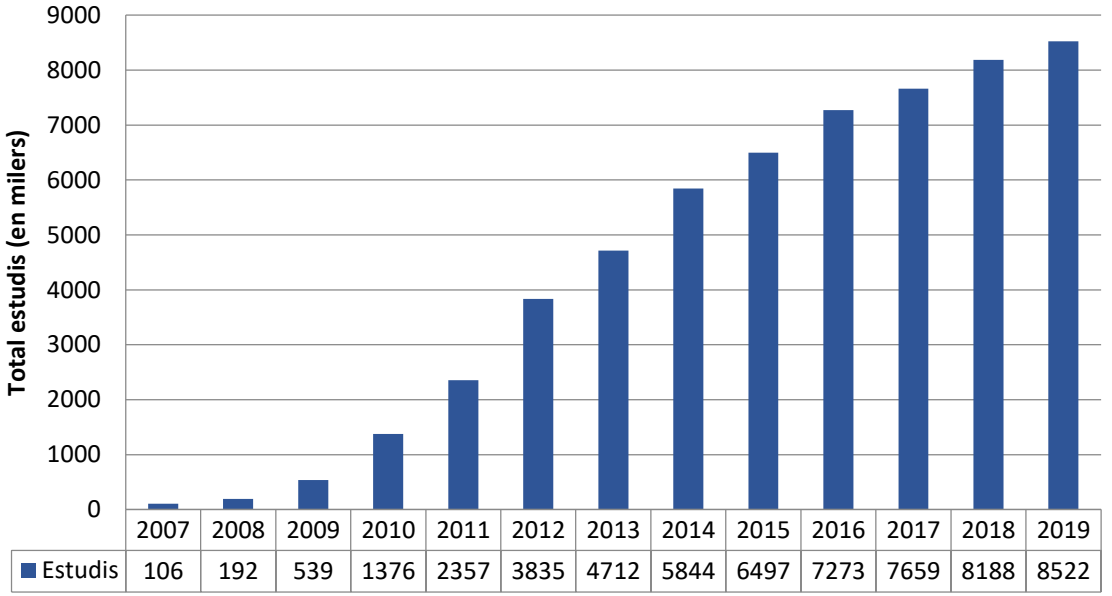

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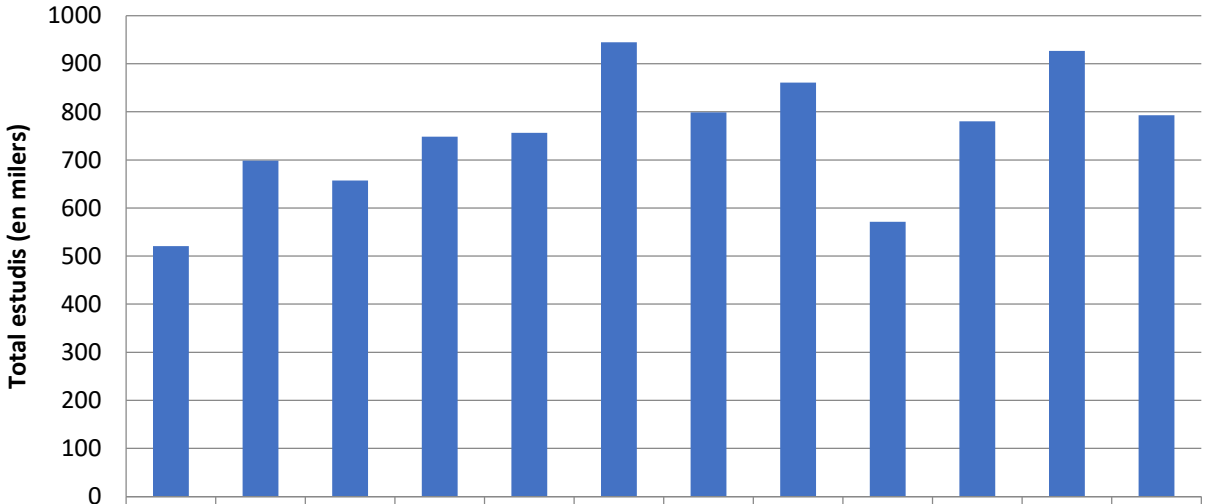

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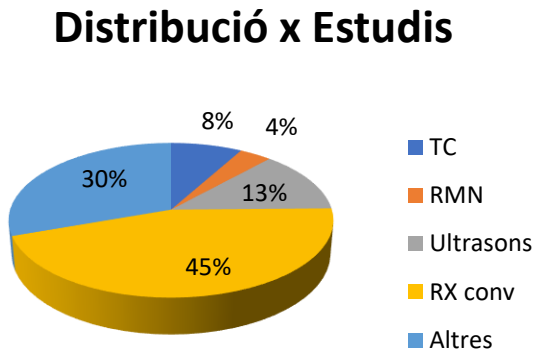


European Health Data Space
Next Steps for the New EU Commission

Ioana Gligor – SANTE.B3

HORIZON 2020

Towards the creation of a European Health Data Space

"We need to make the most of the potential of e-health to provide high-quality healthcare and reduce inequalities. I want you to work on the creation of a European Health Data Space to promote health-data exchange and support research on new preventive strategies, as well as on treatments, medicines, medical devices and outcomes. As part of this, you should ensure citizens have control over their own personal data."

(President-elect von der Leyen's Mission Letter to Commissioner Designate for Health, 10 September 2019)

Towards the creation of a European Health Data Space

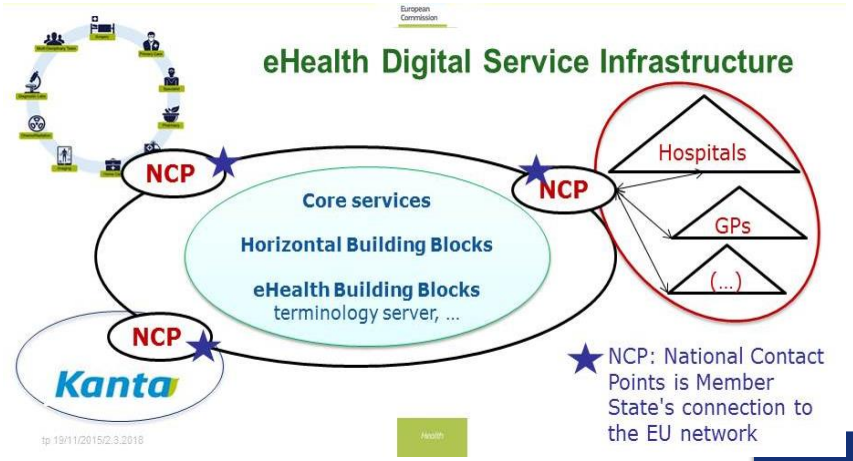
- Use of data for healthcare
  - **eHDSI**
  - **ERNs**
  - **EEHRxF**

