

Vertical LLMs in cardiology: from heart failure to the clinical copilot

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The Promise: Effortless assistance leveraging all of humanity's medical data

Dedicated design and data sources:



Domain expertise: knowledge extracted from multi-omics research, EHRs, disease ontologies, ...



Regulatory compliance: designed to align with regulatory and institutional requirements



Interoperable: integrate with medical software effortlessly

Use cases include:



Diagnostics & Prognostics



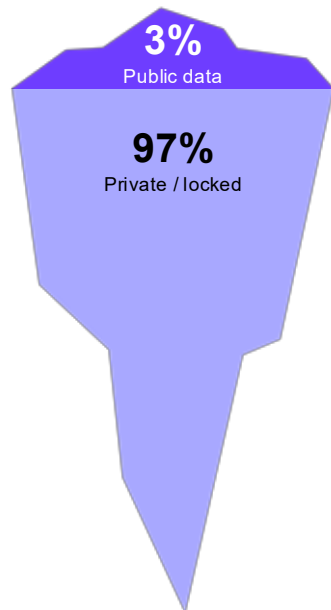
Treatment optimization & personalized medicine



Automated administrative support



The Problem: Domain intelligence requires domain-specific data



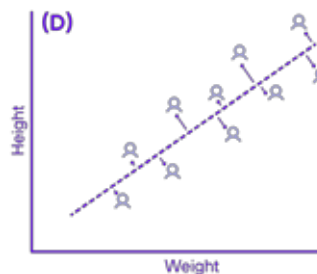
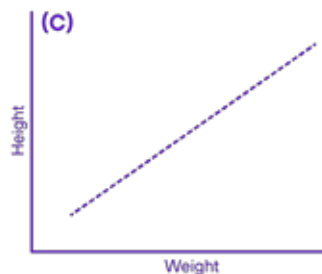
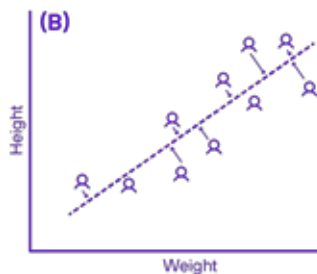
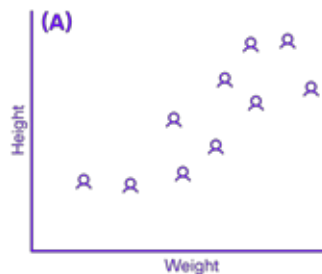
Most medical data is
private and goes unused
[WEF, 2024]

- >95% of medical domain data is personal information;
- Such data cannot be re-used for AI training under privacy legislation and ethics protocols;
- ***Domain intelligence requires access to such data during training;***
- Furthermore, without proprietary innovation, EU data governance cannot be guaranteed.

The Solution: privacy-preserving data generation

Name	Height (cm)	Weight (kg)
John	181	77
⋮	⋮	⋮
Elsa	164	59

Real data



Name	Height (cm)	Weight (kg)
Tim	176	72
⋮	⋮	⋮
Luise	171	63

Synthetic data

The Demand: Recognized growing need for biomedical innovation



Dire need for medical innovation

European Health Data Space (EHDS) Regulation

Foster harmonized European framework for secondary data use for research, innovation, public health, policy-making and personalised medicine (effective 2029)



Need for assessment of medical technologies

Health Technology Assessment (HTA) Regulation

Establish harmonized, faster procedures requiring Joint Clinical Assessments to be completed within 30 days after the authorisation of the medicine



