6th Barcelona TechnoWeek

Cloud use case 1: Medicine

MARIANA CANELAS PAIS

SCIENTIFIC COMPUTING IN THE CLOUD

mariana.pais@mtg.pt

https://www.linkedin.com/in/mariana-canelas-pais-304489175/

Make a background image that represents the use of Data, Informatics and Technology in Medicine, make it edgy and professional-looking, trending on art station

Mariana × DALL·E 2

Human & AI


CESPU
TEACHING HEALTH SINCE 1982

CESPU

HIGHER EDUCATION UNIVERSITY

CESPU
INSTITUTO POLITÉCNICO
DE SAÚDE DO NORTE

4 Degrees
- Biomedical Sciences
- Forensic Science
- Nutrition
- Psychology

3 Integrated Masters
- Pharmaceutical Sciences
- Odontology
- Veterinary Medicine

2 Specialization Courses
- Orthodontics
- Oral Rehabilitation and Prosthodontics

6 Masters
- Clinical Analysis
- Forensic Laboratory Science and Techniques
- Molecular Therapies
- Orthodontics
- Psychology of Health and Neuropsychology
- Oral Rehabilitation

2 PhD
- Biological Sciences Applied to Health
- Toxicology

Total of Students – 1635
Foreign Students – 52,3 %

CESPU

HIGHER EDUCATION POLYTCHENIC

CESPU
INSTITUTO POLITÉCNICO
DE SAÚDE DO NORTE

8 CTESP	Support to Dental and General Doctor Bioanalysis and Control Esthetic Cosmetic and Wellness Gerontology Thermal and Wellness Clinical Secretary Health and Exercise Family and Community Service
10 Degrees	Nursing (ESSVA and ESEnfTS) Pharmacy Clinical Physiology Physiotherapy (ESSVA and ESTeSTS) Osteopathy Podiatry Dental Prosthesis Medical Image and Radiotherapy
2 Specialization Courses	Nursing Rehabilitation (ESSVA and ESEnfTS)
4 Master	Physiotherapy Sports Podiatry Children's Podiatry Mental Health and Psychiatry Nursing

Total of Students - 1713
Foreign Students – 27,5 %

CESPU


ALEMANHA
ISERLOHN
2021
CESPU
MARROCOS
MARRAQUEXE
2013
BRASIL
JABOATÃO DOS
GUARARAPES
2022
ANGOLA
BENGUELA
2007

Predictive Algorithms for Detection of Intimate Partner Violence in the Healthcare System

Mariana Canelas Pais
Teresa Magalhães (Principal Investigator)
Ricardo Dinis-Oliveira
Tiago Taveira-Gomes

An abstract representation of a research study on domestic violence as digital art.
Mariana × Midjourney
Human & AI

CESPU
INSTITUTO UNIVERSITÁRIO
DE CIÊNCIAS DA SAÚDE

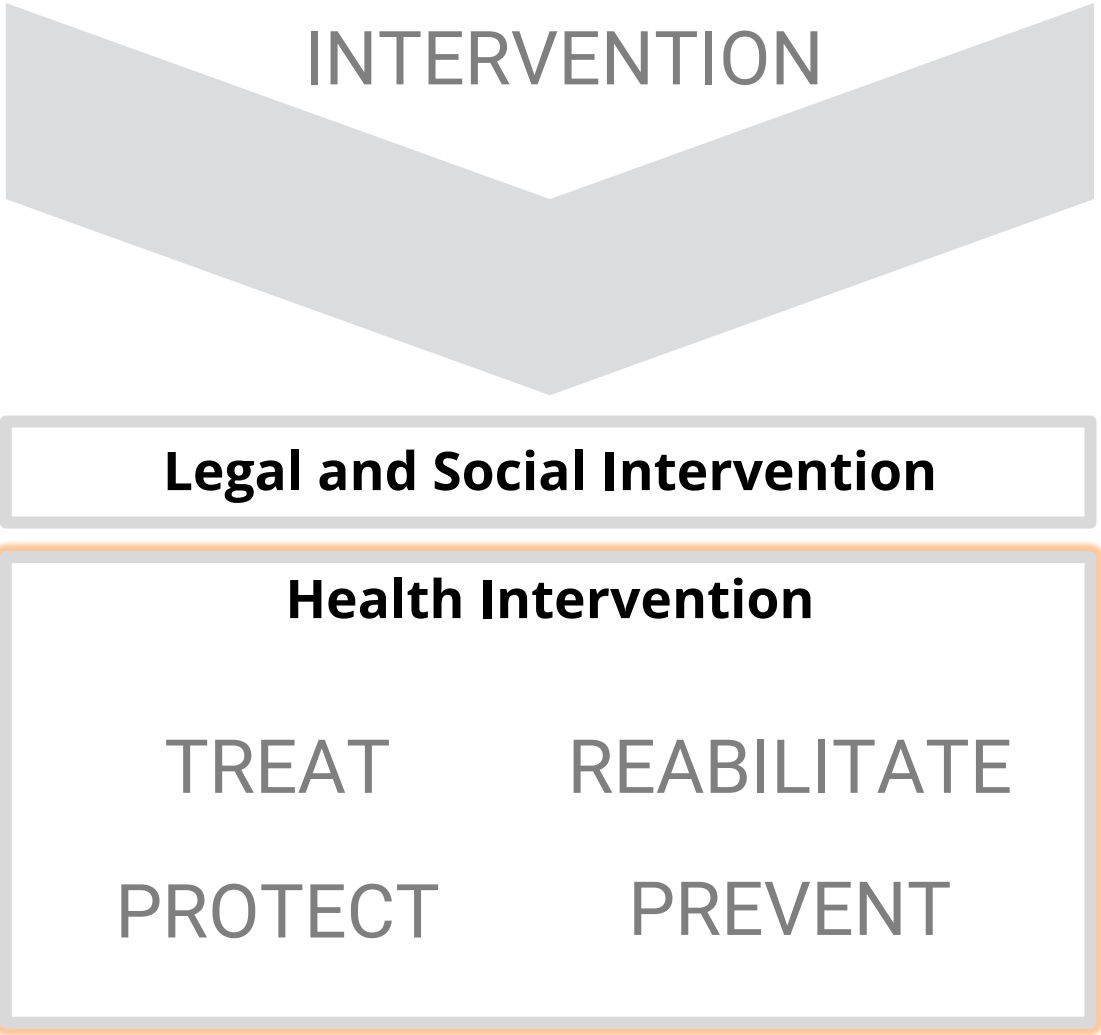
DOMESTIC VIOLENCE

World Health Organization

- Recognized by the World Health Organization (WHO) as a significant public health issue
- High Prevalence Worldwide
- Severe Consequences

International Statistical Classification of Diseases and Related Health Problems

ICD 10 > T74, Y07, Z61



DOMESTIC VIOLENCE

Prevalence (Western Europe)

Children Maltreatment	**~19%**
Intimate Partner Violence	**~20%**
Older Adults Maltreatment	**~19%**

~64% **in institutional context**

Others

An abstract representation of a research study on domestic violence as digital art.
Mariana × Midjourney
Human & AI

DOMESTIC VIOLENCE

Hidden Phenomenon

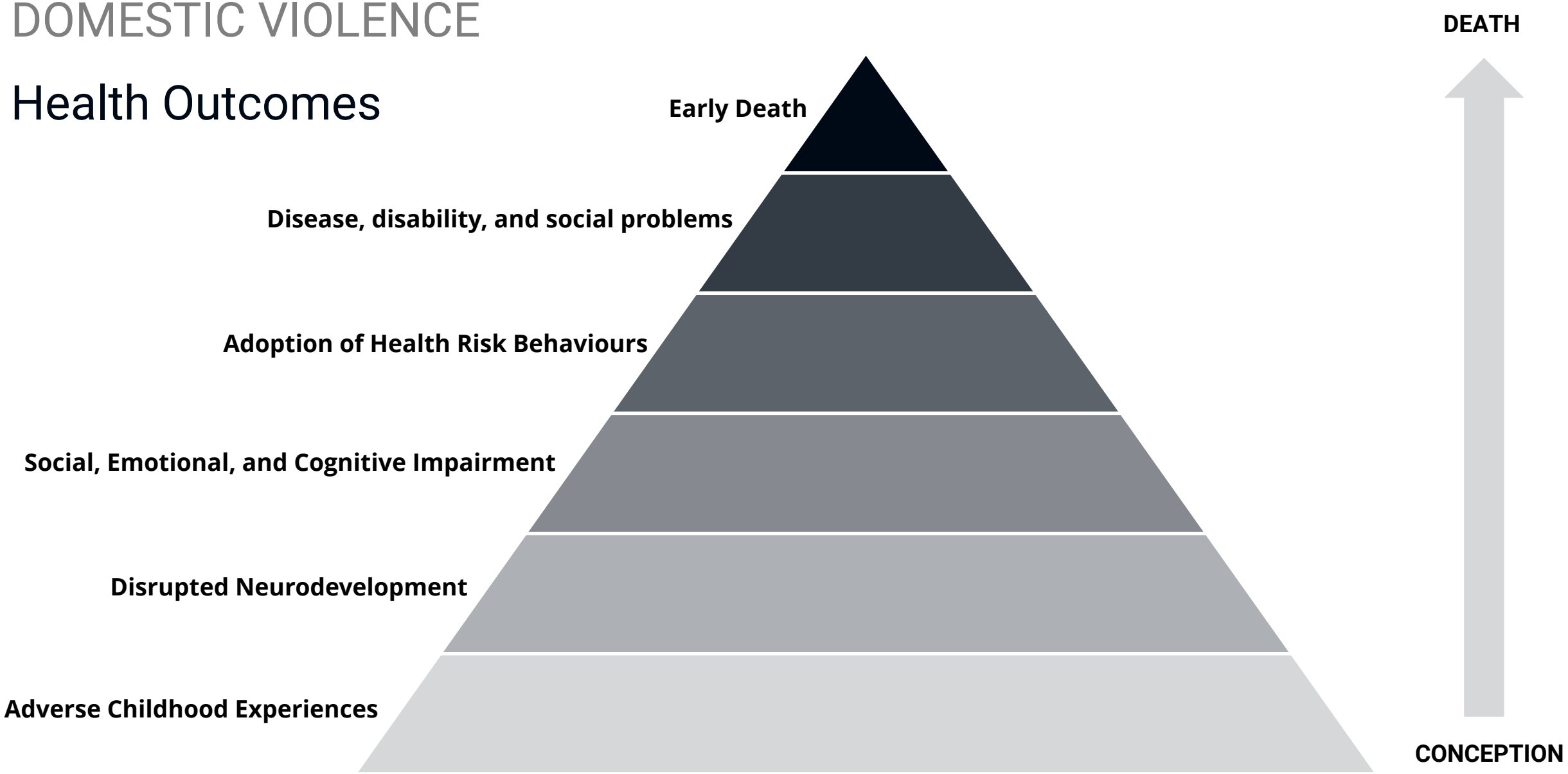
Someone hidding in a dark room because of fear and shame. Face not visible, hands hiding the face. Emotional. Digital art.