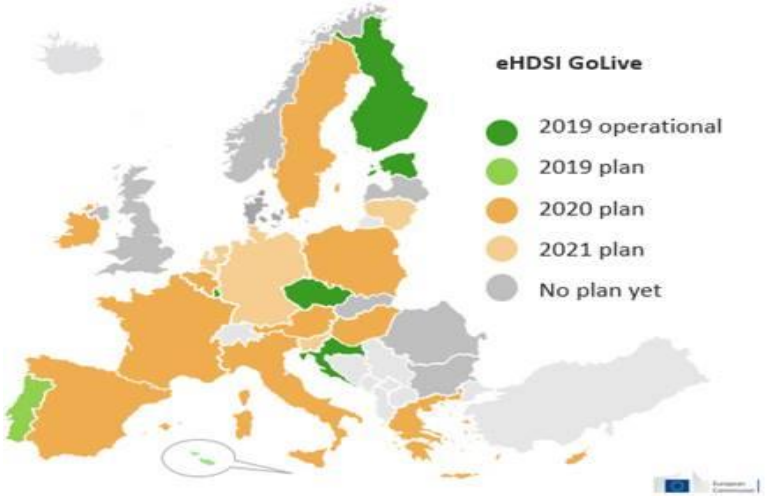
- Use of data for research and policy making
  - **1+ million genomes**
  - **Research infrastructures**
  - **EOSC etc**
- Governance: different models (data permit authorities etc.)
- Framework for the use of AI
- Secondary use of data

eHDSI: Better citizens' access to their health data

The eHealth Digital Service Infrastructure (eHDSI) enables exchange of patient data across borders

- **Patient Summary** provides access to health professionals to verified key health data of a patient during an unplanned care encounter while abroad
- **ePrescription** enables patients to receive equivalent medication while abroad to what they would receive in their home country





Recommendation on a Electronic Health Record exchange format

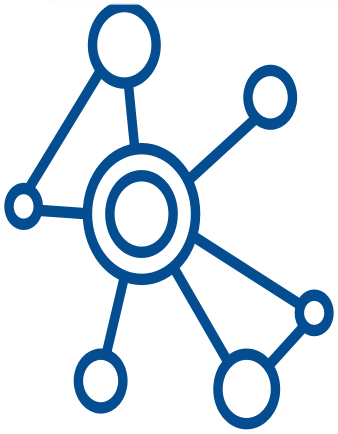
Common technical specifications (baseline)

- Initial set **of health information domains**: patient summaries, ePrescriptions, laboratory reports, medical images and reports, and hospital discharge reports
- Common list of **interoperability specifications** (existing standards and profiles)
- **Incremental and selective approach** for adopting, refining, and maintaining the specifications of the European EHR exchange format