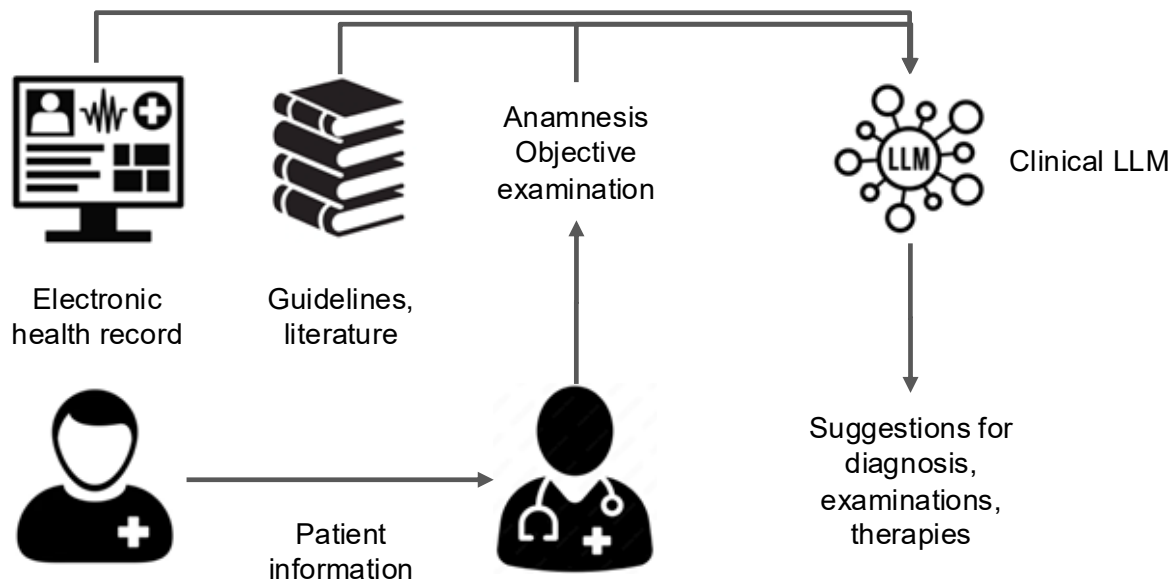
Medical innovation as public interest

Legge 132/2025

Enhance the secondary use (incl. AI) of health data already collected in clinical practice, registries, observational studies, and follow-ups.



Cardiology Clinical LLM: Building clinical-grade assistance



Demo

aindo



Sala d'attesa

Storia clinica
completata - modifica

Referto
attivo in corso

MB

Maria Bianchi - 67 anni - F
CF 8NCMBAS9658H0DT - Visita del 28/04/2026 - Follow-up cardiologico

ANAMNESI
 Età: 67 anni.
 Fattori di rischio: Iperensione arteriosa, dislipidemia, familiarità positiva per cardiopatia ischemica (madre, IMA a 70 anni).
 Storia cardiologica: Cardiopatia ipertensiva (I11.9, dal 02/11/2024). Ecocardiogramma 18/03/2025: FEV5 58%, lieve IVS concentrica.
 Storia extra-cardiologica: Dislipidemia in trattamento (E78.0, dal 03/2021). Non altre patologie di rilievo.

MOTIVO DELLA VISITA
 Controllo cardiologico programmato (follow-up a 6 mesi dall'ultima visita del 12/10/2025).

VISITA OGGIERA
 La paziente riferisce dispnea da sforzo (NYHA II) da circa 3-4 mesi, insorta soprattutto durante la salita delle scale, in assenza di episodi a riposo.
 Nega DT, episodi sincopeali, palpitazioni.

TERAPIA IN ATTO
 - Ramipril 5 mg, 1 cpr al mattino (ATC: C09MA06) — dal 14/05/2025
 - Atorvastatina 20 mg, 1 cpr alla sera (ATC: C10AA05) — dal 03/2021
 Aderenza terapeutica invariata rispetto all'ultima visita (12/10/2025).

AI - Revisione
 Contribuisci - Inizia guida - Segni mancanti

... Anamnesi

QUALITÀ REPORTO
Diagnosi: codifica della dispnea assente
 Dispnea NYHA II di nuova insorgenza menzionata in diagnosi senza codice ICD-10. Suggerito R06.0 (Dispnea) per coerenza con i Ruxel F51/SDO.

... Diagnosi - [codifica ICD](#)

MIGLIORA STESURA
 + DISTINTO

Riti validi; pause libere; soffi assenti. Edemi distali assenti.

Tiri cardiaci validi sui due foci; pause libere, soffi assenti. Edemi declivi assenti.

Prescrizione pratica più rigorosa nel registro cardiologico.

... Osservazioni - [qualità referto](#)

☒ **Applica**
☐ Ignora

MIGLIORA STESURA
 + TERAPIA CONGIUNTA

Considerare ottimizzazione del controllo pressorio (PA ed eme sopra target ESC nonostante terapia in atto).

Valutare add-on di amlodipina 5 mg/die o aumento ramipril a 10 mg/die per il raggiungimento del target ESC <130/80 mmHg.

The Opportunity: Invest in secure federated data infrastructure

Within 3-5 years:

- EHDS secondary use roll-out;
- AI Act's high-risk provisions come into force;
- Regulatory agencies publish guidance.

Meanwhile:

- Federated architectures and synthetic data technologies achieve clinical-grade utility;
- These foster infrastructures and institutional partnerships for evidence propagation.

The organizations that understand today that federated infrastructure, privacy-preserving data generation, and documented AI governance are **not compliance costs but strategic assets** will find, in 2028, that they have already built what the regulation will then require.

A Global Echo, Not a European Peculiarity



US
Sentinel 3.0



EU
DARWIN



JAPAN
MID-NET



CHINA
Hainan Boao
Lecheng