Mariana × Midjourney

Human & AI

DOMESTIC VIOLENCE

Health Outcomes



Adapted from Felitti, Vincent J., et al. "Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study." *American journal of preventive medicine* 14.4 (1998): 245-258.

DOMESTIC VIOLENCE

Health Intervention

International Journal of Environmental Research and Public Health

MDPI

Article

Health Outcomes in Women Victims of Intimate Partner Violence: A 20-Year Real-World Study

Maria Clemente-Teixeira [1], Teresa Magalhães [1,2,3,4], Joana Barrocas [5,6], Ricardo Jorge Dinis-Oliveira [1,3,4,7] and Tiago Taveira-Gomes [2,3,8,9,*]

Table 1. Female population observed at LHUM, 2001–2021.

General Female Population of LHUM (n)	Suspected Female Victims of IPV—n (%)		
	G1 (Codes and Clinical Notes)	G2 (Codes)	G3 (Clinical Notes)
72,376	1676 (2.3)	766 (1.1)	931 (1.3)

Table 2. Victims' history of substance consumption (health risk behaviours).

Substance Consumption	General Female Population		Suspected Female Victims of IPV					
			G1		G2		G3	
	n	%	n	%	n	%	n	%
Tobacco	12,356	17.1	395	23.6	200	26.1	199	21.4
Alcohol	274	0.4	22	1.3	19	2.5	4	0.4
Drugs	54	0.1	8	0.5	7	0.9	1	0.1

DOMESTIC VIOLENCE

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Maria Clemente-Teixeira [1], Teresa Magalhães [1,2,3,4], Joana Barrocas [5,6], Ricardo Jorge Dinis-Oliveira [1,3,4,7] and Tiago Taveira-Gomes [2,3,8,9,*]

Table 3. Victims' history of traumatic injuries and intoxications (medicolegal aetiology unknown).

Traumatic Injuries and Intoxications	General Female Population		Suspected Female Victims of IPV					
			G1		G2		G3	
	n	%	n	%	n	%	n	%
Bone fracture	23,998	33.2	796	47.5	409	53.4	394	42.3
Bone dislocation	1828	2.5	64	3.8	31	4.1	35	3.8
Open wound	17,835	24.6	621	37.1	307	40.1	322	34.6
Superficial injury	1850	2.6	76	4.5	43	5.6	35	3.8
Crushing injury	401	0.6	17	1	6	0.8	11	1.2
Burns	2161	3	76	4.5	40	5.2	35	3.8
Intoxications	9737	13.5	408	24.3	206	26.9	200	21.5

DOMESTIC VIOLENCE

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Table 4. Victims' mental health conditions.

Mental Health Conditions	General Female Population		Suspected Female Victims of IPV					
			G1		G2		G3	
	n	%	n	%	n	%	n	%
Headaches	1793	2.5	79	4.7	52	6.8	28	3.0
Sleep disorders	5016	6.9	285	17.0	191	24.9	98	10.5
Eating disorders	133	0.2	9	0.5	6	0.8	4	0.4
Poor health perception	1348	1.9	58	3.5	36	4.7	24	2.6
Unspecified chronic pain	6947	9.6	286	17.1	179	23.4	114	12.2
Memory disorders	252	0.4	18	1.1	12	1.6	6	0.6
Anxiety disorders	15,552	21.5	699	41.7	440	57.4	271	29.1
Major psychiatric disorder	25,352	35.0	1091	65.1	579	75.6	527	56.6
Posttraumatic stress disorder	74	0.1	13	0.8	10	1.3	3	0.3
Suicidal ideation	212	0.3	36	2.2	19	2.5	19	2.0
Social deprivation	957	1.3	109	6.5	80	10.4	29	3.1
Anxiolytics consumption	37,263	51.5	1276	76.1	670	87.5	627	67.4
Sedatives consumption	18,583	25.7	727	43.4	392	51.2	341	36.6
Antidepressants consumption	28,080	38.8	1156	69.0	624	81.5	551	59.2
Antipsychotics consumption	6209	8.6	418	24.9	208	27.2	217	23.3

DOMESTIC VIOLENCE

Health Intervention

International Journal of *Environmental Research and Public Health*

MDPI

Article

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Maria Clemente-Teixeira [1], Teresa Magalhães [1,2,3,4], Joana Barrocas [5,6], Ricardo Jorge Dinis-Oliveira [1,3,4,7] and Tiago Taveira-Gomes [2,3,8,9,*]

Table 5. Victims' somatic conditions.

Somatic Conditions	General Female Population		Suspected Female Victims of IPV					
			G1		G2		G3	
	n	%	n	%	n	%	n	%
Obesity	12,570	17.3	389	23.2	234	30.5	162	17.4
Hypercholesterolemia	27,750	38.3	772	46.0	382	49.8	398	42.7
Metabolic syndrome	44,298	61.2	1 232	73.5	623	81.3	619	66.4
Type 2 diabetes	3354	4.6	157	9.3	92	12.0	69	7.4
Non-alcoholic fatty liver disease	436	0.6	35	2.0	17	2.2	19	2.0
Chronic obstructive pulmonary disease	416	0.6	17	1.0	8	1.0	9	1.0
Hypertension	13,262	18.3	421	25.1	267	34.9	163	17.5
Early heart disease	254	0.4	12	0.7	5	0.7	7	0.8
Myocardial infarction	212	0.3	11	0.7	5	0.7	6	0.6
Ischaemic stroke	893	1.2	55	3.3	30	3.9	26	2.8
Haemorrhagic stroke	63	0.1	4	0.2	3	0.4	1	0.1
Chronic kidney disease	544	0.8	24	1.4	10	1.3	15	1.6
Inflammatory pelvic disease	210	0.3	10	0.6	4	0.5	6	0.6
Urinary tract infection	3709	5.1	122	7.3	64	8.4	60	6.4
Sexually transmitted infections	1106	1.5	57	3.4	37	4.8	20	2.2
Preeclampsia	592	0.8	20	1.2	15	2.0	5	0.5
Desired pregnancy	1688	2.3	31	1.9	15	2.0	16	1.7
Undesired pregnancy	190	0.3	8	0.5	7	0.9	1	0.1
Spontaneous abortion	1767	2.4	82	4.9	45	5.9	38	4.1
Voluntary abortion	609	0.8	25	1.5	16	2.1	9	1.0
Chronic immune infective disorder	1085	1.5	32	1.9	15	2.0	17	1.8
Asthma	4583	6.3	141	8.4	72	9.4	70	7.5
Cancer	7550	10.4	253	15.1	124	16.2	131	14.1
Cervical cancer	248	0.3	10	0.6	6	0.8	4	0.4

DOMESTIC VIOLENCE

Predictive Algorithm

A predictive algorithm at the service of the security authorities to predict violence; use references from the minority report film; sci fi ambience; digital art

Mariana × Midjourney

Human & AI

PREDICTIVE ALGORITHM

1. Detection
2. Report
3. Diagnosis
4. Forensic Evaluation

GENERAL OBJECTIVE

A predictive algorithm at the service of the security authorities to predict violence; use references from the minority report film; sci fi ambience; digital art
Mariana × Midjourney
Human & AI

OBJECTIVE

To develop of a **predictive model for suspected intimate partner violence (IPV)** based on latent risk factors that can be identified in the electronic health records regularly produced by healthcare professionals in the context of clinical practice.

SPECIFIC OBJECTIVES

- Estimate the **prevalence and incidence of IPV** in Portugal
- Compare the **risks of short and long-term unfavorable health outcomes** in the IPV population versus the general population
- **Identify people at increased risk of IPV** at a given point of contact with the health system
- Identify people at increased risk of **recurrent IPV** at a given point of contact with the health system
- **Empower health institutions** with actionable data to predict and identify IPV at every contact with patients

STUDY DESIGN

Health Intervention

TARGET POPULATION

- Individuals aged 16 or older served by the institution.