European Commission

24 Networks

European Reference Networks



26 Countries

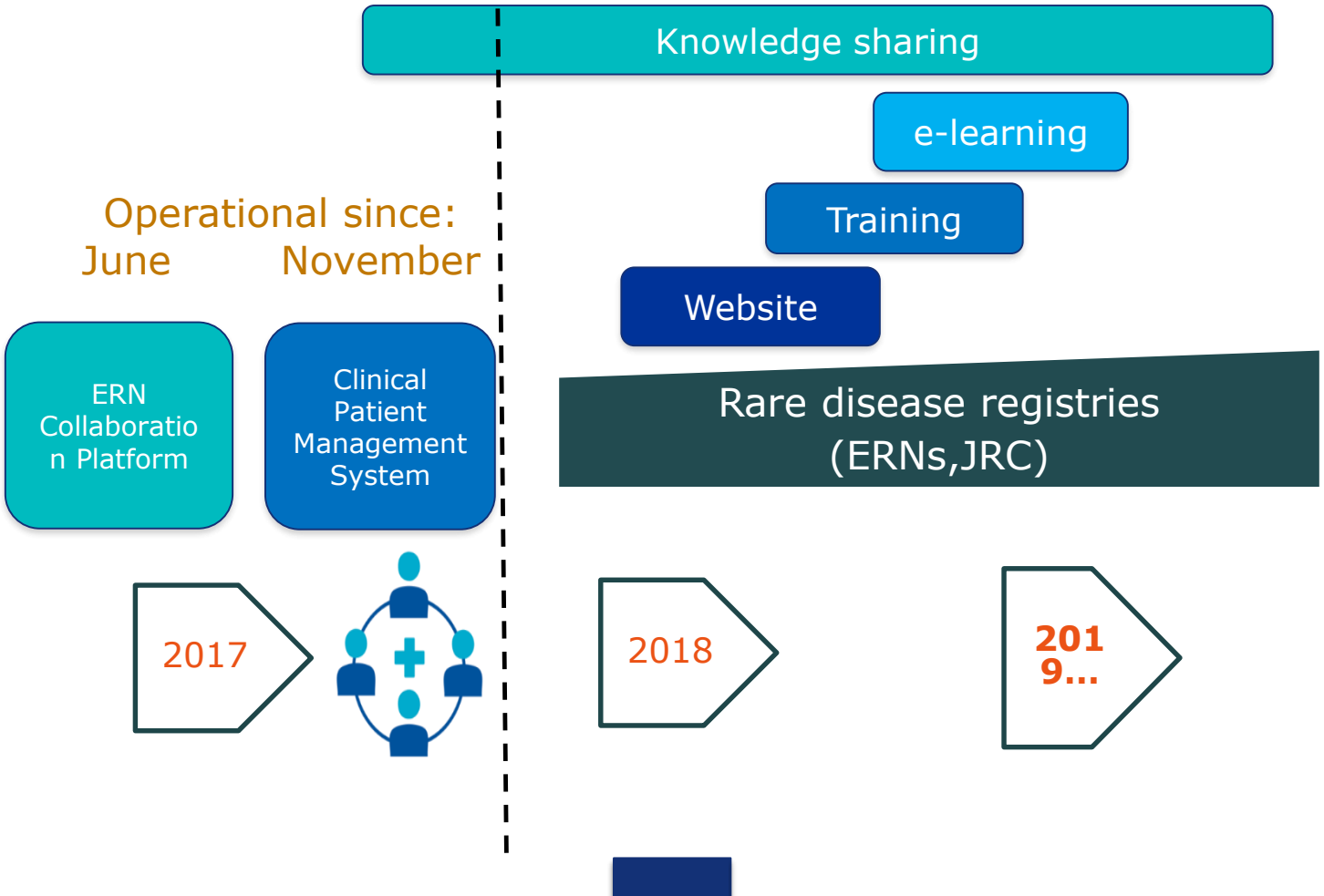
› 300 HOSPITALS

Full Member

Affiliated partner

› 900 HEALTHCARE UNITS

European Reference Network's IT Tools



European Commission

1MGenomes

Pooling health data for research and personalised medicine

Declaration for delivering cross-border access to **genomic database**

- 1 million **genomes accessible** in the EU by 2022
- **Linking access** to existing and future genomic database across the EU
- Providing a sufficient scale for **new clinically impactful** associations in research

The 1+ Million Genome initiative

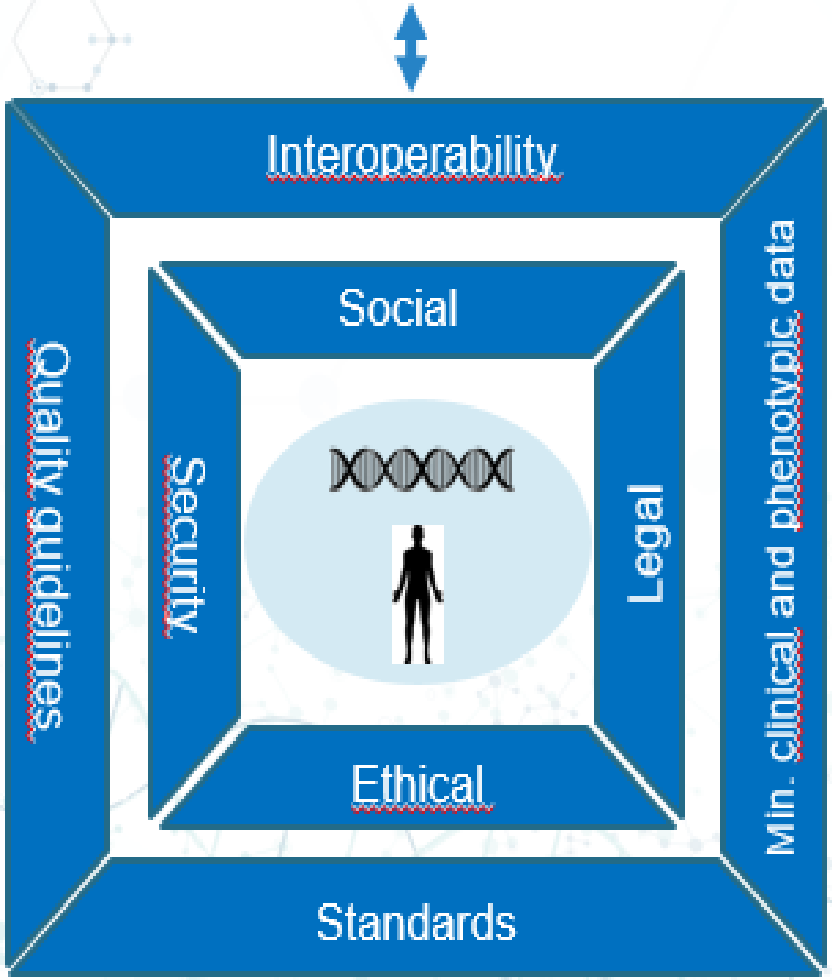
European Commission

- Federated framework that would allow **secure** and **authorised** cross-border access to **genomic** and other **health data** across the EU, supporting **research, health care and prevention**.
- To allow users to search and access the data through a user-friendly and effective data governance structure **building on existing national and European initiatives**.
- To ensure that citizens, researchers and health systems in Europe can benefit from the full potential of genomics to **advance targeted health care interventions** leading to better **prevention, early diagnosis and treatment of diseases**

Member States of the European Union, the European Economic Area (EEA) and the European Free Trade Association (EFTA)

Join forces!

1+MillionGenomes linking
National clinical genomics initiatives



BBMRI
ICPerMed
CORBEL
Global Alliance for Genomics & Health
Collaborate. Innovate. Accelerate.
European Alliance for Personalised Medicine
GACD
EUROPEAN MEDICINES AGENCY
elixir
Joint Research Centre
CanDIG

IRDiRC
EUROPEAN JOINT PROGRAMME RARE DISEASES
European Reference Networks
Electronic Health Records
EURORDIS
imi innovative medicines initiative
EOSC-Life
Cancer Core Europe
EU Can
CINECA
ecrin

Canada-EC Joint Health Data Flagship Collaboration

AI – converging intelligences

Clinical applications

- **Radiology, pathology, Dermatology, Ophthalmology, Cardiology, Gastroenterology, Mental Health ….**

Health systems applications

- **Risk of readmission, risks of sepsis or septic shock, machine vision and microsurgery, wearables for continues monitoring, efficiency gains in workflows**

AI and patients

- **Medical adherence, digital twins, predict glycemic responses**

The European Strategy on AI

The new EU initiative on AI

AI package

Publication of Ethics guidelines for trustworthy AI, 8 April 2019

First draft of the European AI ethics guidelines, 18 December 2018

Coordinated Plan on Artificial Intelligence, 7 December 2018

Commission Communication on Artificial Intelligence for Europe, 25 April 2018

Declaration of Cooperation on Artificial Intelligence for Europe, 10 April 2018

Digital health 2021-2027

MFF under negotiations by co-legislators

Digital Europe Programme and Connecting Europe Facility

Horizon Europe

European Social Fund + and European Globalisation Adjustment Fund

European Regional Development Fund

The Way Forward

Governance

Artificial Intelligence (ethical issues, safety, liability)

Access to health data (incl. data protection compliance)

Infrastructure

Prevent new health inequalities

Address regulatory gaps and barriers

Interoperability

Ethics and economics of data

Digital skills

(Cyber-) security

The active engagement of all parties is essential to succeed in creating a "triple win" that benefits people, health systems and the market.

