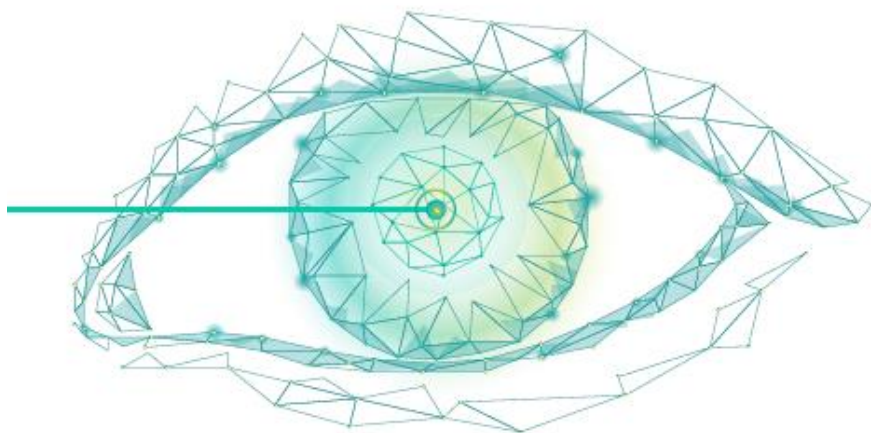# FROM *big* DATA TO *smart* HEALTH:
PUTTING DATA TO WORK FOR THE PUBLIC´S HEALTH

Data strategy for *next generation* National Health Service | Portugal

Cátia Sousa Pinto, MD
Advanced Analytics and Intelligence Unit
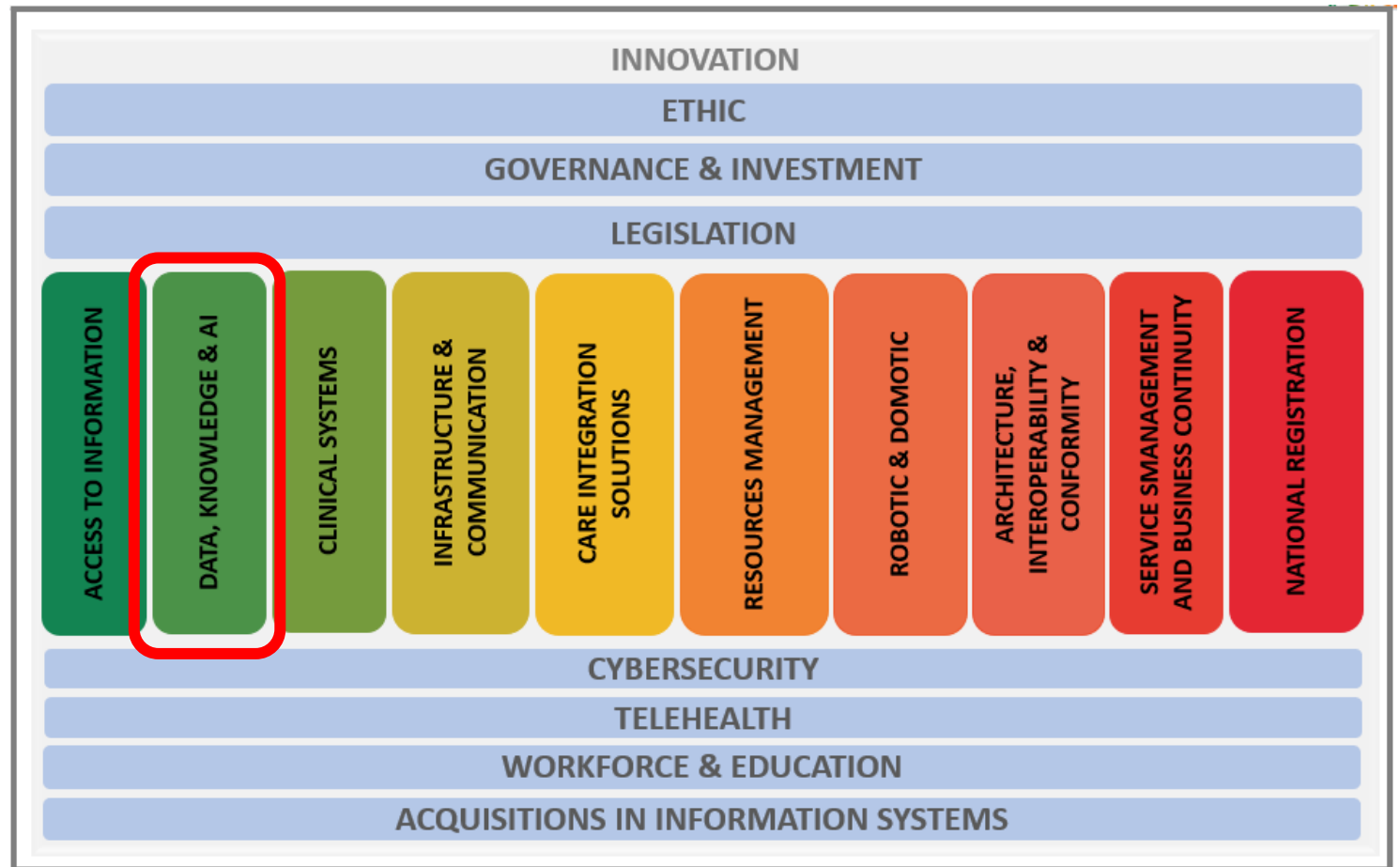Shared Services of Ministry of Health
Portugal