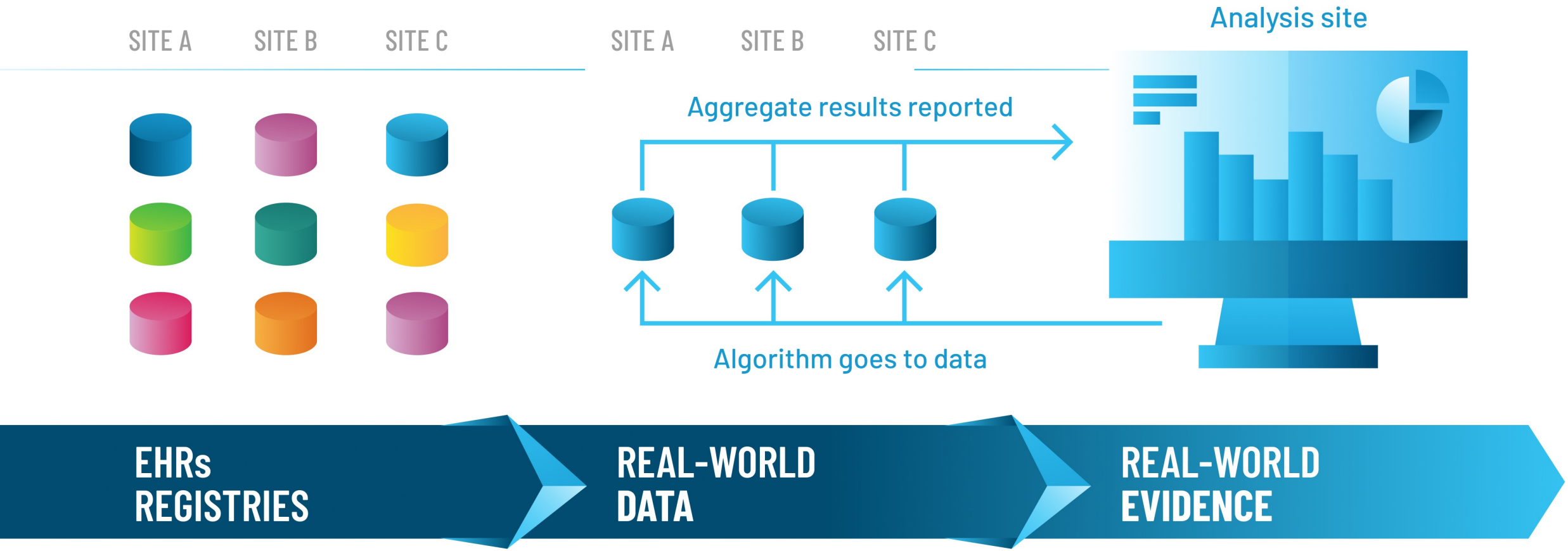
INCLUSION CRITERIA

- Patients aged 16 or older with at least one electronic clinical record in the last 365 days of observation and at least one medical consultation with the family doctor in the last 3 years prior to the index date.

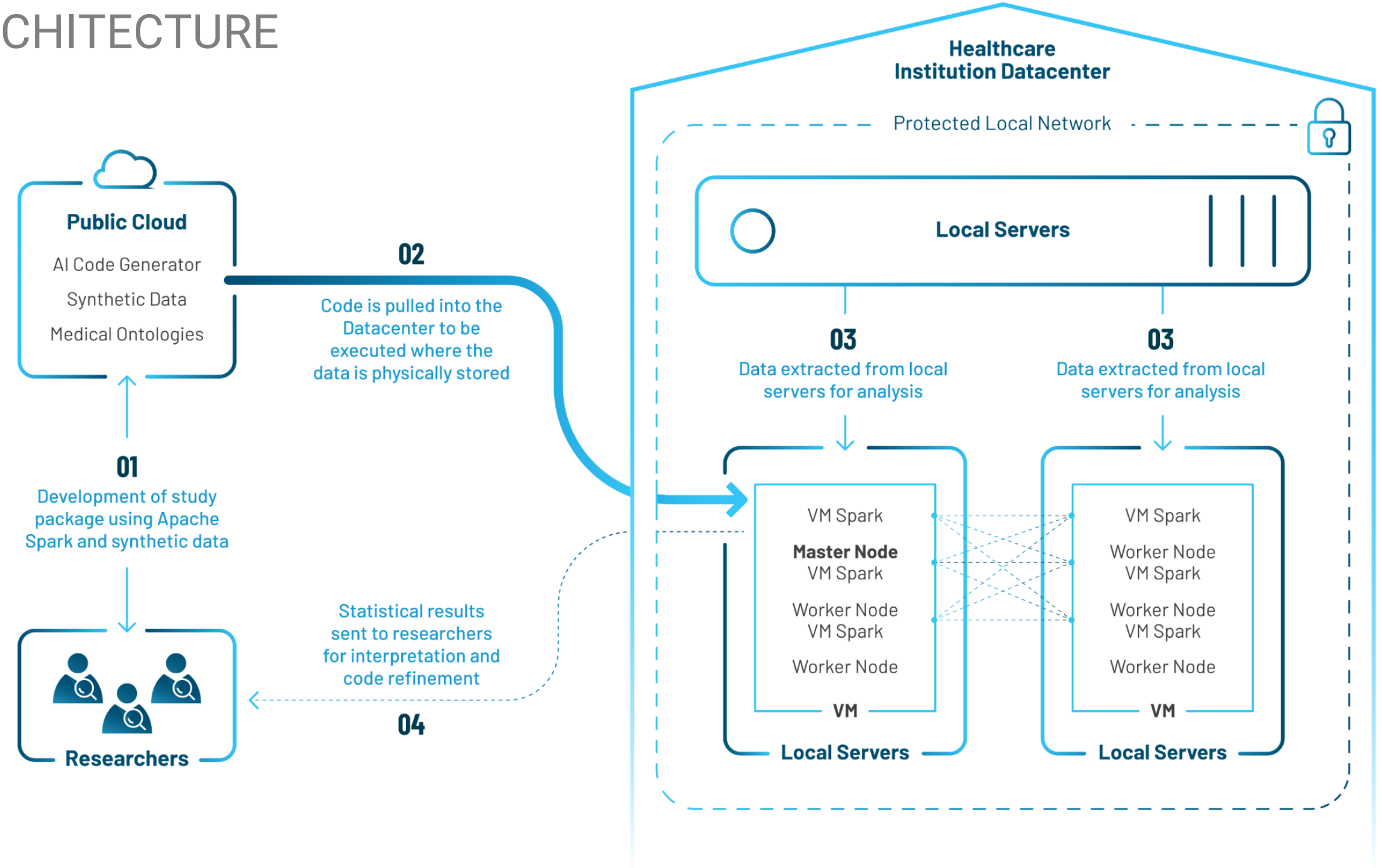
EXCLUSION CRITERIA

- Inability to determine the patient's gender.
- Inability to determine the patient's age.

IMPLEMENTATION PROCESS



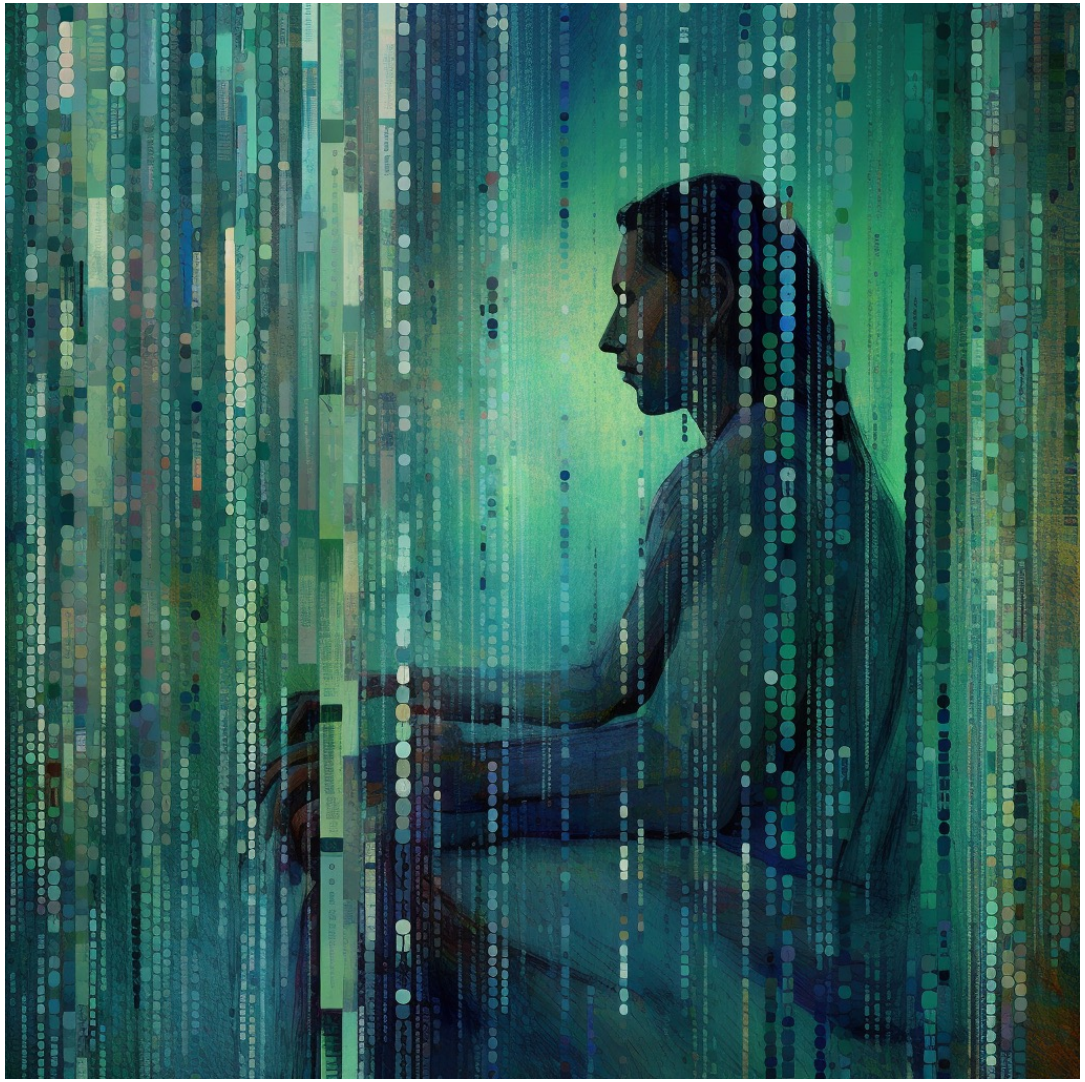
ARCHITECTURE



LIMITATIONS

A very large futuristic datacenter, sci fi ambience, digital art.
Mariana × Midjourney
Human & AI