Questions:

- What are the needs of public authorities, researchers, clinicians, innovators with regard to the different types of health data?
- Under what conditions should different types of health data be shared, and with which users?
- What are the existing governance models in the Member States for the use and sharing of health data? What does the experience tell us so far? What is the cost of setting up and maintenance of these governance models?
- Where is the health data stored, and how can we encourage/incentivise those who hold it to make it available within a health data space?
- What do we need to do to facilitate the linking of different health data within and between countries?
- What technologies can support the implementation of a health data space? (Do they exist, or do we need to develop them?)
- How do we best facilitate the use of analytic tools such as supercomputing capacity, with AI algorithms for the different types of users?

Thank you!

DigitalSingleMarket@DSMeu
EU_Health@EU_Health

DG Health and Food Safety
http://ec.europa.eu/health/ehealth/policy/index_en.htm

Industry View on AI, Big Data and Digital Therapeutics in Europe

John Crawford

Digital Health Consultant
CrawfordWorks Ltd

EHTEL Symposium 2019

3-4 December 2019, Caixa Forum, Barcelona

‘Big Data’ for health in the 1850’s – Mortality data registers

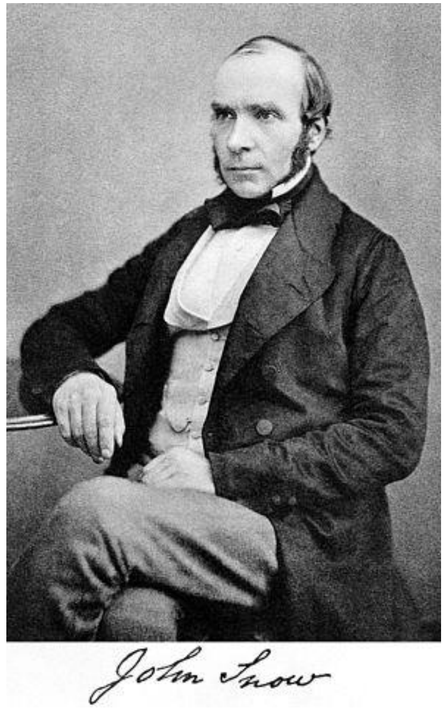
William Farr

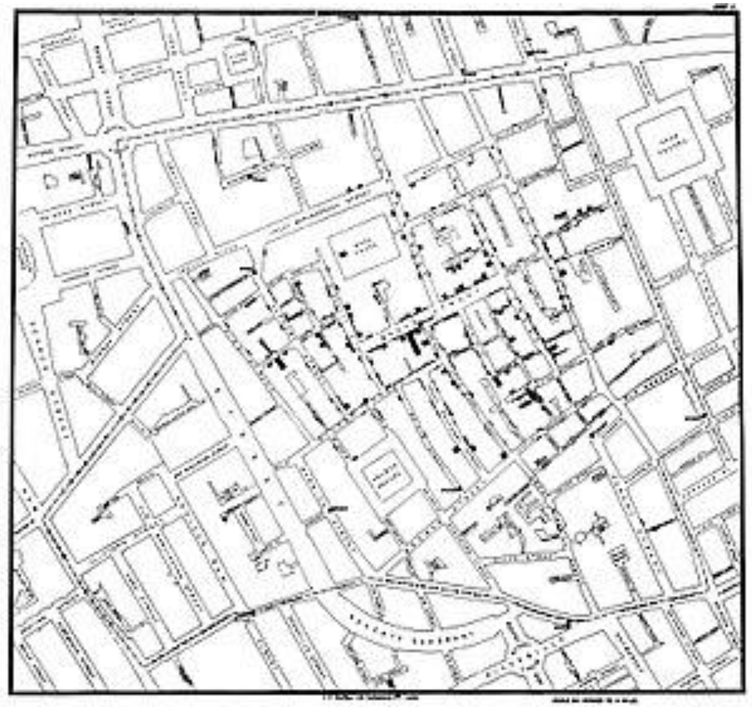
- In 1849, an outbreak of cholera in London killed 15,000 people – the way it spread was not understood – the most commonly held idea was ‘miasma theory’
- In 1852 William Farr compiled a mortality dataset, using statistical methods to test 8 explanatory variables
- Based on this, he concluded that elevation above the river Thames was was the most important factor

‘The science of epidemiology, that Farr helped to found, has continued to advance. Had logistic regression been available to Farr, its application to his 1852 data set would have changed his conclusion’. (1)

1 - John Snow, William Farr and the 1849 outbreak of cholera that affected London: a reworking of the data highlights the importance of the water supply. Bingham P[1], Verlander NQ, Cheal MJ - Public Health. 2004 Sep;118(6):387-94.

‘Big Data’ for health in the 1850’s – Mapping cholera outbreaks





- Following the 1854 cholera outbreak in London, John Snow used dot maps to visualise the spread of cholera across Soho (a Voronoi diagram)
- This indicated that cholera was transmitted through water, and pointed to a single water pump as the primary source

- This helped to disproved the ‘miasma theory’ of disease transmission in favour of the ‘germ theory’ of disease

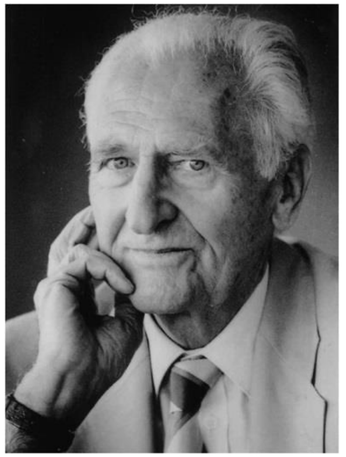
‘Big Data’ in the 1950’s - Statistical analysis of health outcomes

- 1952 – Sir Austin Bradford Hill, Richard Doll

  Randomised control clinical trials
  Case-control studies
  Retrospective & prospective cohort studies

Smoking as a risk factor in lung cancer (1952-2000)

Similar endeavours – Framingham Heart Study, Nurses Health Study, Cochrane Collaboration



Early expert system for doctors at Stanford (1972) – MYCIN

Feature Interview

Edward H. Shortliffe on the MYCIN Expert System

MYCIN used an inference engine and a knowledge base of ~600 rules.