CONTEXT   VISION   GOALS   DIMENSIONS   STRATEGIC STREAMS   INITIATIVES

"A Health Information Ecosystem as a reference guide to the best practises for a more digital, integrated, sustainable and citizen-centered Health System, contributing to the delivery of benefits and optimization of resources."

*"A Health Information Ecosystem as a **reference guide** to the best practises for **a more digital, integrated, sustainable and citizen-centered Health System**, contributing to the delivery of **benefits** and **optimization** of risks and resources."*
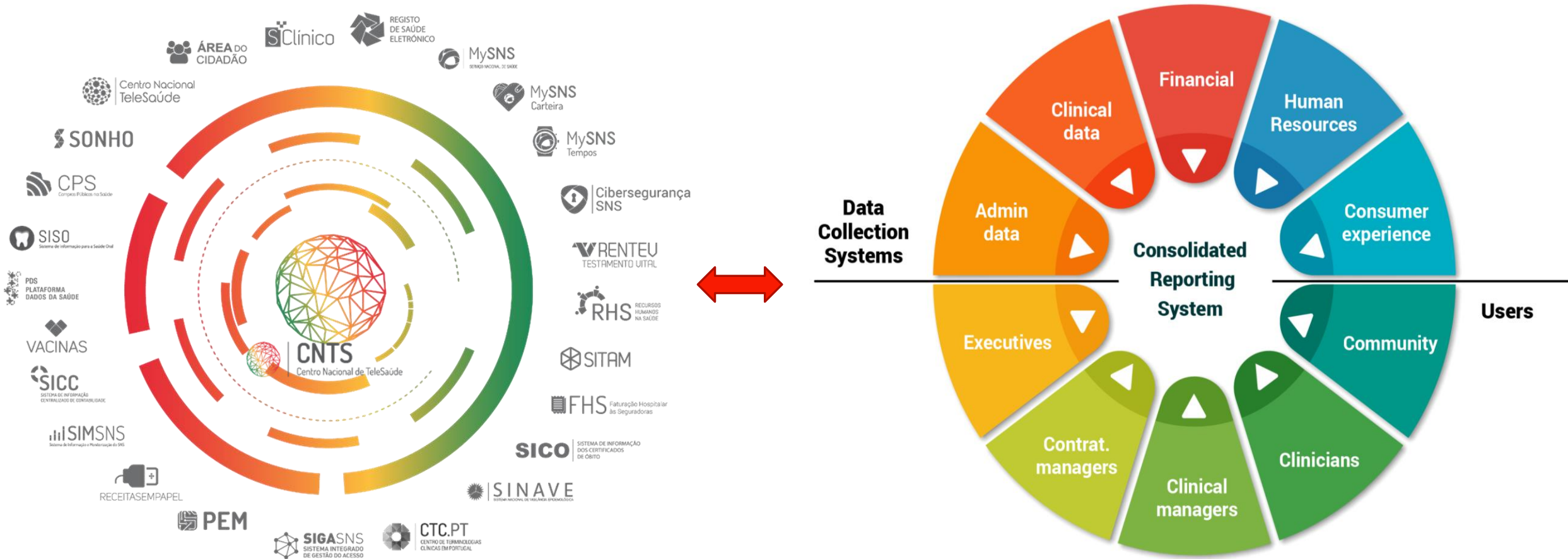
DIMENSIONS