LIMITATIONS



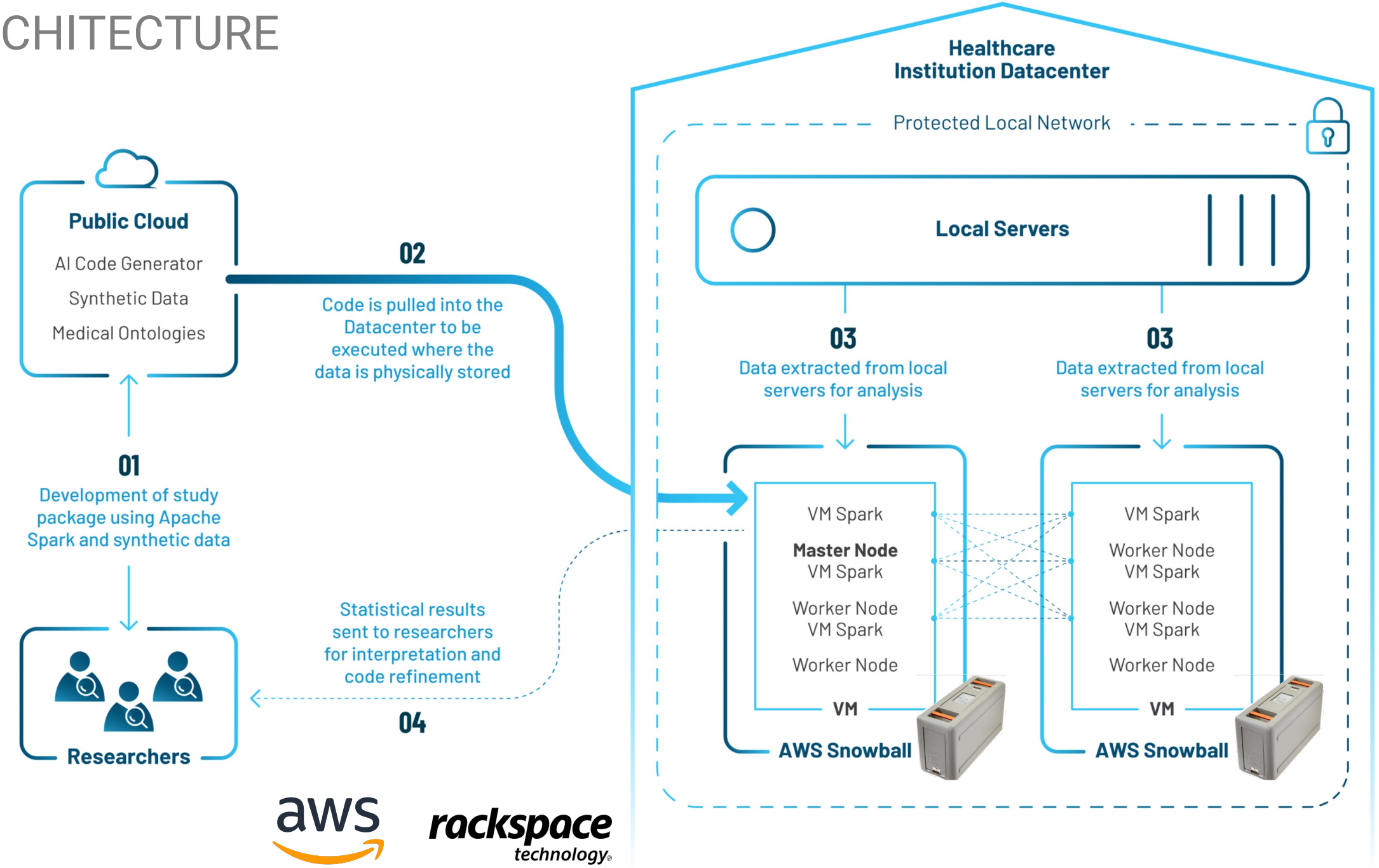
An abstract representation of data privacy leaks in the context of health data, as digital art.
Mariana × Midjourney
Human & AI

AWS SNOWBALL DEVICES

aws

rackspace technology®

ARCHITECTURE



ARCHITECTURE

- Enables evidence generation using **in-house data**
- **No need to share data** with third parties
- Facilitates **unrestricted EHR data research**

high solution acceptance by healthcare professionals, administrations, ethical committees, data protection officers, and IT departments

Lock symbolizing data security, line chart symbolizing evidence generation.
Mariana × Midjourney
Human & AI

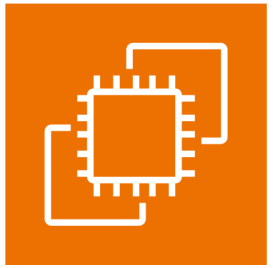
Cloud Scalability and Elasticity

- Enables horizontal **scalability of hardware** resources
- Elasticity using SBE devices only when needed with **minimal configuration**
- **More cost-effective** than traditional server solutions for processing Apache Spark clusters

A network of computers or servers (symbolizing hardware resources) in the cloud.
Mariana × Midjourney
Human & AI

Use of Cloud APIs

- **Adoption of standard technologies** (S3, EC2, etc.) with a strong technical community
- Likely increase in adoption due to controlled **exposure to cloud technologies**
- **Builds technical expertise** and trust in the cloud provider



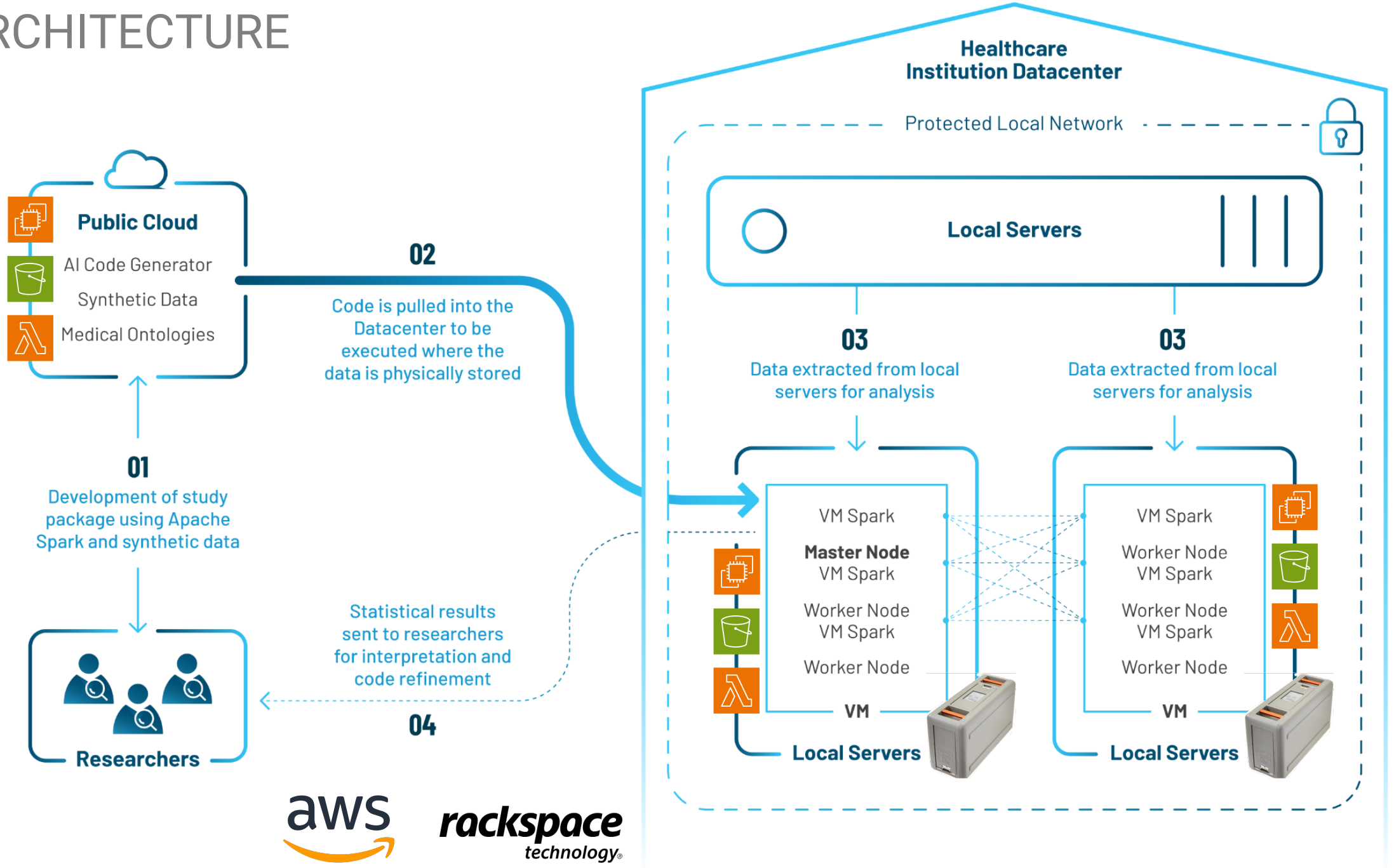
Amazon Elastic Compute Cloud (Amazon EC2)