It would query the physician with a long series of simple yes/no questions.

It provided a list of possible bacteria ranked from high to low based on the probability of each diagnosis, level of confidence, reasoning behind each diagnosis, and recommended antibiotic regime.

The ‘AI Winter’ – 1974 to 1993

Artificial Intelligence (AI) is powered by Algorithms

Categories of algorithms:

- Prioritisation: Making an ordered list
- Classification: Picking a category
- Association: Finding links
- Filtering: Isolating what's important

Paradigms for creation of algorithms:

- Rule-based algorithms – Instructions constructed by humans

- Machine-learning algorithms – Inspired by how living creatures learn

Taken from 'Hello World – How to be Human in the Age of the Machine' by Hannah Fry, Transworld Publishers, 2018 – ISBN 9780857525246

In 2015, scientists gave 16 novice testers a touch screen monitor, sho
wing pathology and radiology images of breast tissue.

After a short training period they were asked to identify cancerous tiss
ues from the images.

The results were impressive.

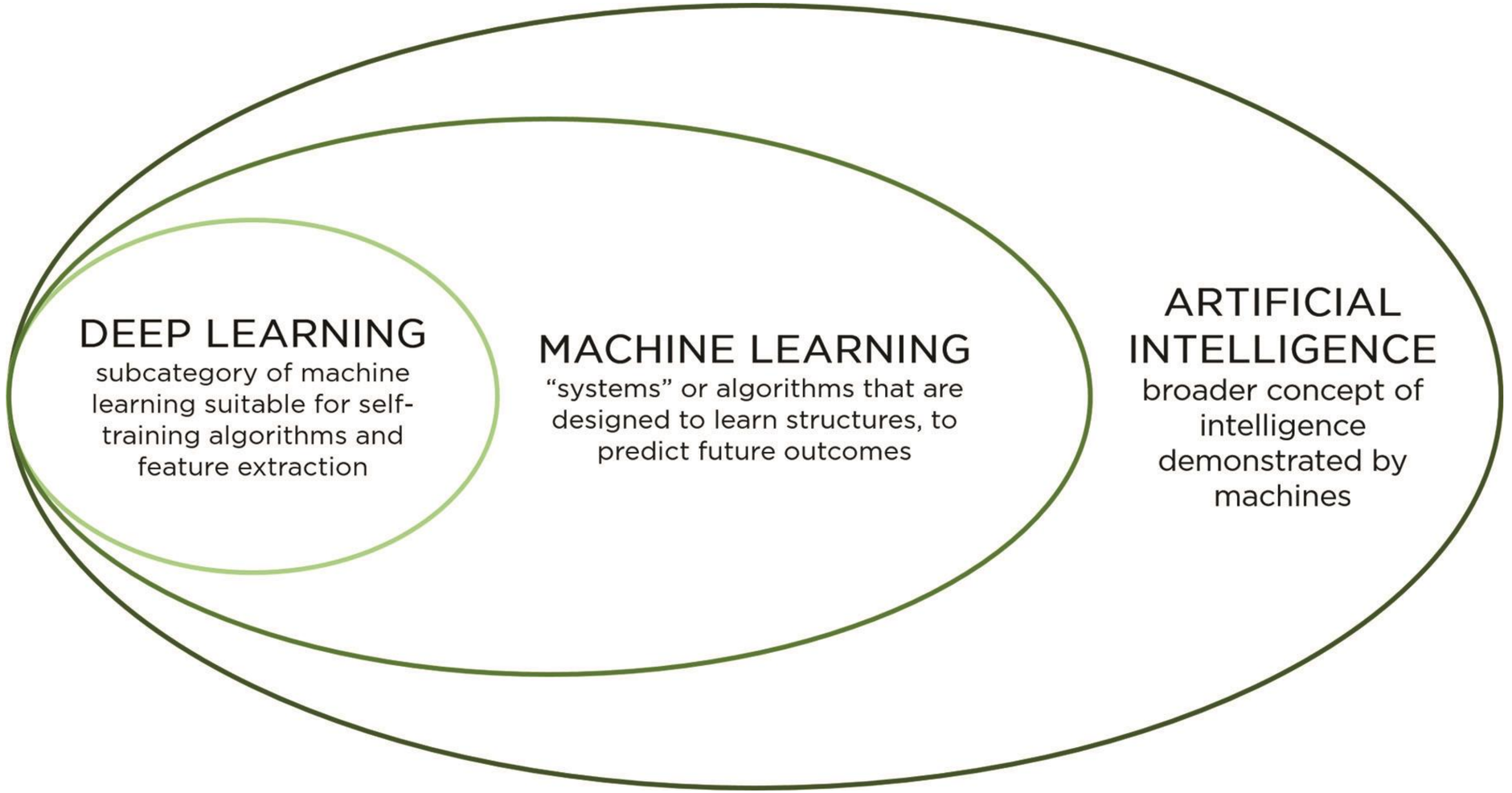
Pigeons (Columba livia) as trainable observers of pathology and radiology breast cancer images

Individual performance up to 85% accuracy

Pooled performance (ensemble method) 99% accuracy

Levenson et al, published: November 18, 2015 https://doi.org/10.1371/journal.pone.0141357

Machine Learning and Deep Learning are subsets of Artificial Intelligence



Google Deepmind: AlphaGo Zero (19/10/17)