INNOVATION
ETHIC
GOVERNANCE & INVESTMENT
LEGISLATION

ACCESS TO INFORMATION
DATA, KNOWLEDGE & AI
CLINICAL SYSTEMS
INFRASTRUCTURE & COMMUNICATION
CARE INTEGRATION SOLUTIONS
RESOURCES MANAGEMENT
ROBOTIC & DOMOTIC
ARCHITECTURE, INTEROPERABILITY & CONFORMITY
SERVICE SMANAGEMENT AND BUSINESS CONTINUITY
NATIONAL REGISTRATION

CYBERSECURITY
TELEHEALTH
WORKFORCE & EDUCATION
ACQUISITIONS IN INFORMATION SYSTEMS

DATA, KNOWLEDGE & AI

DIMENSIONS

e – NATIONAL HEALTH (INFORMATION) SYSTEM

Advanced Analytics and Intelligence Unit |
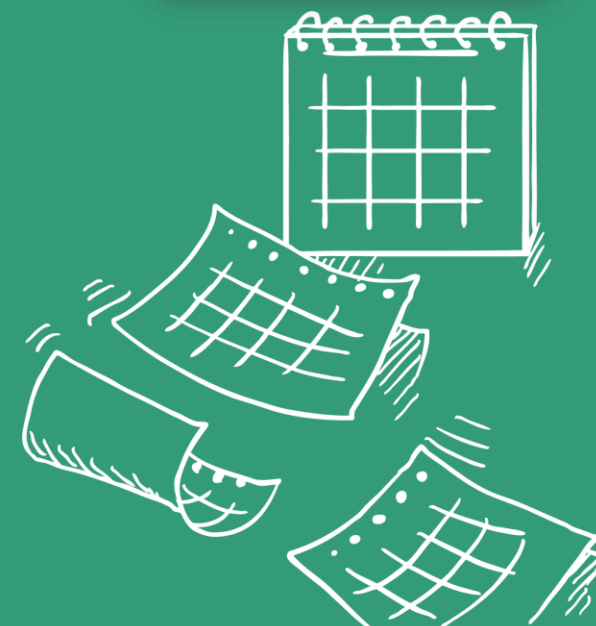# Rising to the challenge: from *e-NHS* to *i-NHS*

- ✓ *Success of NHS digital transformation: realize the promisse of big data for healthcare, public health and medical practice*

- ✓ *From **e**-NHS to **i**-NHS: data-driven by default, measures performance on the basis of what it delivers to people´s health*

- ✓ Robust data governance :
  NHS can only be as intelligent as the quality of data it holds
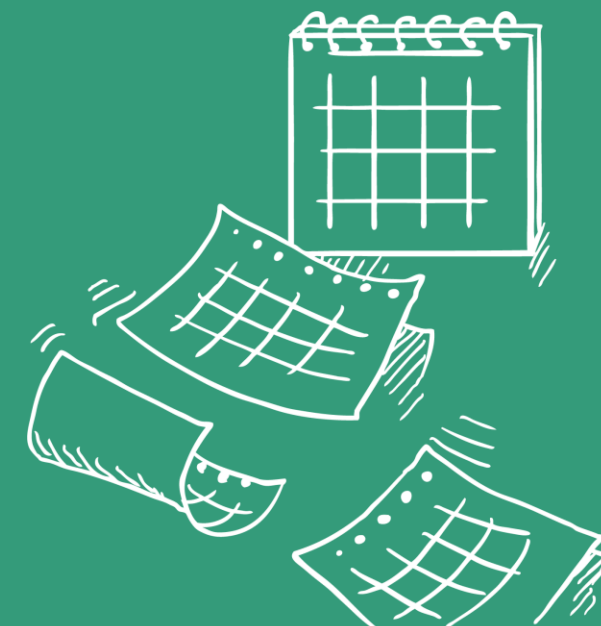
Data governance: *shaping population health and precision medicine in the big data era*

