# Creating knowledge-transfer hubs inside universities

## St Thomas' MedTech Hub

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**School of Biomedical Engineering & Imaging Sciences**

KING'S HEALTH PARTNERS

NHS
Guy's and St Thomas'
NHS Foundation Trust

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# MedTech – Market Size

The UK is among the leaders in the development of healthcare technologies, a market of **world-wide value of over £260bn**.

The **UK holds approximately 13%** (of which 10% is local production) of the total EU/EEA market (£100bn) (third within the EU), exporting approximately £6.6bn worth of products.

The market is predominantly made of SMEs and start-ups (over 85%).

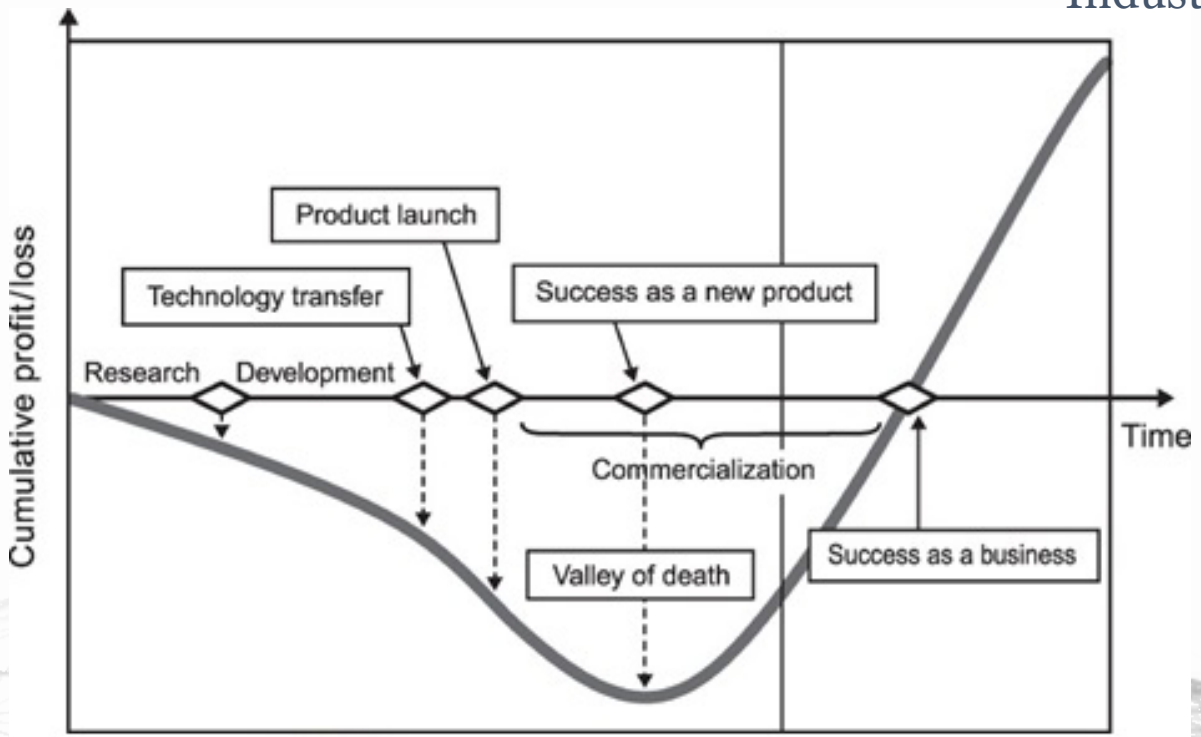
Merge and acquisition is the norm, even at large scale (Medtronic-Covidien merger 43$B).

# The knowledge to impact pathway in MedTech

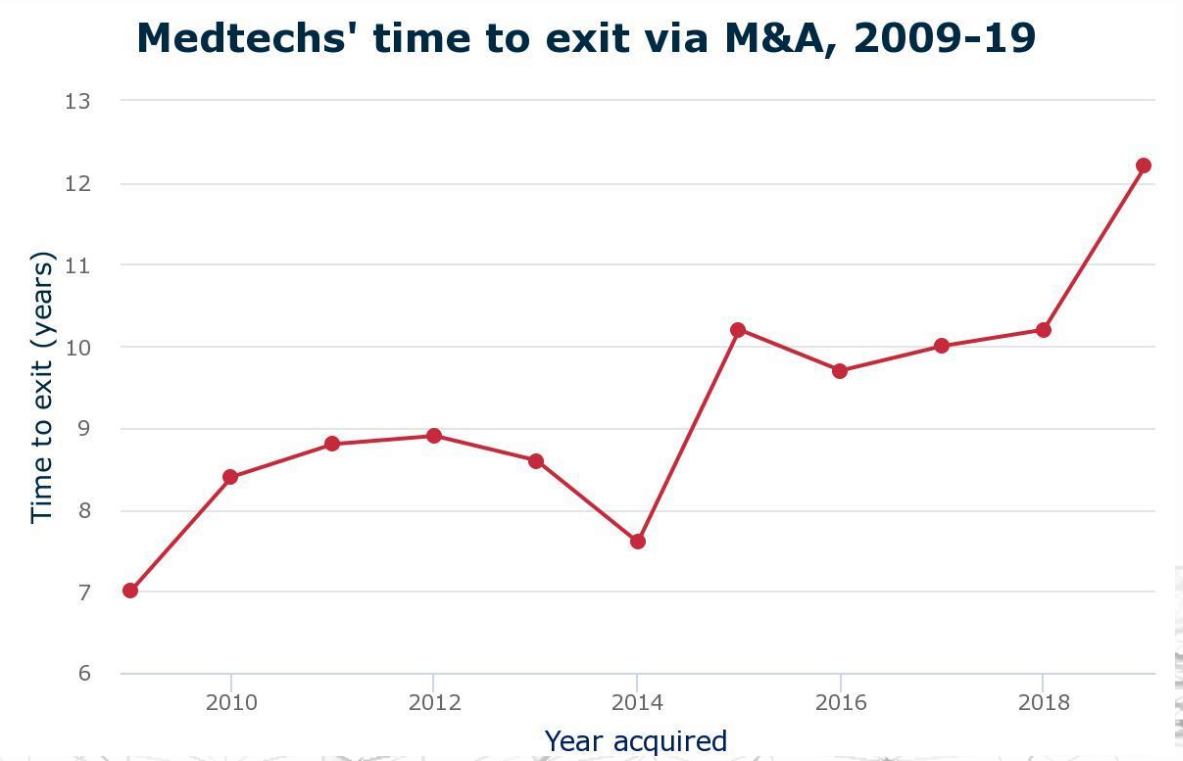
Universities are converting money into knowledge