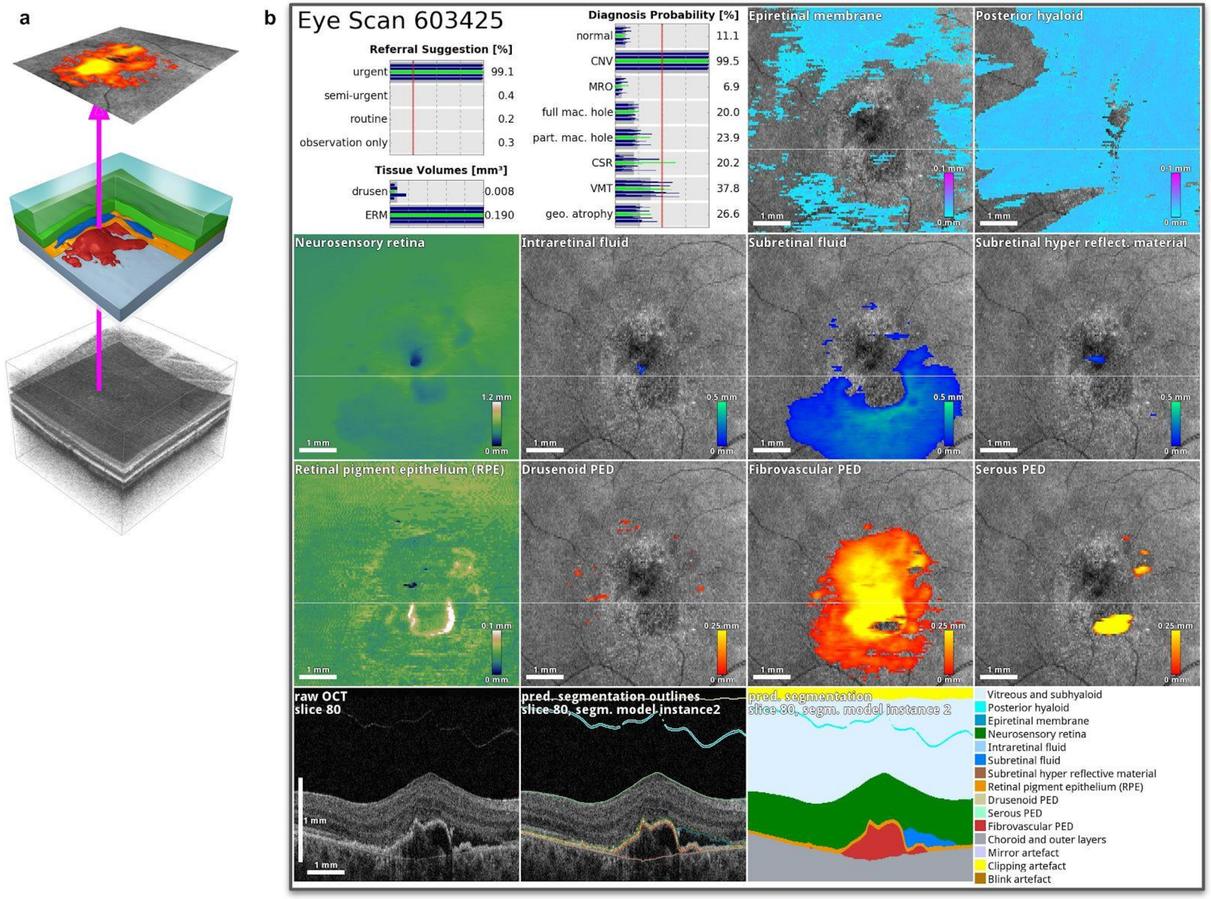
Previous versions of AlphaGo initially trained on thousands of human amateur and professional games to learn how to play Go. AlphaGo Zero skips this step and learns to play simply by playing games against itself, starting from completely random play. In doing so, it quickly surpassed human level of play and defeated the previously published champion-defeating version of AlphaGo by 100 games to 0.

It is able to do this by using a novel form of reinforcement learning, in which AlphaGo Zero becomes its own teacher.

This technique is more powerful than previous versions of AlphaGo because it is no longer constrained by the limits of human knowledge. Instead, it is able to learn tabula rasa from the strongest player in the world: AlphaGo itself.

https://deepmind.com/blog/alphago-zero-learning-scratch/

Google Deepmind: Clinically applicable deep learning for diagnosis and referral in retinal disease (13/8/18)



Here, we apply a novel deep learning architecture to a clinically heterogeneous set of three-dimensional optical coherence tomography scans from patients referred to a major eye hospital. We demonstrate performance in making a referral recommendation that reaches or exceeds that of experts on a range of sight-threatening retinal diseases after training on only 14,884 scans.

https://deepmind.com/research/publications/clinically-applicable-diagnosis-and-referral-retinal-disease/

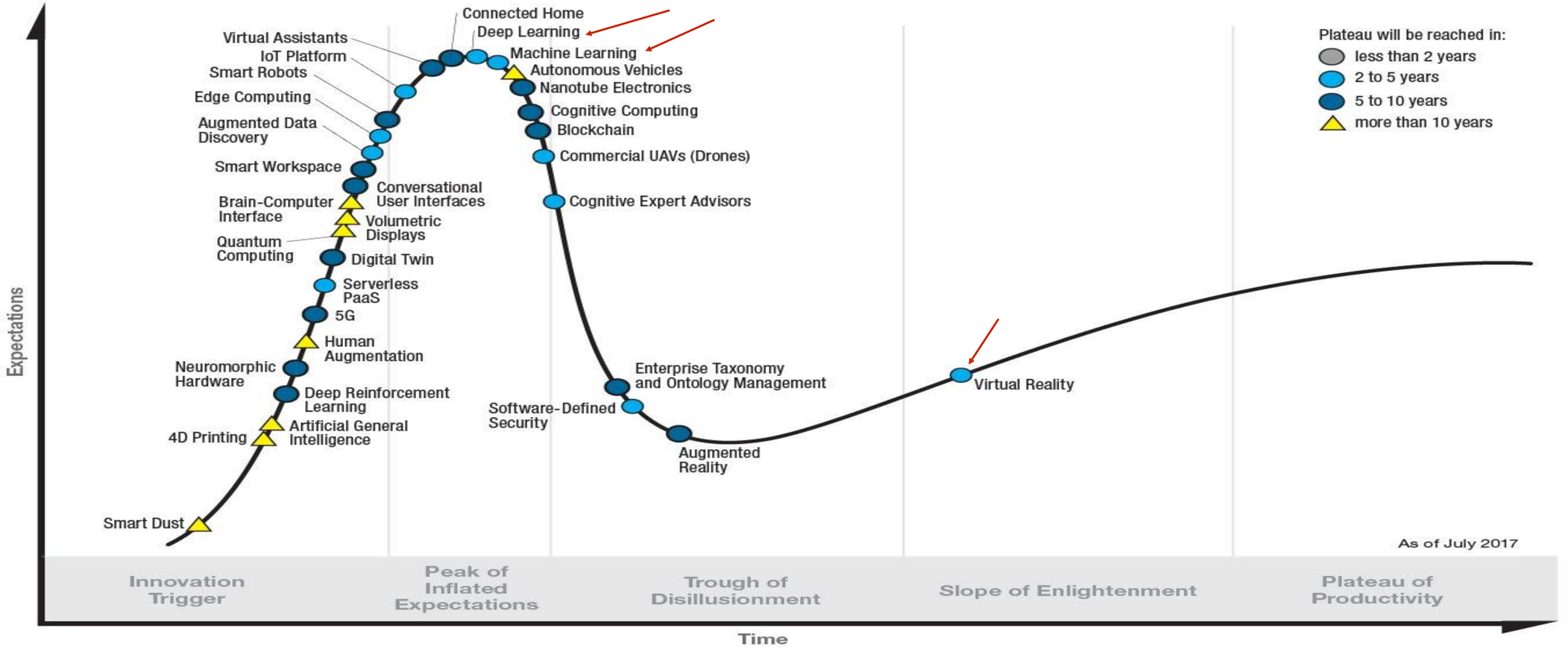
Royal Free breached UK data law in 1.6m patient deal with Google's DeepMind