- Strong governance model for management, accountability, precision medicine and public health intelligence for next generation NHS

- Address fundamental challenges: universal coverage, quality of care and financial sustainability

- Leverage NHS towards "Health for all" and primary healthcare

- Data ecossystem for operation of AI-backed systems: intelligent IT services that add value

FROM BIG DATA TO SMART HEALTH
PUTTING DATA TO WORK FOR THE PUBLIC´S HEALTH

Data Strategy for Next Generation
Portuguese National Health Service
Advanced Analytics and Intelligence Unit
Information Systems Department
Shared Services of the Ministry of Health

CORE VALUES

1 **Maintain public´s trust**
- Data Protection and privacy rights
- Trust in government agencies

2 **High-quality data**
- Circular data quality assurance
- Relevant health indicators

3 **Efficiency through data integration**
- Interoperability and datawarehouse
- Smart inference chains for knowledge generation

4 **Data-driven innovation**
- Simplified user-interaction platforms
- Data ecossystem for AI

i-HEALTH: Key areas for a data-driven NHS

Trusted environment for data reuse endorsing NHS foundational values

- ✓ **Key area 1: Stakeholder engagement**

- ✓ **Key area 2: Legal and ethical framework**

- ✓ **Key area 3: Advance *prevention-oriented* analytics**

- ✓ **Key area 4: Enhance national public health intelligence**

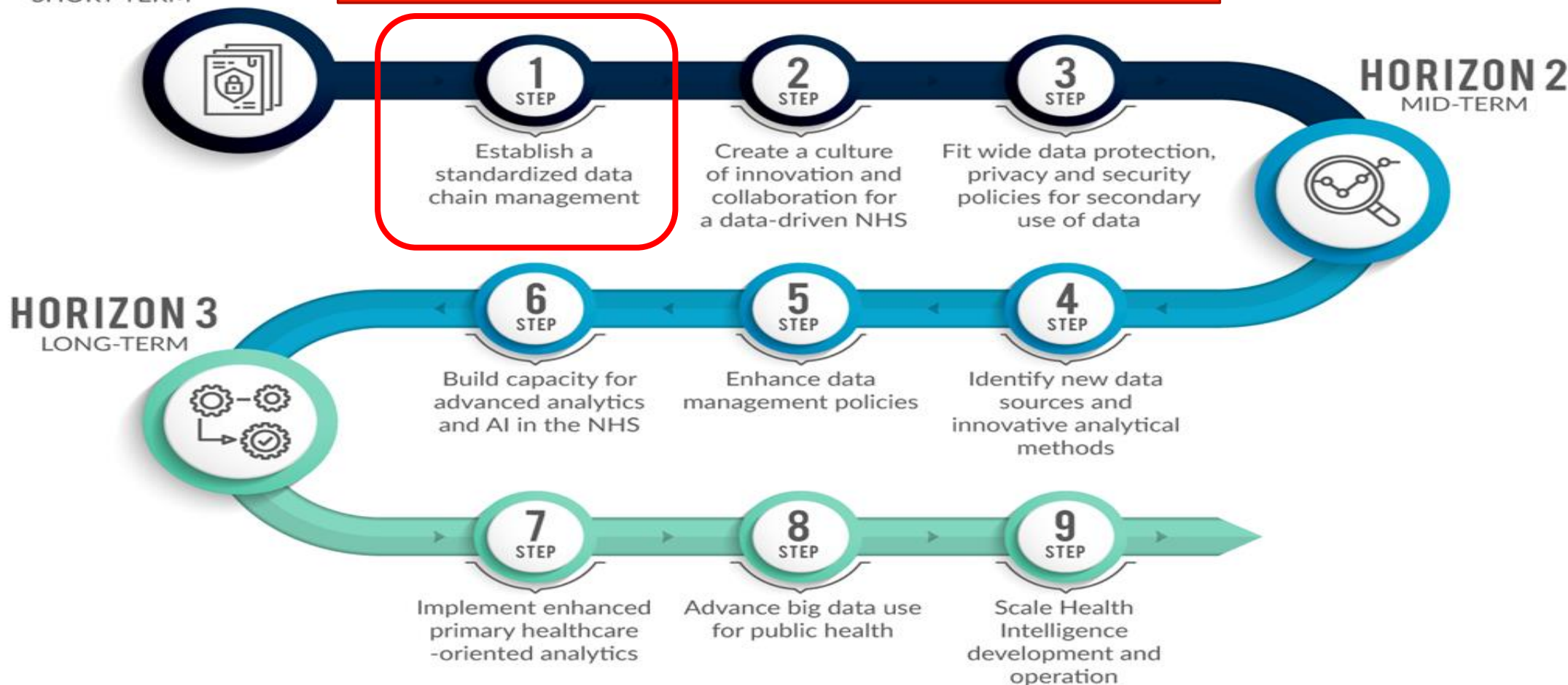- ✓ **Key area 5: Culture of innovation and collaboration**
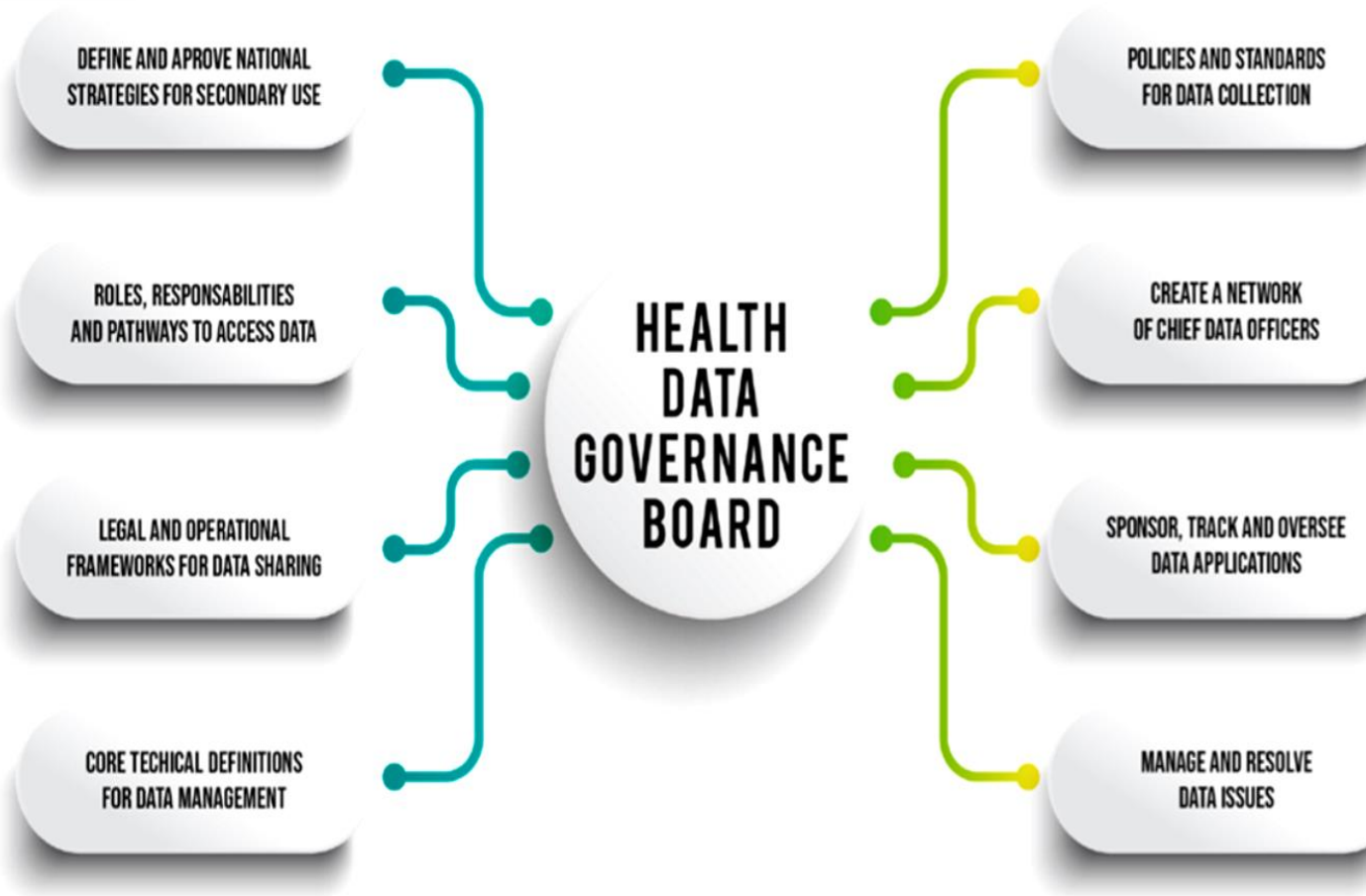
i-NHS
FROM BIG DATA TO SMART DATA ROADMAP