*Is it as straightforward?*

Industry are converting knowledge into money




the linear "classic" model



# The MedTech Hub @ St Thomas' Hospital

Translation of innovative technologies into any healthcare system is complex - requires **multidisciplinary teams** (clinicians, engineers, computer scientists, applied physicists, industry, regulatory advisors)

Many novel technologies fail due to **poor understanding of the challenges** surrounding clinical practice, manufacturing, diagnostic/treatment pathways, clinical adoption, regulation and commercialisation

We aim to create an infrastructure that support clinical and commercial translation of medical devices, including digital health technologies, that will be of global significance

**Are we optimizing patient benefits out of this research?**

# Facilitating academic - NHS - industry partnerships

**Our Objectives:**

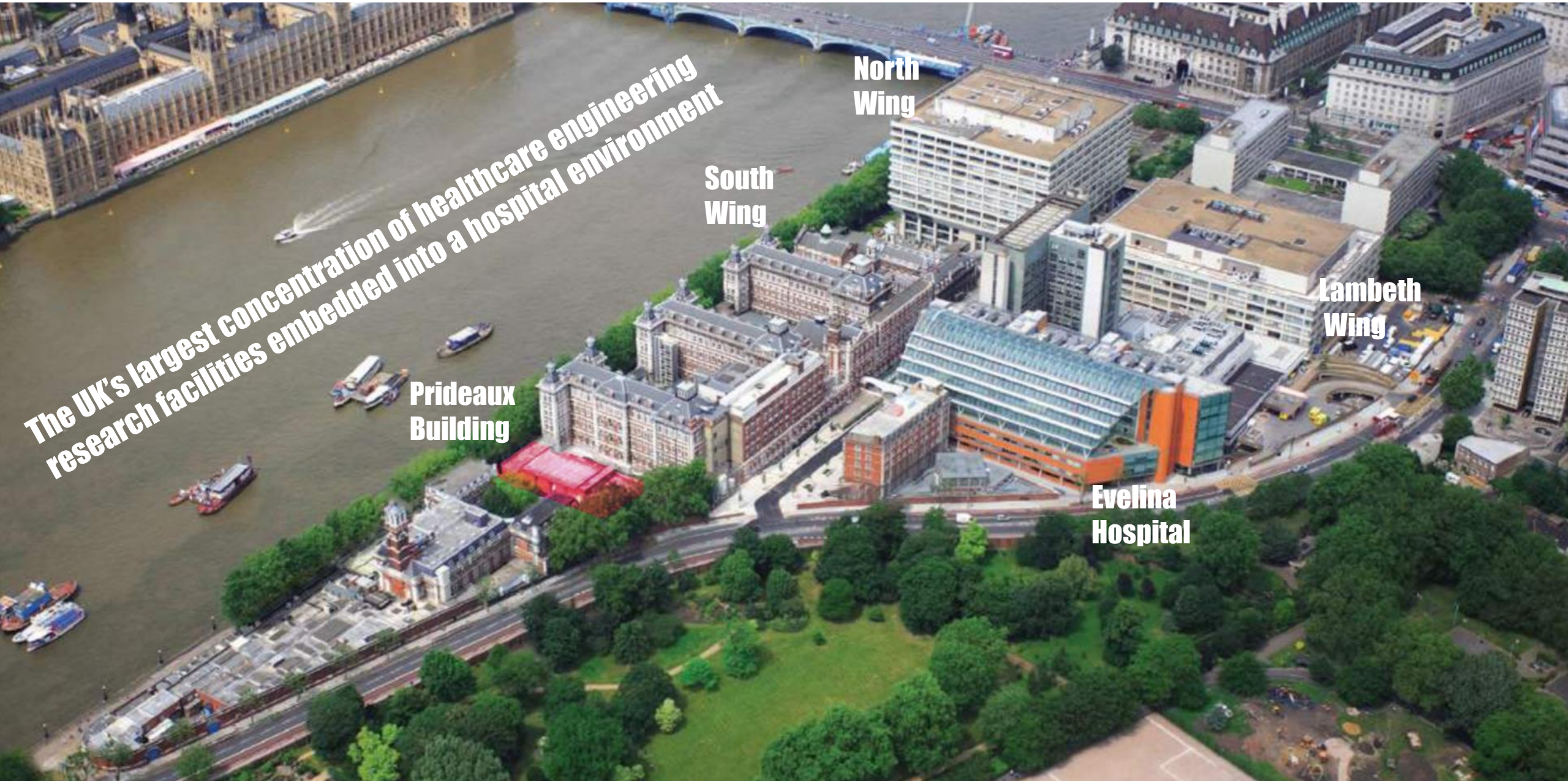
Physically locate internationally-leading academic research with major healthcare technology **industry partners**, **SMEs** and **start-ups**, within the **UK's most research-active NHS Hospital Trust**

Host staff from multi-national MedTech Companies e.g. Medtronic and Siemens Healthineers

Create **incubator space for MedTech SMEs and start-ups to grow**

Use these strategic partnership to deliver both **improved patient outcomes** and **substantial economic benefit**

# St Thomas' MedTech Hub



# London Institute for Healthcare Engineering

*"We will support and encourage universities and other research institutions to make knowledge exchange and commercialisation an equal priority alongside their teaching and research missions."* UK Research and Innovation (UKRI) Strategic Prospectus

*"We are not fulfilling Britain's potential if, despite having scientists and universities renowned the world over, we cannot turn their ideas into the products and services on which the industries of the future will be built."* Foreword by the Prime Minister for the Government's Industrial Strategy.