London’s Royal Free hospital failed to comply with the Data Protection Act when it handed over personal data of 1.6 million patients to DeepMind, a Google subsidiary, according to the Information Commissioner’s Office.

The data transfer was part of the two organisation’s partnership to create the healthcare app Streams, an alert, diagnosis and detection system for acute kidney injury. The ICO’s ruling was largely based on the fact that the app continued to undergo testing after patient data was transferred. Patients, it said, were not adequately informed that their data would be used as part of the test.

https://www.theguardian.com/technology/2017/jul/03/google-deepmind-16m-patient-royal-free-deal-data-protection-act

Gartner Hype Cycle for Emerging Technologies, 2017

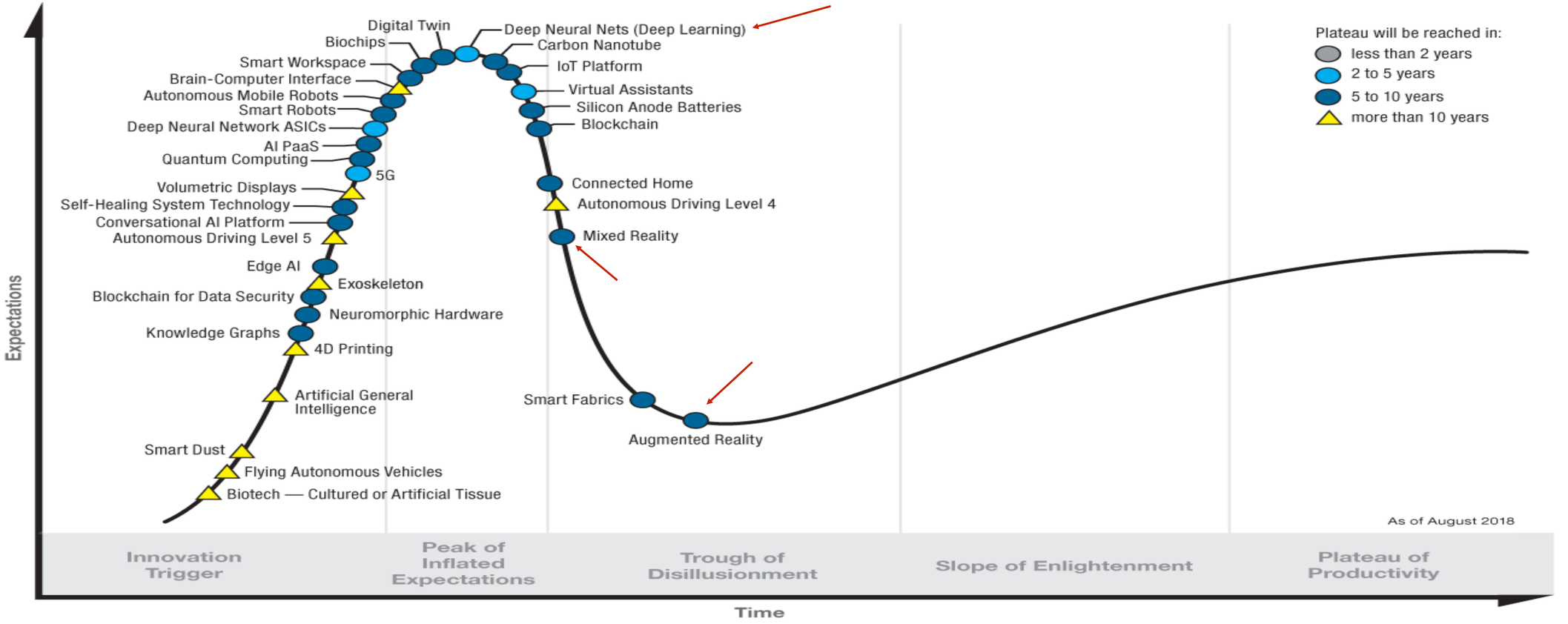


gartner.com/SmarterWithGartner

Source: Gartner (July 2017)