HORIZON 1 SHORT-TERM

HORIZON 2 MID-TERM

HORIZON 3 LONG-TERM

Robust Governance: **Health Data Governance Board**

1 STEP — Establish a standardized data chain management

2 STEP — Create a culture of innovation and collaboration for a data-driven NHS

3 STEP — Fit wide data protection, privacy and security policies for secondary use of data

4 STEP — Identify new data sources and innovative analytical methods

5 STEP — Enhance data management policies

6 STEP — Build capacity for advanced analytics and AI in the NHS

7 STEP — Implement enhanced primary healthcare -oriented analytics

8 STEP — Advance big data use for public health

9 STEP — Scale Health Intelligence development and operation

i-NHS : Data governance as a health service

- Support the cooperation between different database owners;

- Active role in clinical and public health process redesign;

- Approval of national strategies for secondary use of data;

- Definition of responsibilities and pathways to access and data;

- Enforce data policies and standards in data collection, storage and retrieval for secondary use;

- Ensuring accountability for data management through a network of chief data officer´s vertically and horizontally;

- Help health institutions track and oversee the delivery of data applications;

- Manage data related issues, to assure end-users that the data is accurate.

# Key area 5: Innovation and collaboration

Health Intelligence Lab :
Create actionable data using Artificial Intelligence

Health Intelligence Lab

Responsible and trustworthy AI integration in clinical decision support, public health intelligence and management

Anticipate and manage risks associated with AI

Management

Precision medicine

Public Health Intelligence

Precision prevention

Citizens´empowerment

Research
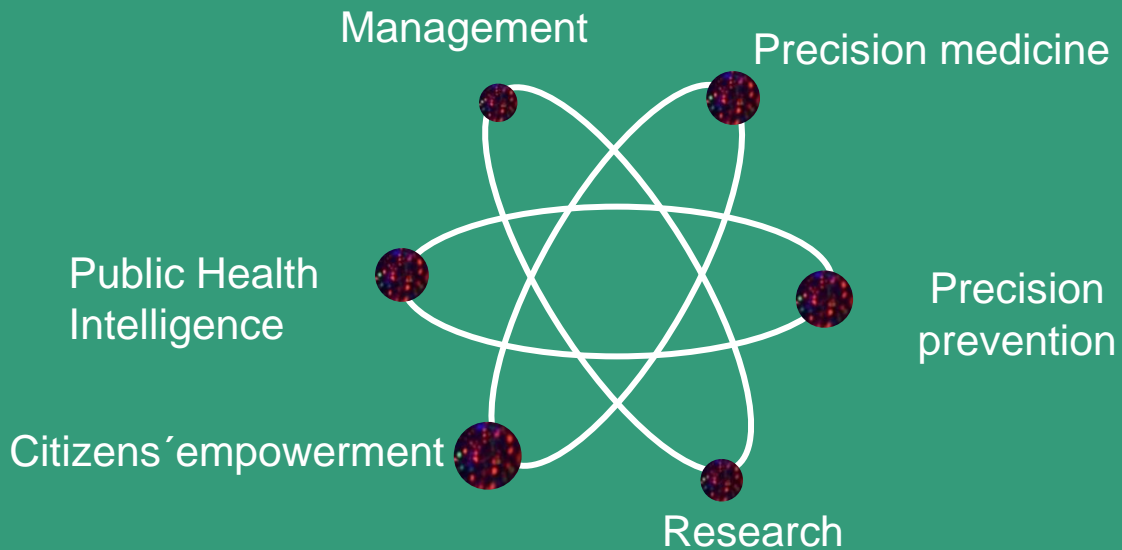
GOALS:

- ✓ Advance secondary use of data in priority health programs
- ✓ Translate stored NHS data into useful AI-backed tools
- ✓ Test and scale Innovative IT solutions
- ✓ Establish NHS testing environment
- ✓ Partnerships with academic institutions, public and private sector organizations
- ✓ Promote NHS efficiency, safety and quality

Deep neural models for ICD-10 coding of death certificates and autopsy reports in free-text

Francisco Duarte ᵃ ⌂ ✉, Bruno Martins ᵃ ✉, Cátia Sousa Pinto ᵇ ✉, Mário J. Silva ᵃ ✉

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Deep neural models for ICD-10 coding of death certificates and autopsy reports in free-text.

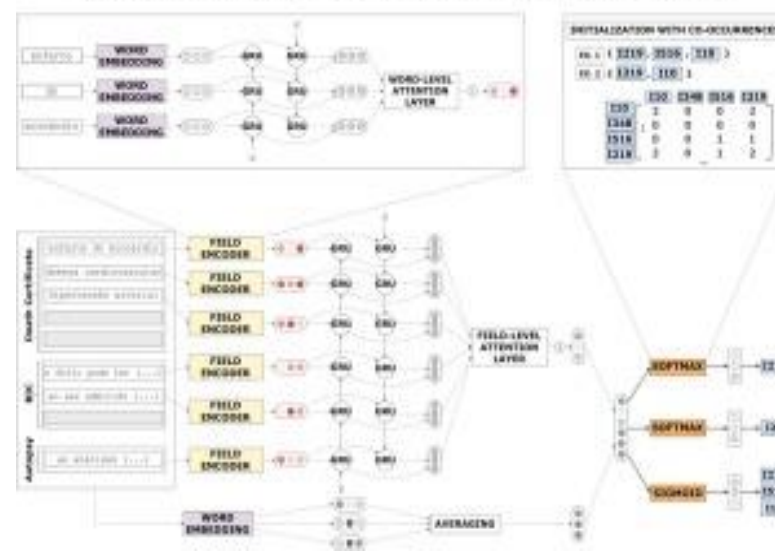Duarte F¹, Martins B², Pinto CS³, Silva MJ⁴.