# School of Biomedical Engineering & Imaging Sciences

The Queen's Anniversary Prizes
For Higher and Further Education
2019

78 academics

~600 staff

4th Shanghai Ranking (Medical Technology)

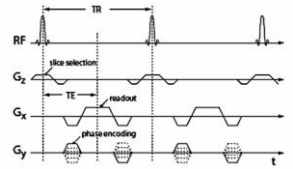
## Cutting Edge Imaging

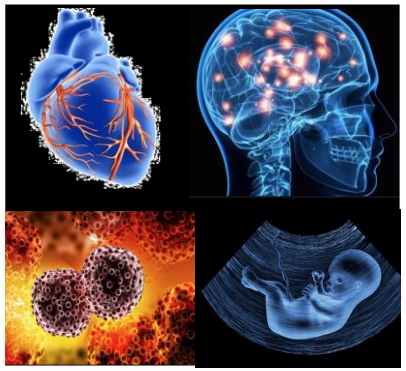
7T MRI / Multi transmit

XMR

PET-MRI

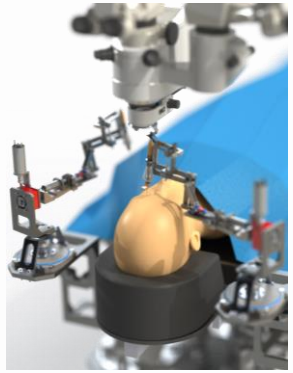
Advanced image acquisition and reconstruction



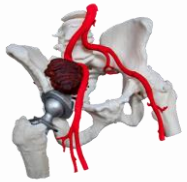



## Surgery and Intervention

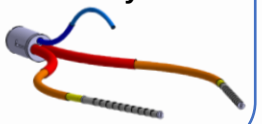
intra-operative imaging



surgical planning



robotic systems



## AI-enabled Imaging

Machine learning

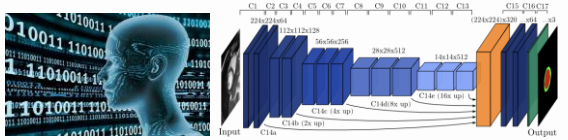
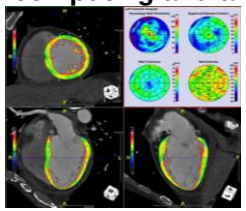
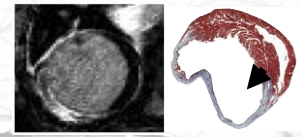