AWS Lambda

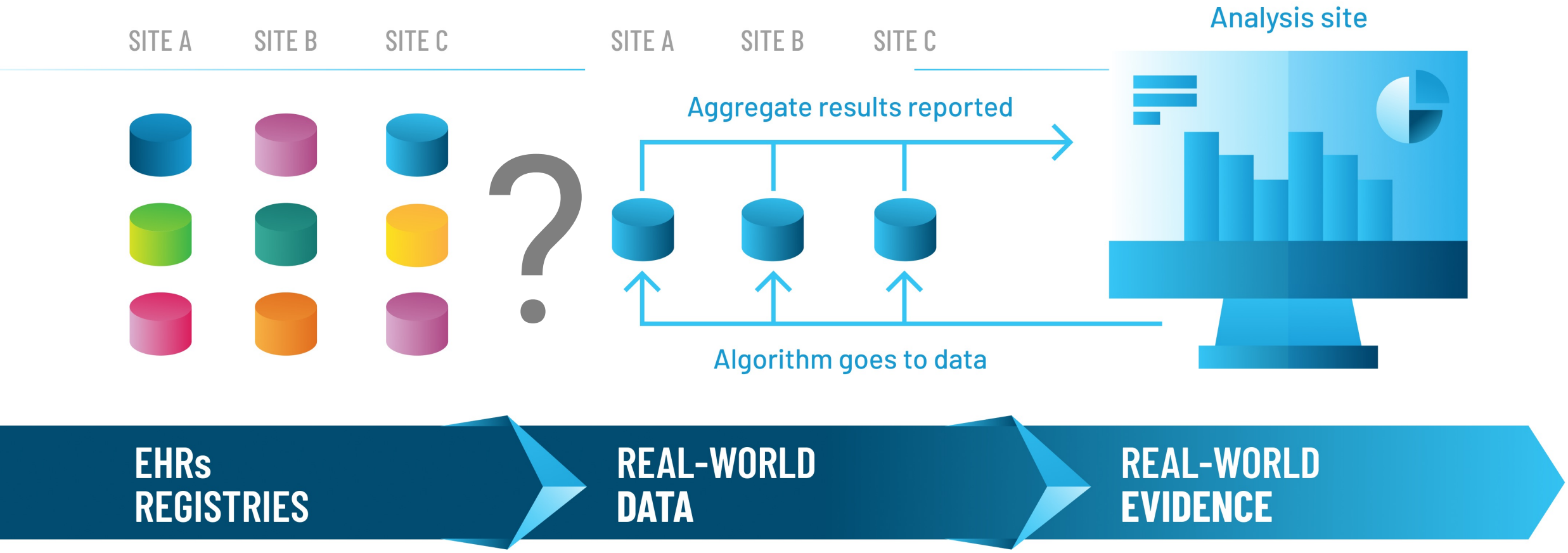
Amazon Simple Storage Service (Amazon S3)

AWS Snowball

ARCHITECTURE



IMPLEMENTATION PROCESS



DATA HARMONIZATION

OMOP Common Data Model

The Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) is an open community data standard, designed to standardize the structure and content of observational data and to enable efficient analyses that can produce reliable evidence.

"The OMOP Common Data Model serves as the foundation of all our work in the OHDSI community, and I'm proud that our open community data standard has been so widely adopted and so extensively used to generate reliable evidence."

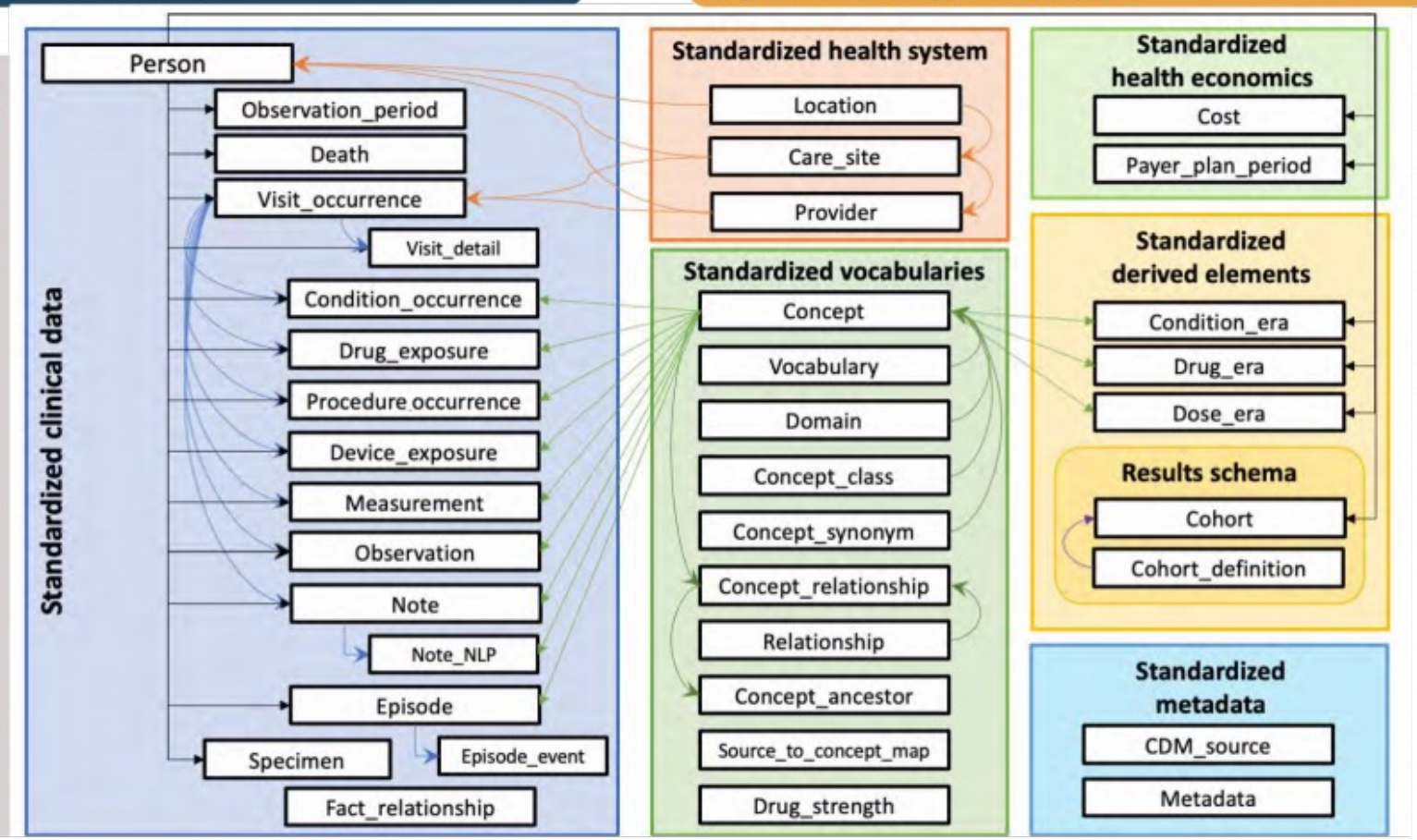
- Clair Blacketer
2020 Titan Award for Data Standards recipient

OMOP CDM By The Numbers

37 tables
- 17 to standardize clinical data
- 10 to standardize vocabularies

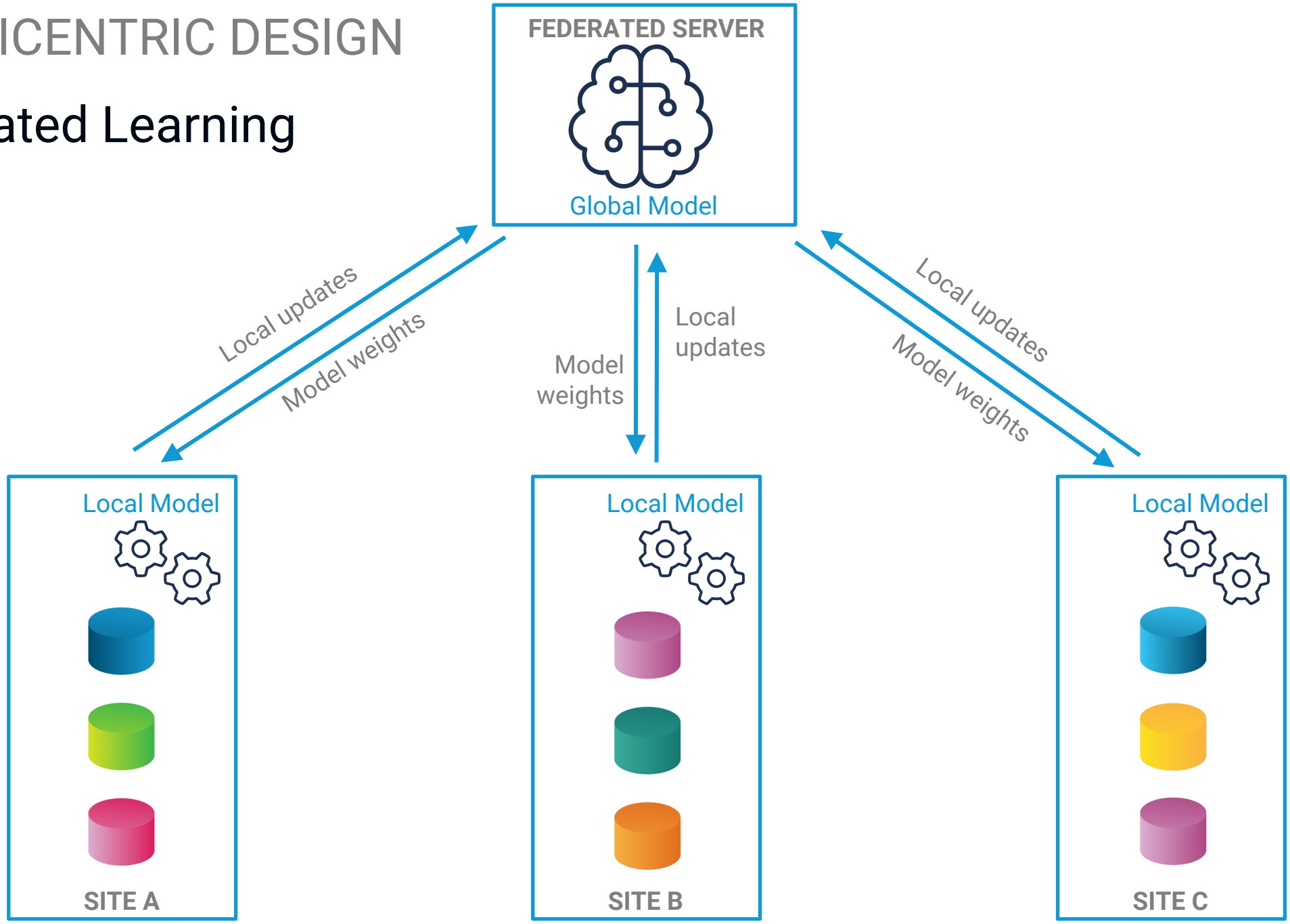
394 fields
- 193 with _id to standardize identification
- 101 with _concept_id to standardize content
- 43 with _source_value to preserve original data