⊕ Author information

Abstract

We address the assignment of ICD-10 codes for causes of death by analyzing free-text descriptions in death certificates, together with the associated autopsy reports and clinical bulletins, from the Portuguese Ministry of Health. We leverage a deep neural network that combines word embeddings, recurrent units, and neural attention, for the generation of intermediate representations of the textual contents. The network also explores the hierarchical nature of the input data, by building representations from the sequences of words within individual fields, which are then combined according to the sequences of fields that compose the inputs. Moreover, we explore innovative mechanisms for initializing the weights of the final nodes of the network, leveraging co-occurrences between classes together with the hierarchical structure of ICD-10. Experimental results attest to the contribution of the different neural network components. Our best model achieves accuracy scores over 89%, 81%, and 76%, respectively for ICD-10 chapters, blocks, and full-codes. Through examples, we also show that our method can produce interpretable results, useful for public health surveillance.
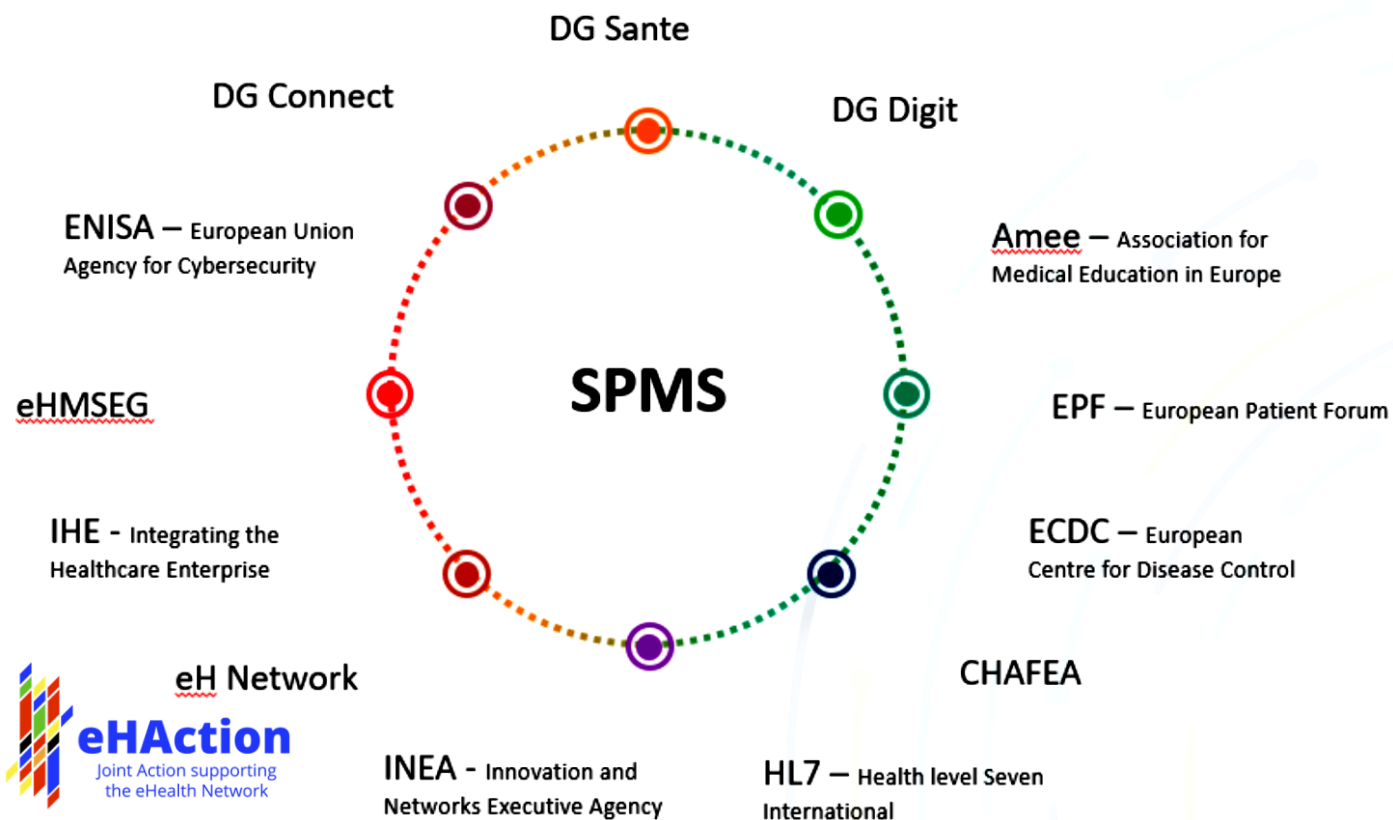
International Cooperation

DG Sante

DG Connect

DG Digit

ENISA — European Union Agency for Cybersecurity

Amee — Association for Medical Education in Europe

SPMS

eHMSEG

EPF — European Patient Forum

IHE - Integrating the Healthcare Enterprise

ECDC — European Centre for Disease Control

eH Network

eHAction
Joint Action supporting the eHealth Network

CHAFEA

INEA - Innovation and Networks Executive Agency

HL7 — Health level Seven International

Bilateral Protocols
Informal:
- Hong Kong
- SITRA (Finland)
- Estonia – MoH

- Andaluzia
- Galiza

International eHealth Forums
- ECHAlliance
- PCHAlliance
- GDHP
- HL7 EUROPE

- SNOMED
- ISfTeH
- HIMSS

European Agencies
- ENISA
- EMA
- ECDC

- DG SANTE
- CHAFEA
- INEA

- DG DIGIT
- DG CONNECT

**FROM *big* DATA TO *smart* HEALTH:
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THANK YOU