Image computing and analysis

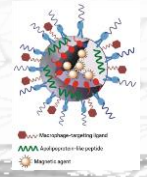


## Smart Imaging Probes

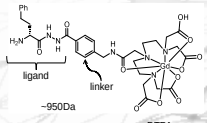
Pre-clinical validation



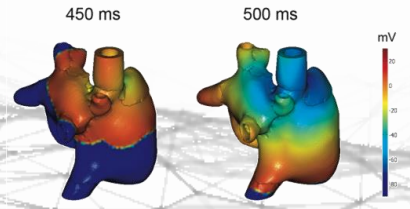
Theranostics



Targeted agents




## Computational Modelling




## Affordable Technology

Low-cost imaging

Wearable sensors

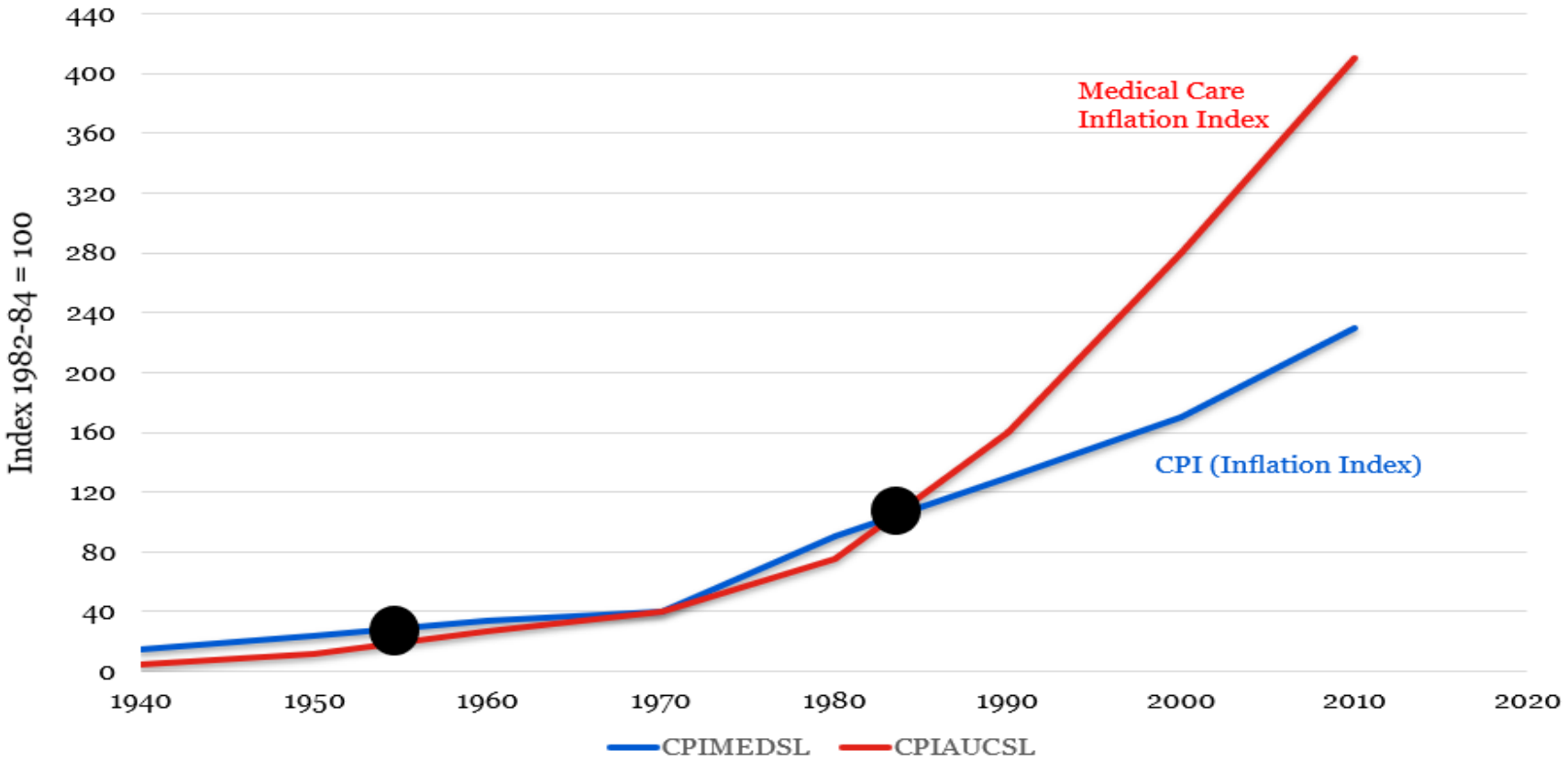
# Launching AI platforms for the NHS: 2021–2023

## Unlocking the power of AI in healthcare

AI CENTRE for Value Based Healthcare

# Changing the healthcare business model

## Σ Healthcare costs




Consumer price index for urban consumers: Medical care = **CPIMEDSL**

Consumer price index for urban consumers: All items = **CPIAUCSL**

- Healthcare costs once tracked inflation very closely
- Healthcare costs start outplacing inflation in the mid 1980's