1 Open Community Data Standard



MULTICENTRIC DESIGN

Federated Learning

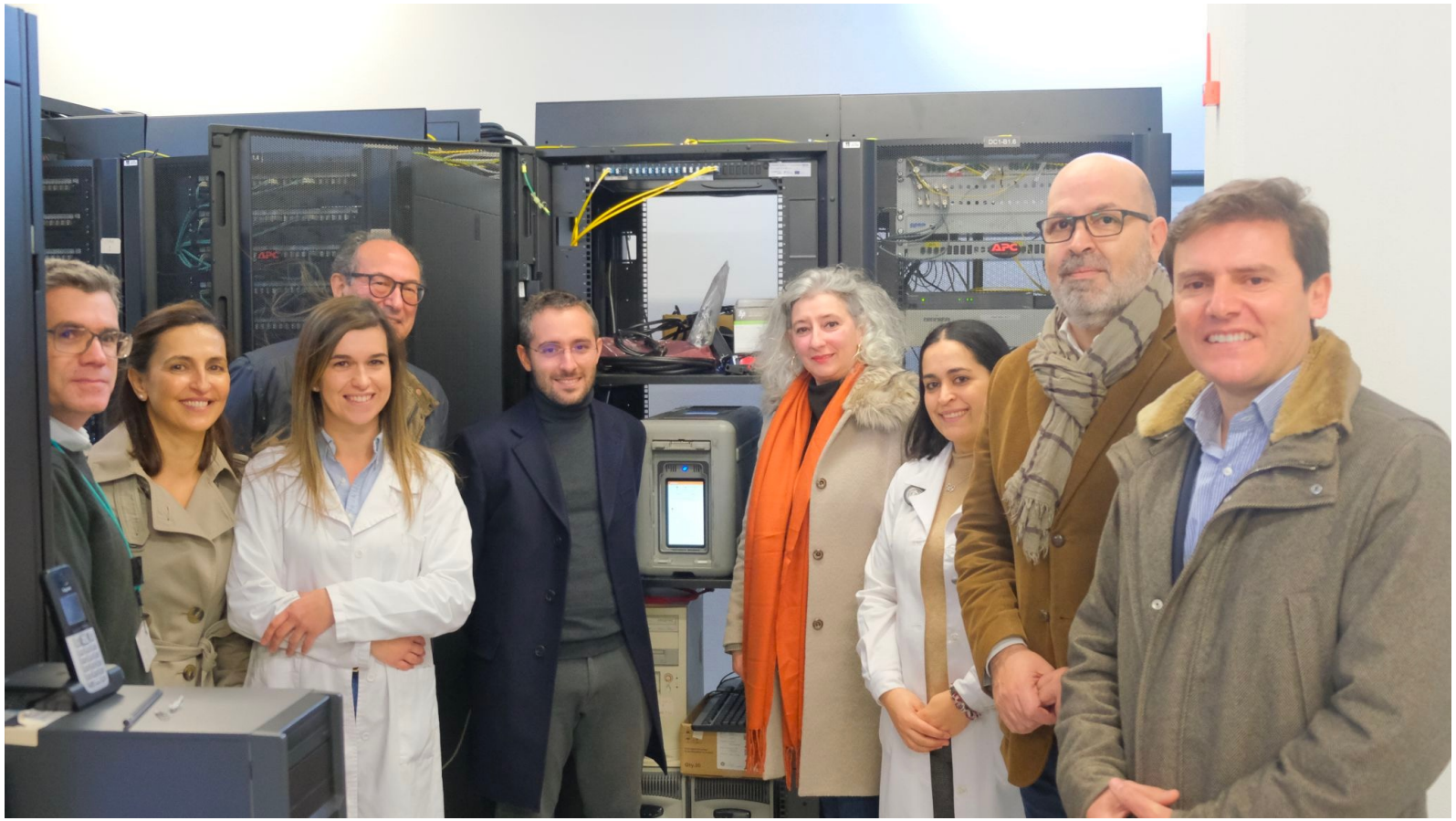


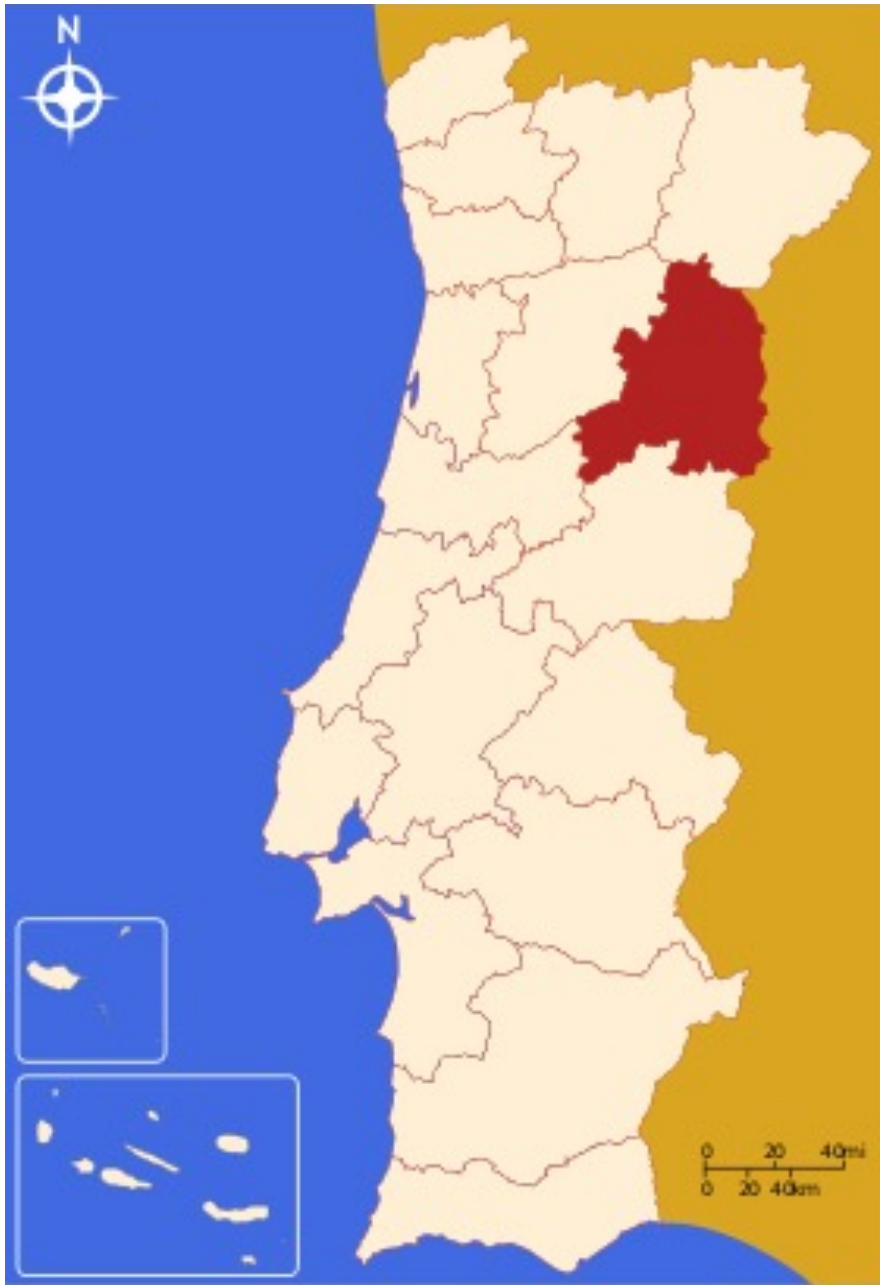
MULTICENTRIC DESIGN

Name	Region and Setting	Nº centres per care level	Patients	% Population
ULSM Unidade Local de Saúde de Matosinhos	Matosinhos North Urban	20 primary care centres 1 hospital	177.175	1.7%
ULSAM Unidade Local de Saúde do Alto Minho	Viana do Castelo North Urban + Rural	38 primary care centres 2 hospitals	249.161	2.4%
ULSNE Unidade Local de Saúde do Nordeste	Bragança North Urban + Rural	25 primary care centres 2 hospitals	132.389	1.3%
ULSG Unidade Local de Saúde da Guarda	Guarda Center Urban + Rural	18 primary care centres 2 hospitals	151.279	1.5%
ULSCB Unidade Local de Saúde de Castelo Brance	Castelo Branco Centre Urban + Rural	11 primary care centres 1 hospitals	74.517	0.7%
SESARAM Serviço de Saúde da Região Autónoma da Madeira	Madeira Islands Urban + Rural	47 primary care centres 4 hospitals	250.769	2.4%
Total	**All regions**	**159 primary care centres** **12 hospitals**	**1.035.290**	**10.0%**