Gartner

Hype Cycle for Emerging Technologies, 2018

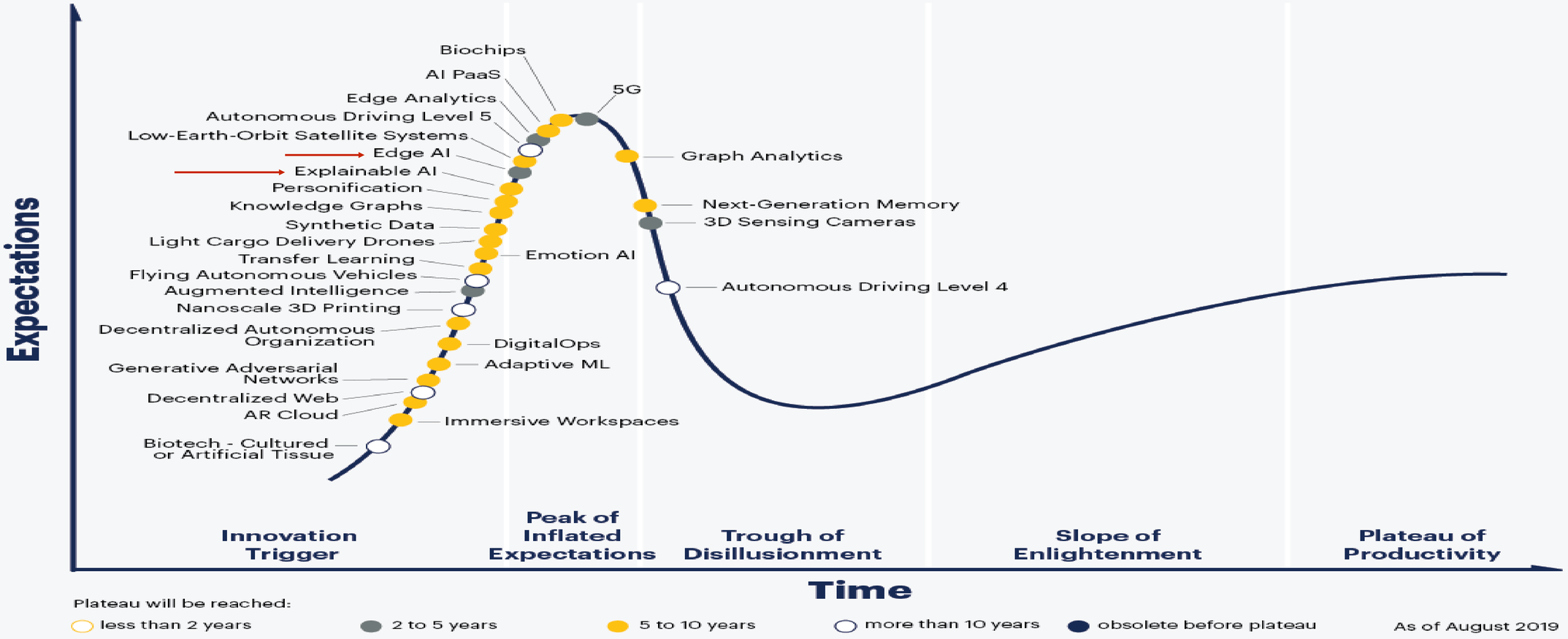


gartner.com/SmarterWithGartner

Source: Gartner (August 2018)

Gartner

Gartner Hype Cycle for Emerging Technologies, 2019



gartner.com/SmarterWithGartner

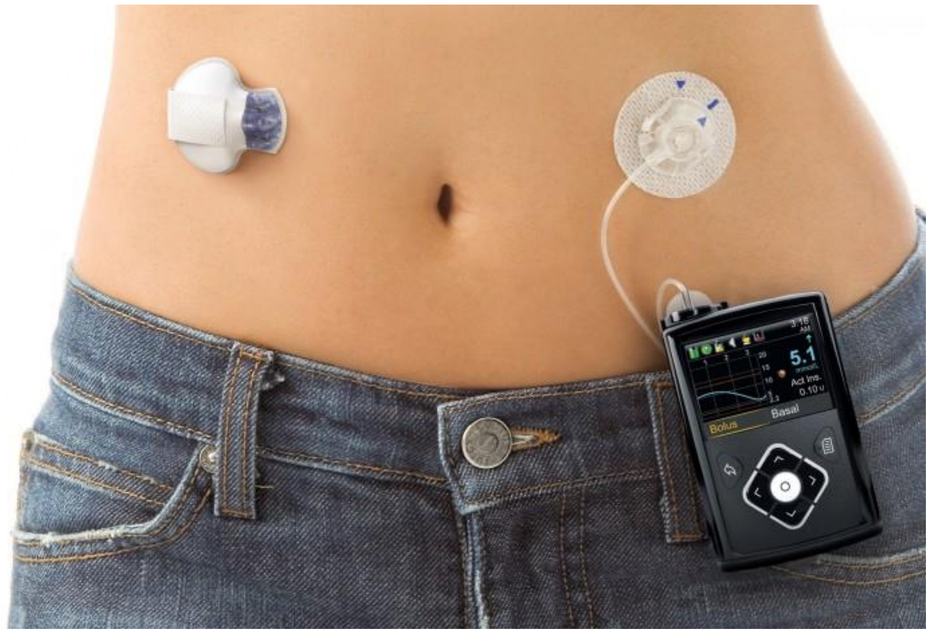
Source: Gartner

Gartner

Algorithms to detect heart arrhythmias: Alivecor KardiaMobile

1-lead ECG using algorithms on smartphone to detect Atrial Fib rillation in 30 seconds and capture ECG trace

First ‘artificial pancreas’: Medtronic Minimed 670G (launched 2017)



Continuous glucose monitoring and connected automated insulin pump

‘Bionic pancreas’:
Beta Bionics iLet (FDA trials began May 2018)

Continuous glucose monitoring, dual insulin/glucagon pump and machine learning algorithms

Many issues are raised by AI

- Privacy – how can we protect ourselves from exploitation and prejudice
- Safety and efficacy – do we need stronger regulation of AI algorithms?
- Transparency – can we really trust AI systems to be unbiased?
- Legal – can we hold algorithms (and the companies behind them) to account?

Digital Therapeutics – Ready for Take-Off?

What are Digital Therapeutics?

Digital therapeutics (DTx) deliver evidence-based therapeutic interventions to patients that are driven by high quality software programs to prevent, manage, or treat a medical disorder or disease.

They are used independently or together with medications, devices, or other therapies to optimize patient care and health outcomes.

Source: Digital Therapeutics Alliance – https://dtxalliance.org

Digital Therapeutics – Treating Psychosis with VR

https://gamechangevr.com

Nature **573**, S106-S109 (2019)

Digital Therapeutics – Exposure Therapy with VR

REALISTIC INTERACTIVE CHARACTERS

Actors filmed with 360 degree video in a real location. You can stand at a fixed point in the location and interact with a character.

https://www.timestory.dk/projects/

VRExposure is a virtual reality exposure therapy tool for therapists working with people who suffer from social anxiety. It consists of 12 VR exposure experiences in a supermarket and a bus.

The person with social anxiety can train to stand close to people and communicate, while the therapist can observe what the person is looking at during the experience.

We use speech recognition and pulse measuring tools. VRExposure has been tested on people with social anxiety and the result is highly positive. It shows that VR exposure therapy can help people reduce anxiety.

Digital Therapeutics – Physiotherapy & Rehabilitation

Screening

Daily caregivers are able to make an objective assessment of the citizens' physical ability and need for assistance.

Exercise

The tailored exercise programmes can be performed in the citizens' own home with supervision from the caregiver and assistance from videos.

Analysis

DigiRehabs manageable analysis function ensures that the rehabilitation effort can be watched in real time. No elderly person is exercising in vain.

https://digirehab.dk/en/#om-digirehab