# Our Vision

***Using advanced Imaging, Data Science and Artificial Intelligence to deliver Value-Based Healthcare for:***

**Patient benefit**

*Faster diagnosis*
*Effective screening*
*Personalised therapy*

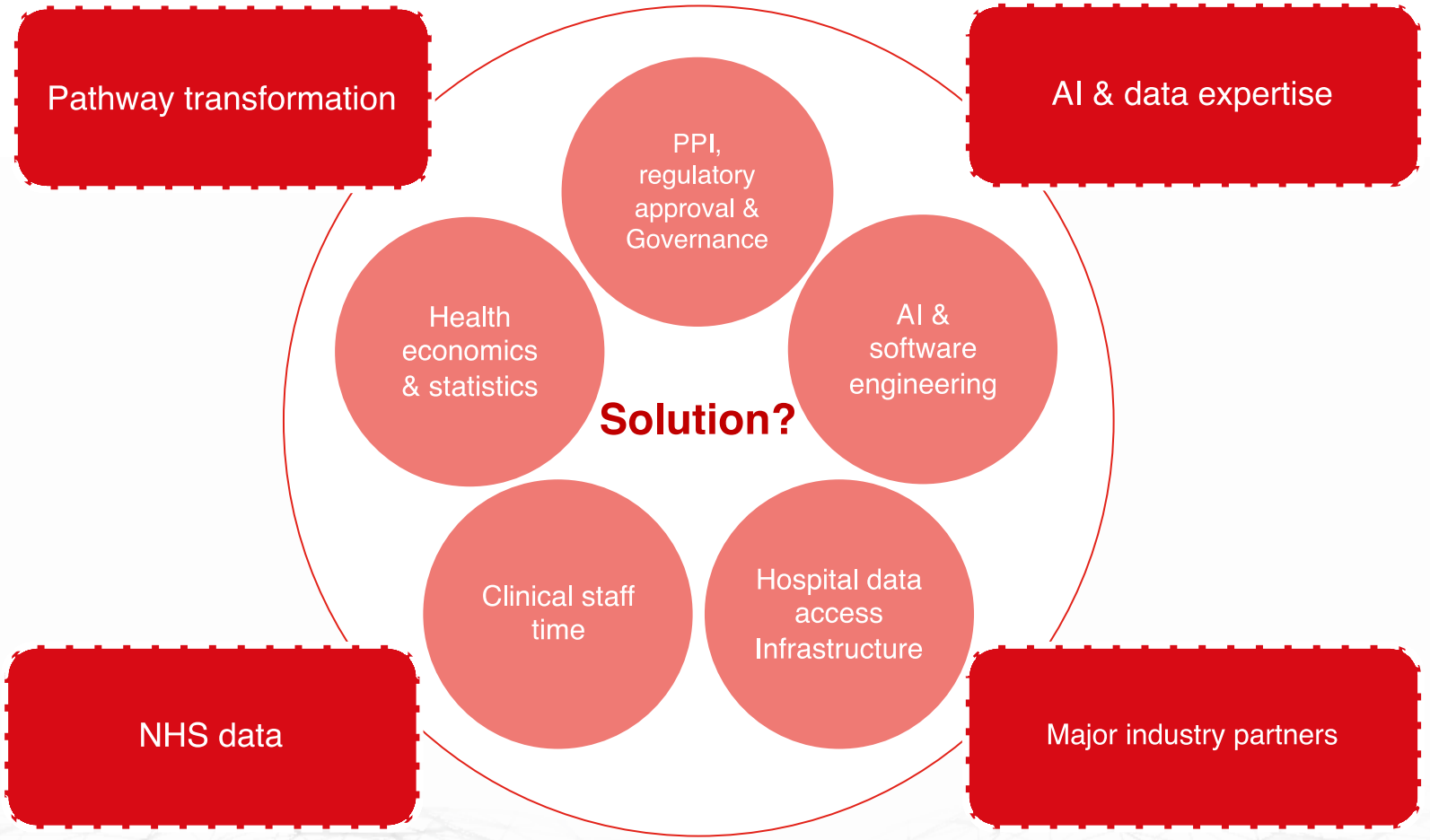
**The NHS**

*Cost effective individual patient pathways*
*Optimising the healthcare system*

**The UK**

*Transformative economic growth*

# Convergence of needs and expertise



# Phase 1: London Medical Imaging & AI Centre for Value Based Healthcare

- UKRI funded
  - 3 years (Feb 2019)
  - £~10M from InnovateUK
  - £~10M from Industry
- Partnership
  - 3 Universities
  - 4 Hospitals
  - 12 pathways
  - 10 start-ups
  - 4 multinationals

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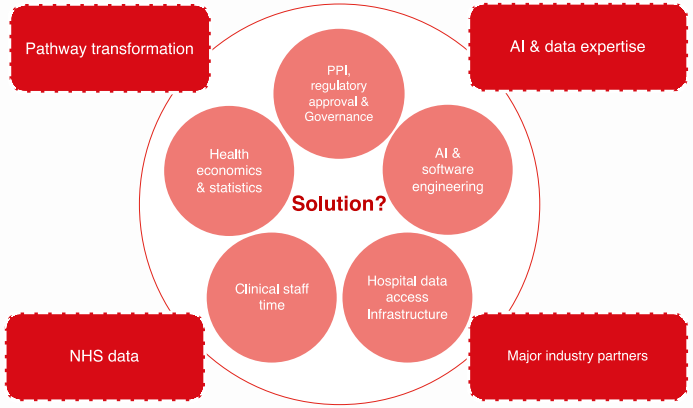

# Phase 2: Extension to 10M+ patients

## OLS/Treasury funded (January 2021)

- 3 years
- £~16M

## Partnership

- 4 Universities (+1)
- 10 Hospitals (+6)
- 10 start-ups
- 4 multinationals
- 20M+ patients

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NHS Guy's and St Thomas' NHS Foundation Trust

NHS South London and Maudsley NHS Foundation Trust

NHS East Kent Hospitals University NHS Foundation Trust

NHS Imperial College Healthcare NHS Trust

NHS Maidstone and Tunbridge Wells NHS Trust

NHS Barts Health NHS Trust

NHS University College London Hospitals NHS Foundation Trust

NHS Royal Brompton & Harefield NHS Foundation Trust

NHS Brighton and Sussex University Hospitals NHS Trust

## Aim

- To professionalize the Phase 1 proof-of-concept
- To create a national standard for large scale data analytics

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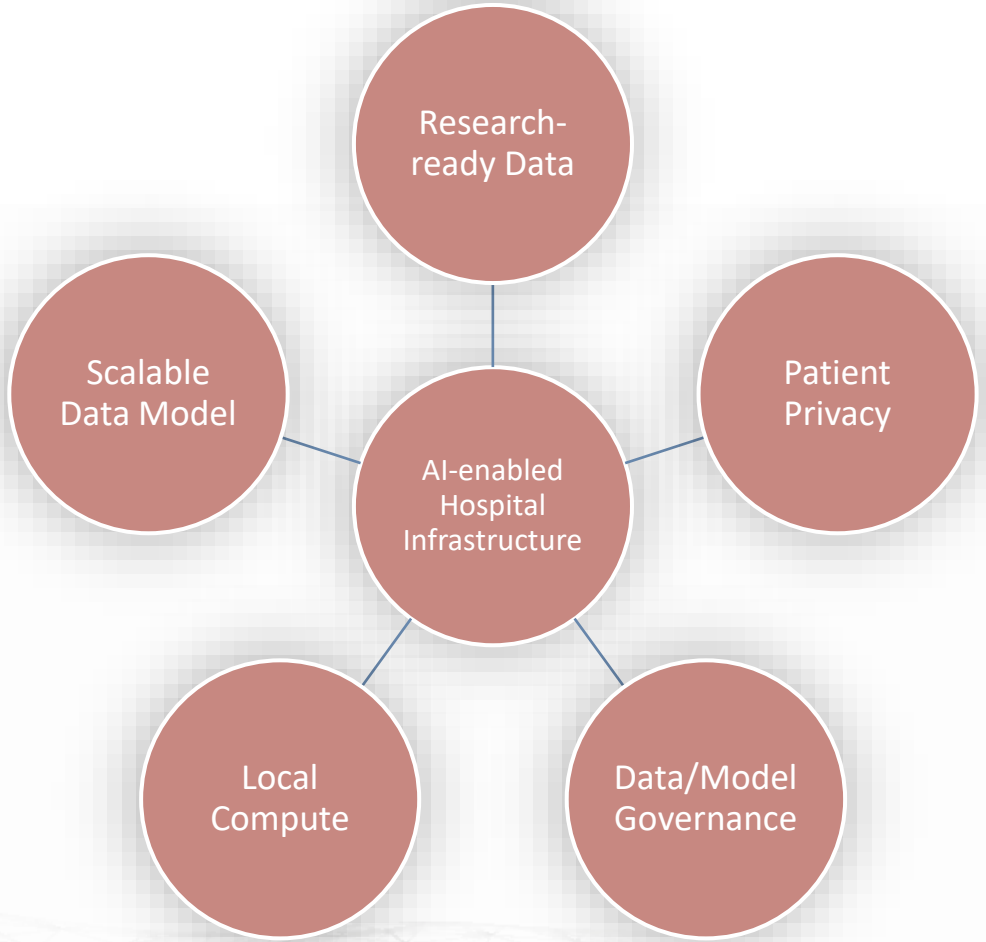
# AI-Enabled Hospital Infrastructure