MULTICENTRIC DESIGN

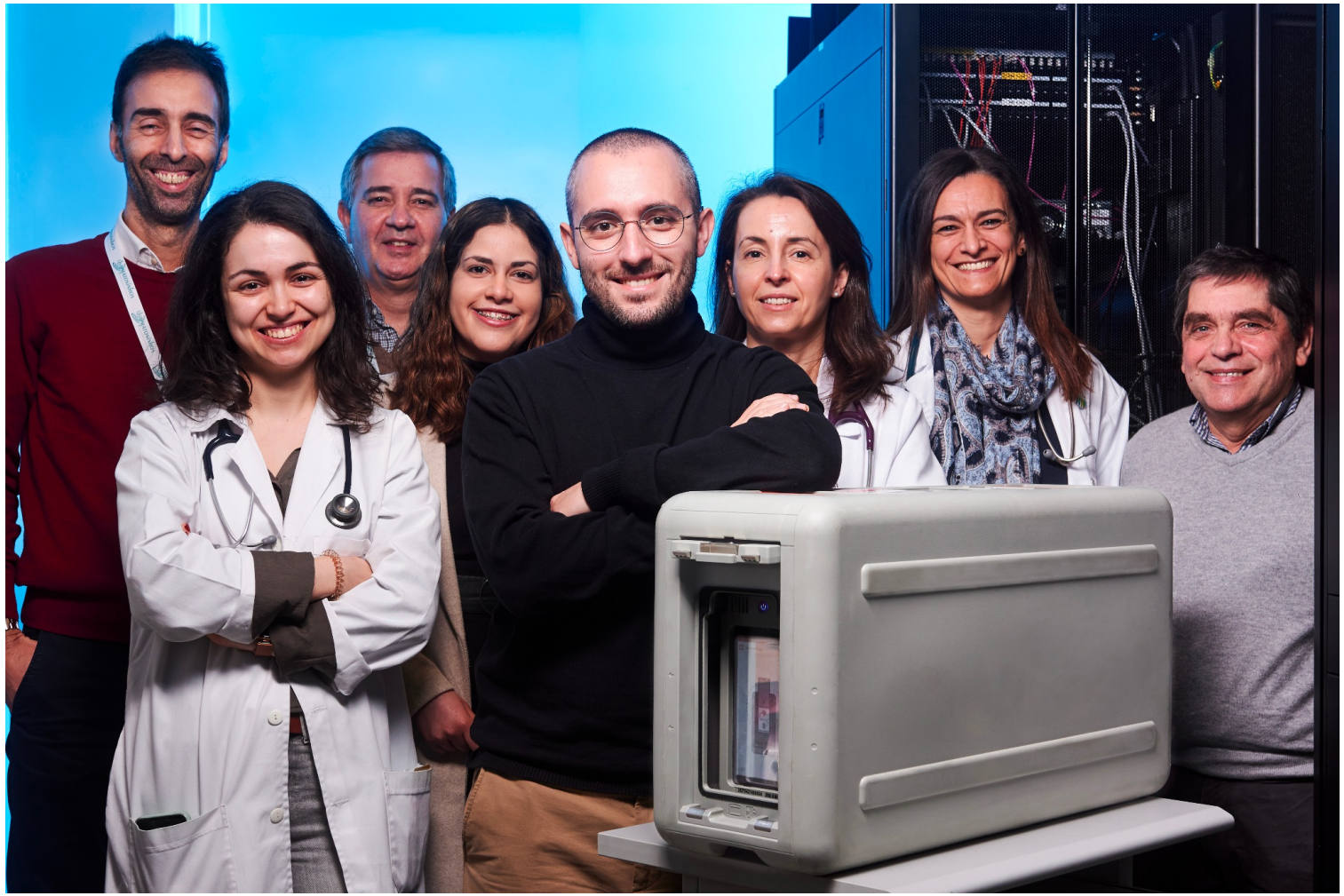
Unidade Local de Saúde da Guarda
N = 143 019