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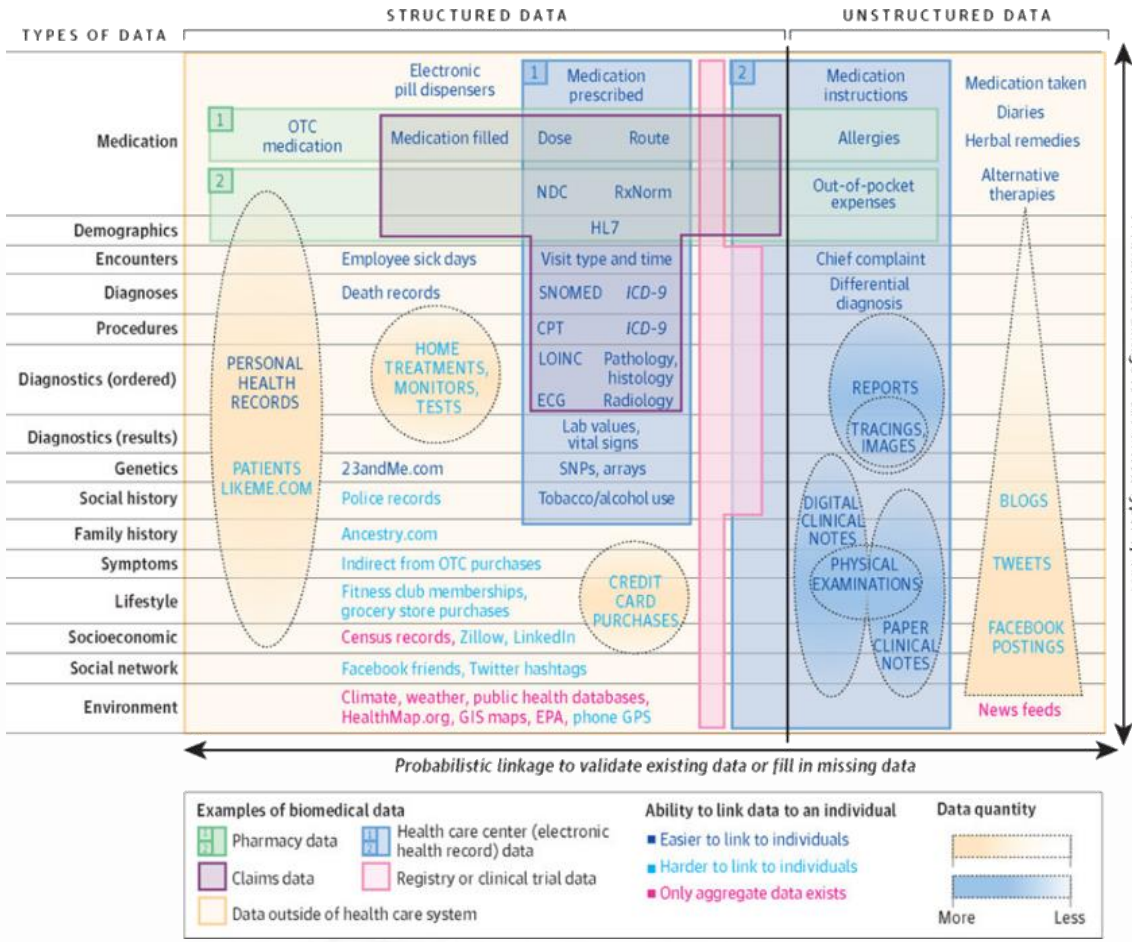
# Challenges in Clinical Data Science

- **Real world data**
  - Missing, causal, dirty, unstructured, and encompassing
- **Data Aggregation**
  - Data collection from multiple databases and EHR/PACS/RIS
  - Utilisation of ontologies and standards compliance
- **Data Search**
  - Structured + Unstructured data, large volumes
- **Informatics Infrastructure and governance**
  - Computing, storage, deployment
- **Computational/Technical Challenges**
  - Model size vs labelled data, data complexity



# Informatics Infrastructure

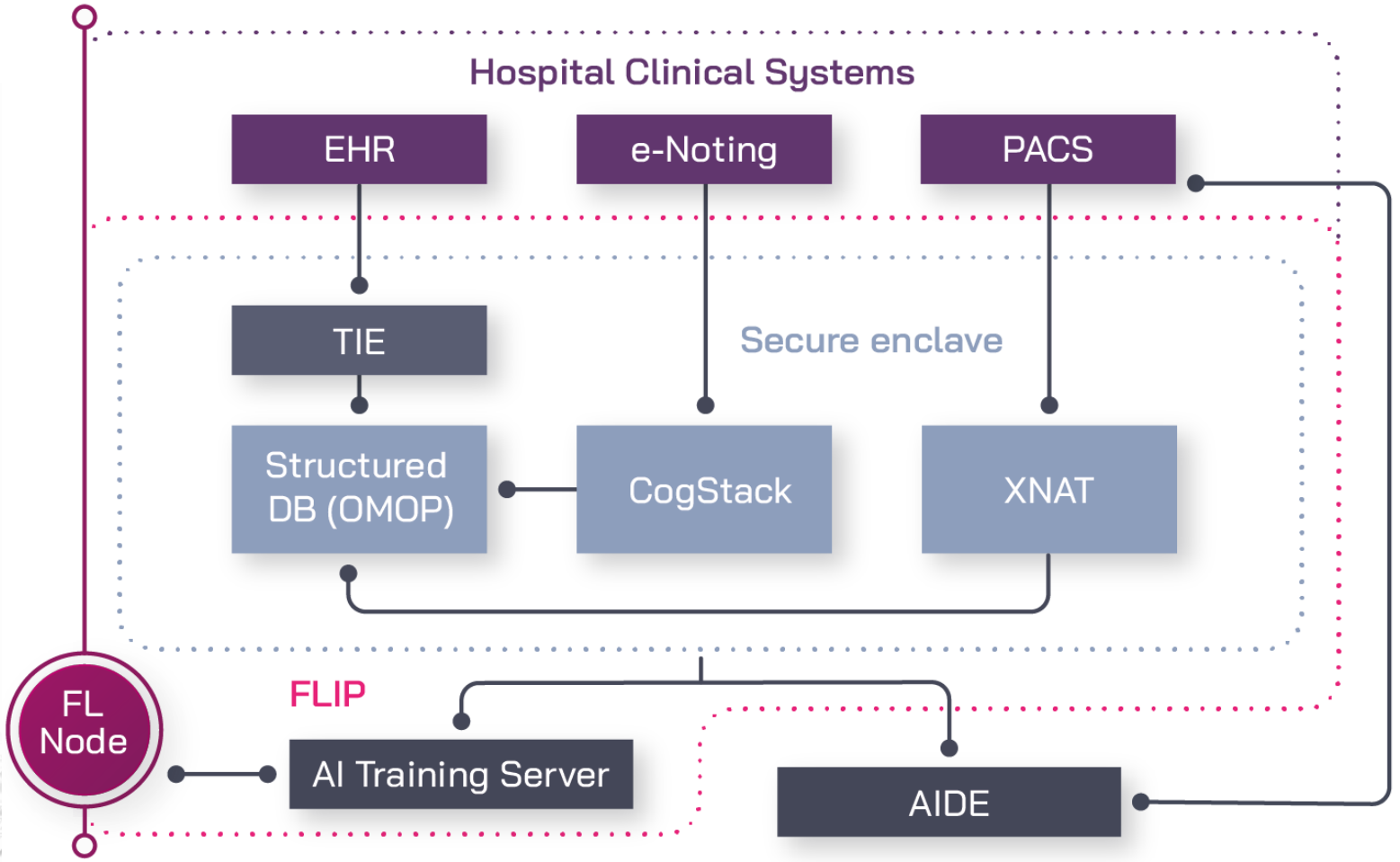
- **Make data research ready**
  - Develop data storage, curation and search
  - Aggregate data from multiple feeds
- **Data governance and patient privacy**
  - “Move models, not data”
  - Federated learning across hospitals
- **Model/Data governance framework**
  - AI model auditing to avoid data leaks
- **Needs formalisation of infrastructure**
  - Answer Digital

Answer
MONAI
CogStack
Semantic EHR
XNAT
OWKIN
NVIDIA
NetApp
Mellanox TECHNOLOGIES
SCANS
OHDSI
SIEMENS Healthineers
syngo.via
run:ai
IBM

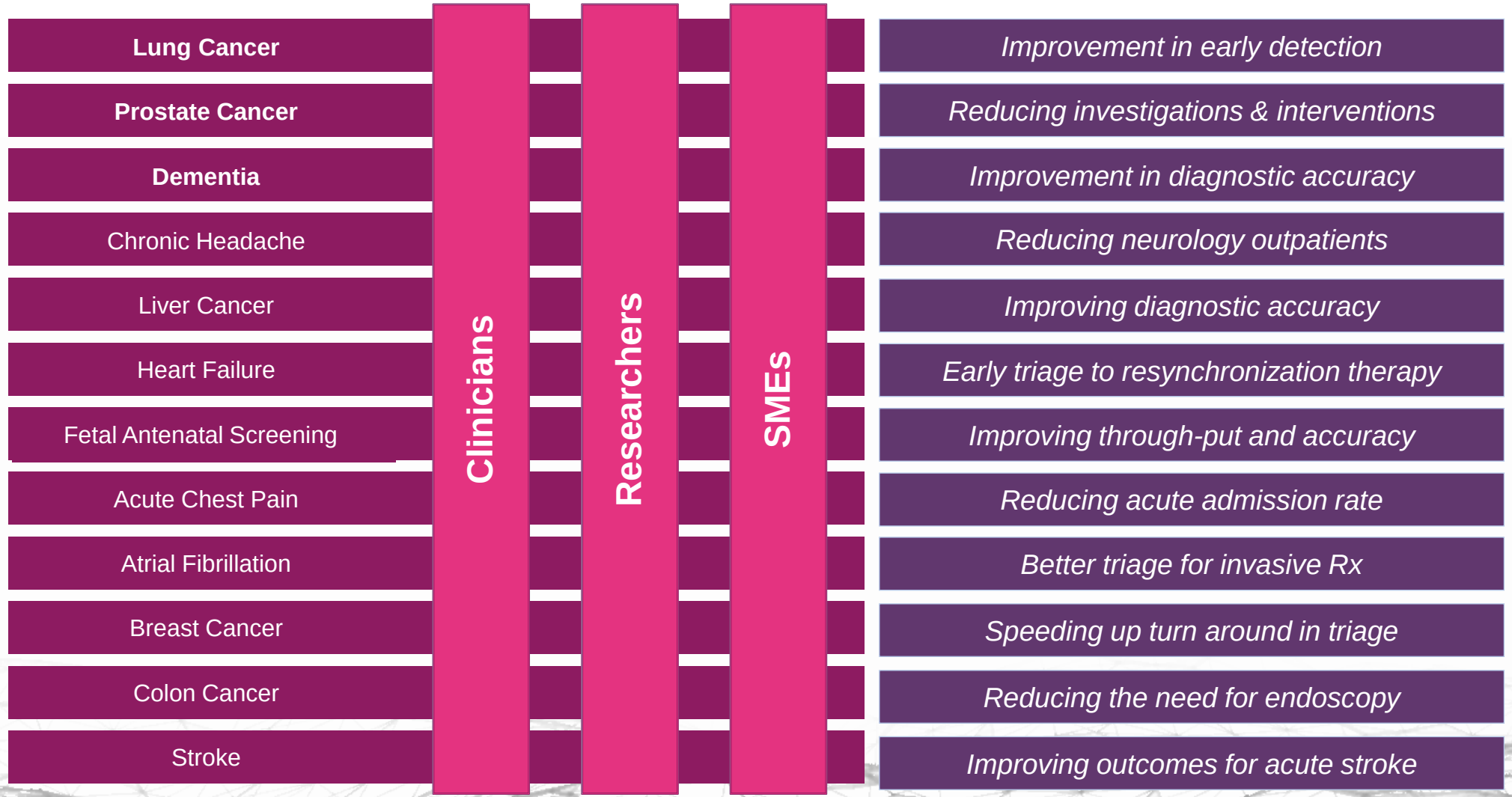
# Federated Learning & Interoperability Platform (FLIP)