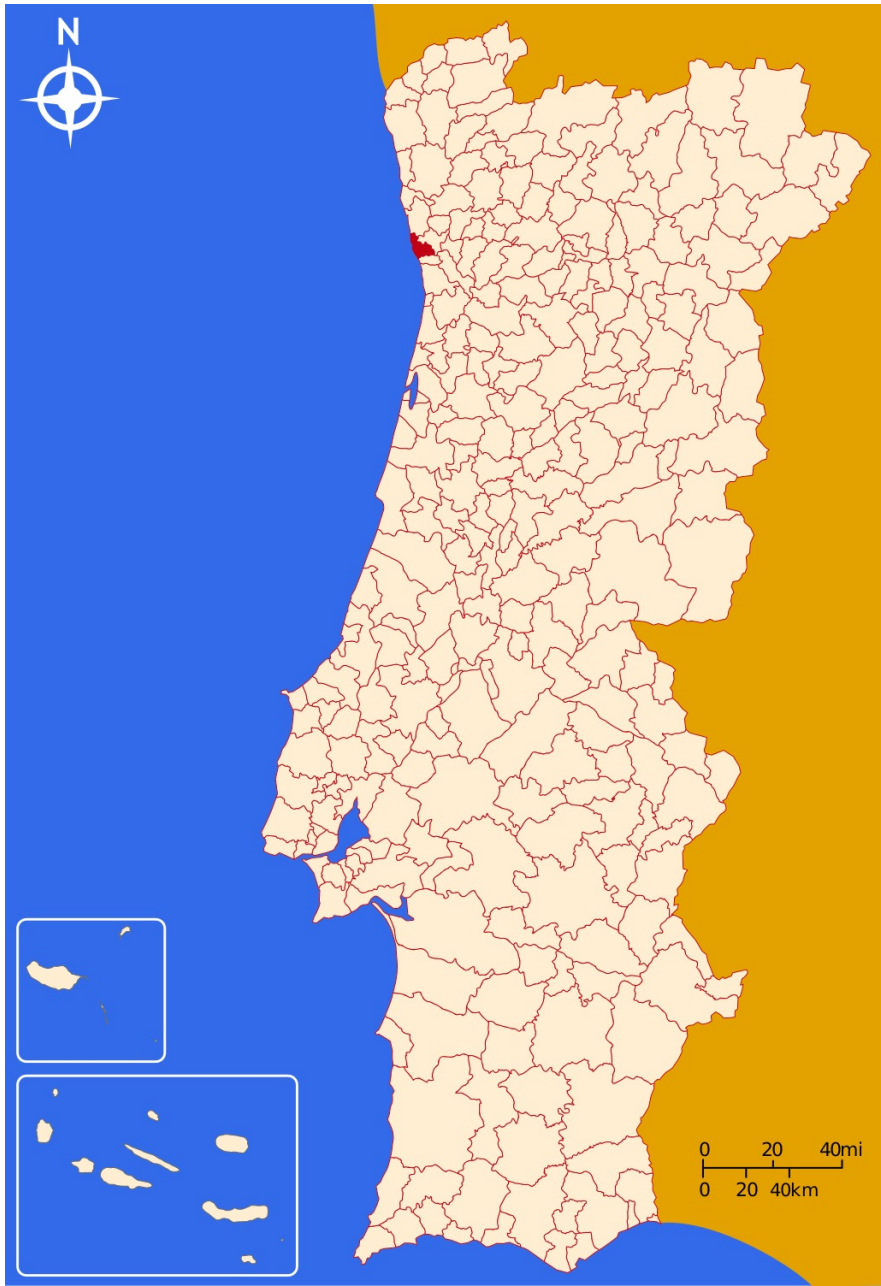




MULTICENTRIC DESIGN

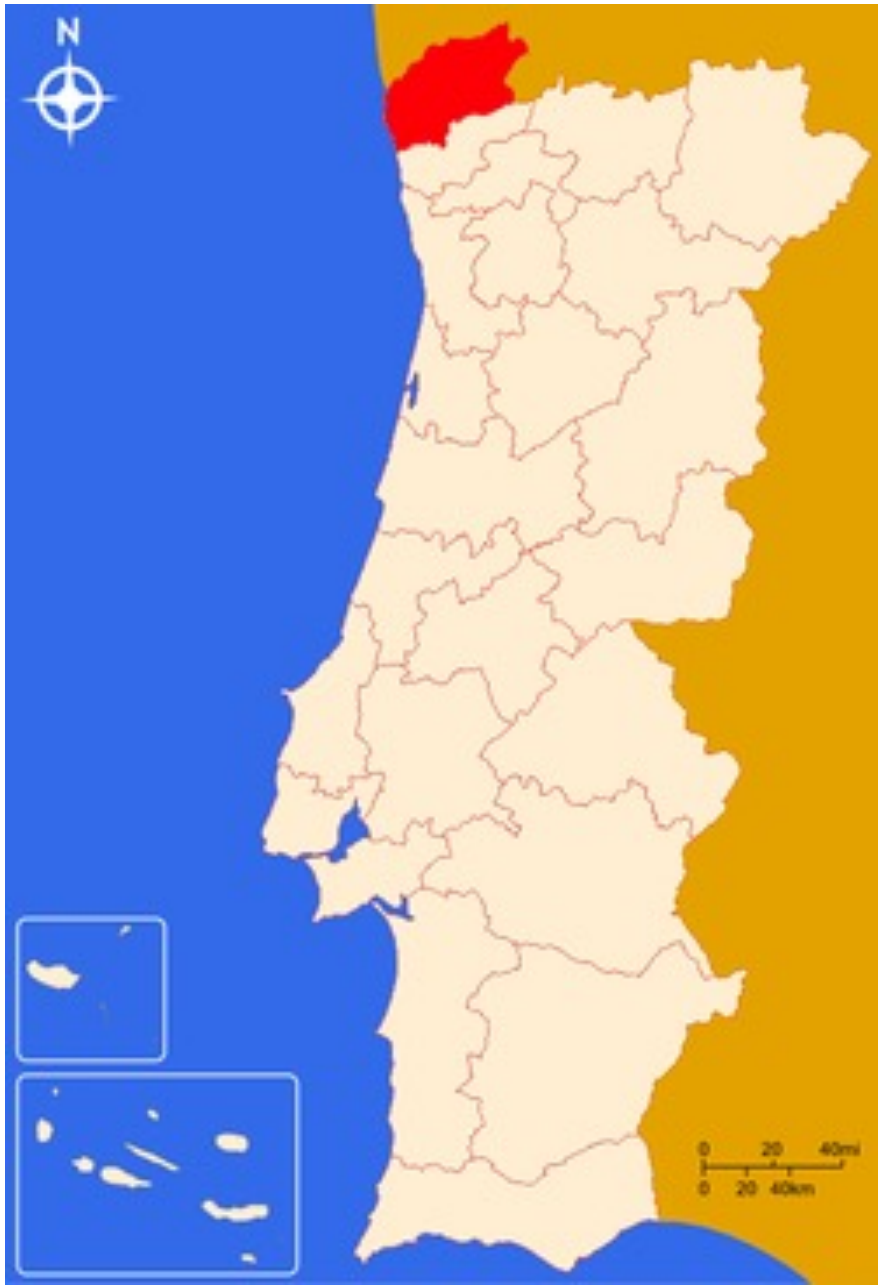
Unidade Local de Matosinhos
N = 172 669





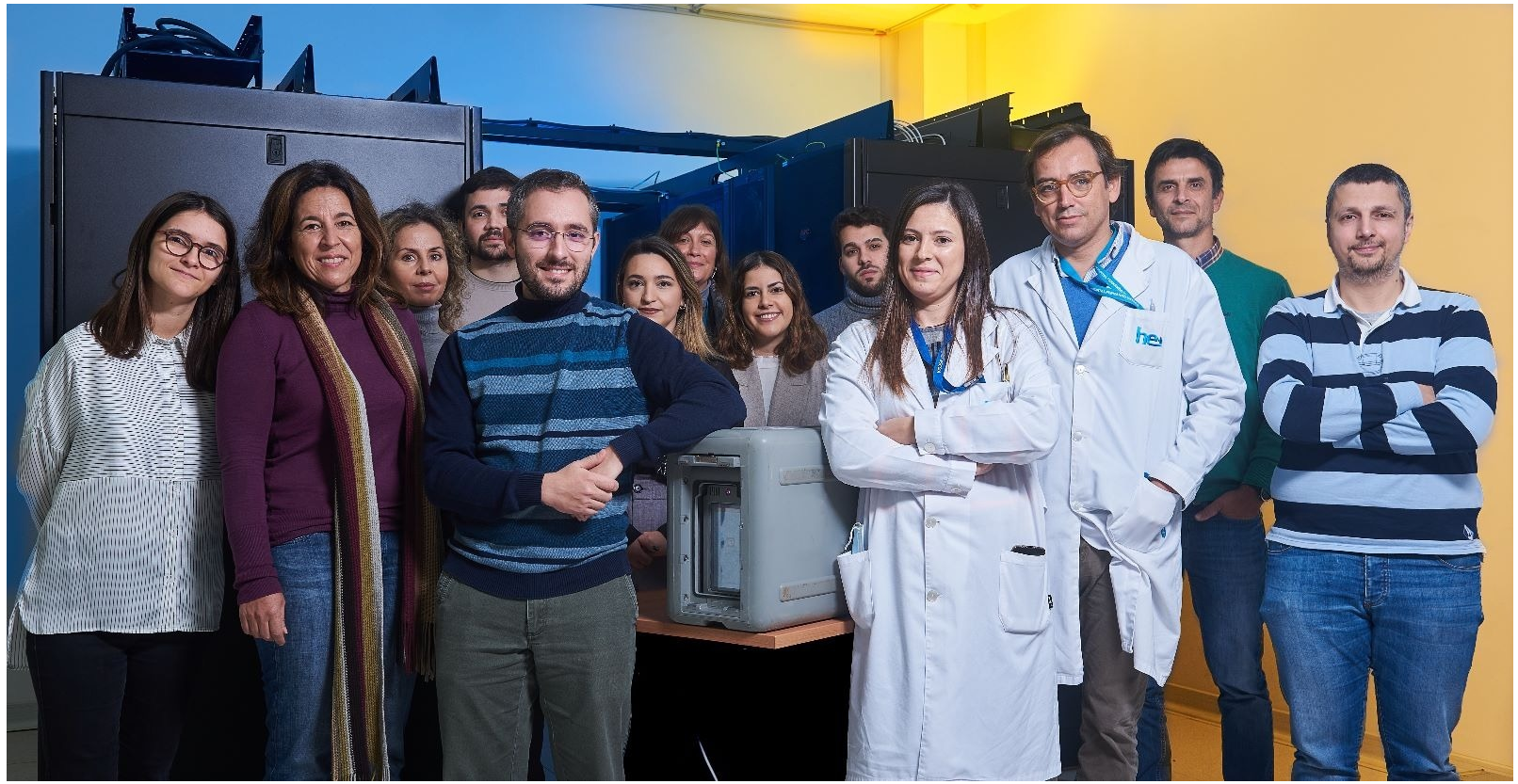
MULTICENTRIC DESIGN

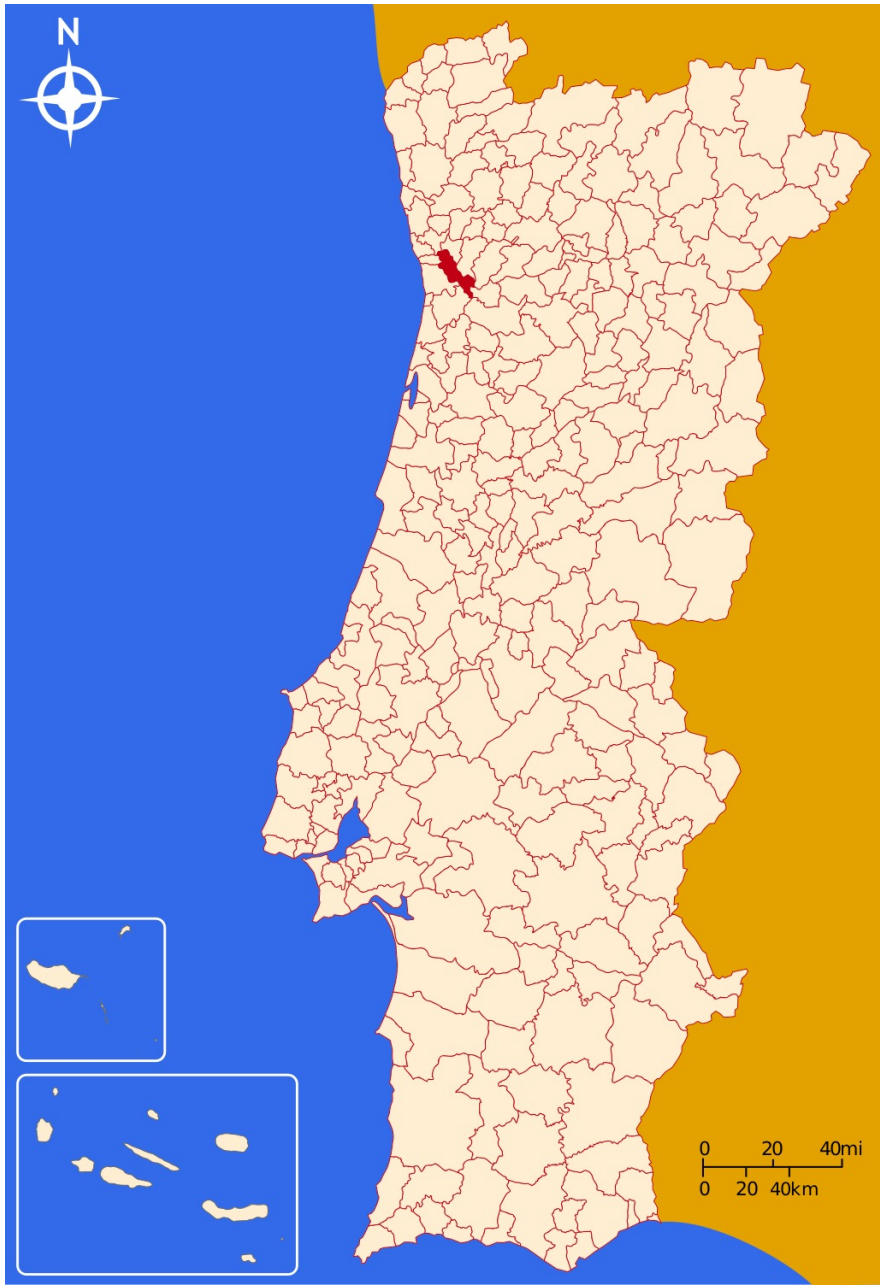
Unidade Local de Saúde do Alto Minho
N = 230 954



MULTICENTRIC DESIGN

Hospital Escola Fernando Pessoa, Gondomar
N = 164 255





NEXT STEPS

Q1 Infrastructure implementation

Q2 Finish harmonization

Q2 Develop algorithm

Q3 Refine algorithm

Q4 Refinement and publication

CONCLUSION

- Fosters **Multidisciplinary Cooperation**
- **Overcomes Hardware and Regulatory Constraints**
- Bolsters **Trust** and **Acceptance**
- Promotes **Cost-Effective** Research
- Facilitate **Evidence-based Decision Making**

6th Barcelona TechnoWeek

Cloud use case 1: Medicine

MARIANA CANELAS PAIS

SCIENTIFIC COMPUTING IN THE CLOUD