- The Federated Learning & Interoperability Platform gives access to the whole patient pathway without data leaving the Trust.

- Learning would be undertaken locally i.e. algorithms for learning will be sent to the data, and the data will not leave the hospital site. No one will “see” the data as the algorithm returns with the learning only.

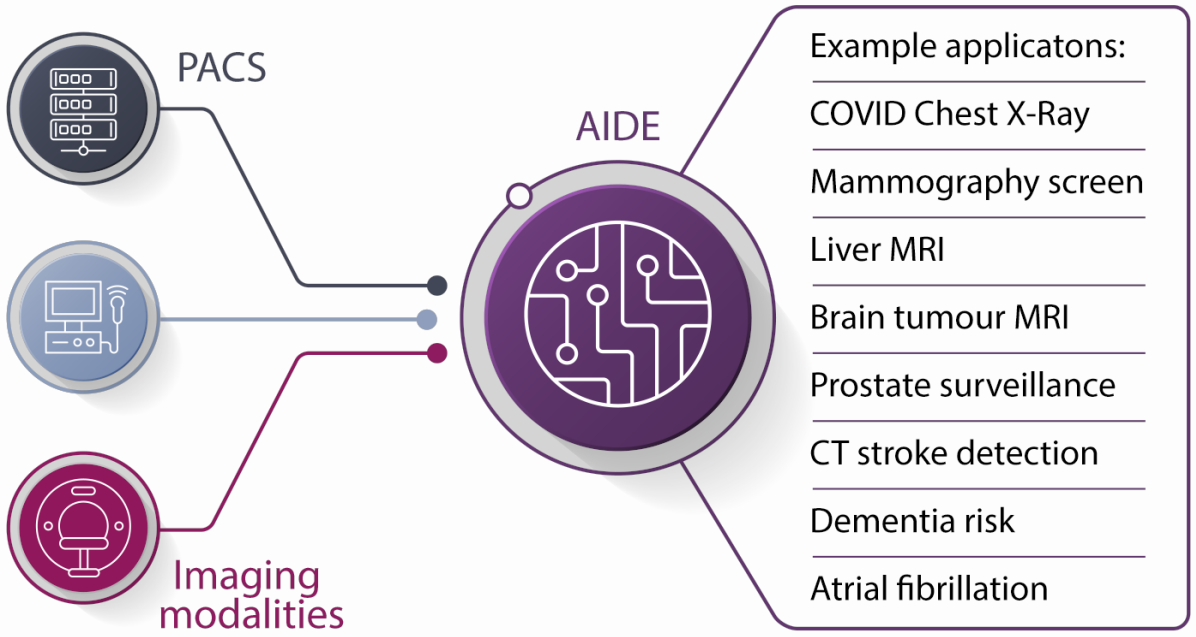


# AI Centre clinical pathways



# Artificial Intelligence Deployment Engine (AIDE)

- Build complex and composable pipelines.
- FUBU NHS repository to share and distribute in-house algorithms.
- Safe and robust pipeline to test and use AI tools developed to improve patient care.



# AIDE & FLIP


AIDE & FLIP Development
Jun 2021 - Jun 2022
AIDE & FLIP Hardware Rollout
Oct 2021 - Mar 2022
Pathways Phased Rollout
Jul 2021 - Jun 2022
Trusts Onboarding
Jun 2021 - Sep 2023
Discovery Phase Completed
May 2021
AIDE MVP - KCH (Stroke ICH pathway)
Aug 2021
FLIP MVP - KCH & UCLH (Stroke ICH pathway)
Nov 2021
AIDE/FLIP specifications available to all pathways
Jun 2022
All FLIP Trusts Live
Apr 2023
All AIDE Trusts Live
Sep 2023
2021
May
Aug
Nov
Feb
May
Aug
Nov
Feb
May
Aug
2023
Today

# Conclusions

- Untapped value in retrospective data
- Create the new standard for the AI-enabled hospital of the future
- Leverage technical and infrastructural developments across NHS Trusts
- Improving patient care and operational efficiency
- Bring together Academics, Clinicians and Industry
- Create ecosystem for innovation and tech transfer
- Expand internationally

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# Thank you

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