Using digital healthcare to improve lung cancer outcomes

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Disclosures

- Advisory boards and educational talks
  - Astra Zeneca
  - GSK

- Consultancy
  - Axana

Overview

- 3 use cases of AI in clinical and academic practice
  - Use case 1

    AI solutions in imaging
  - Use case 2

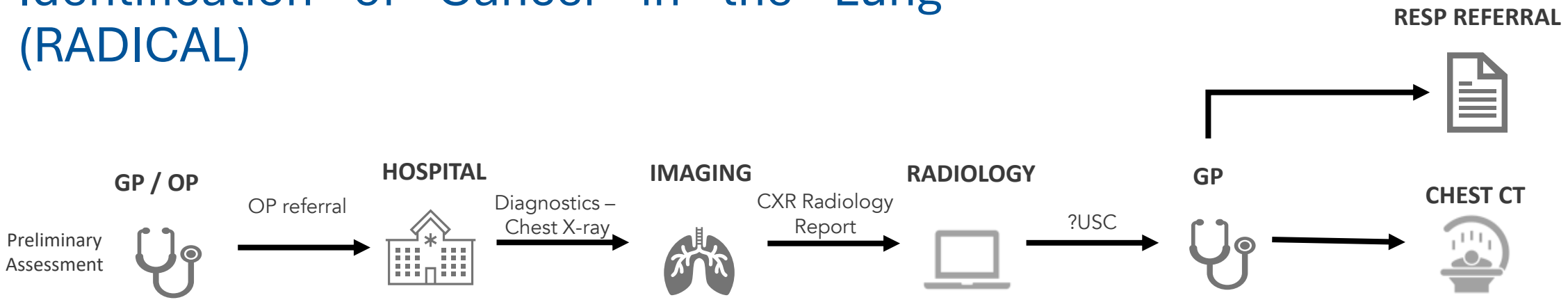
    AI solutions in MDT and audit
  - Use case 3

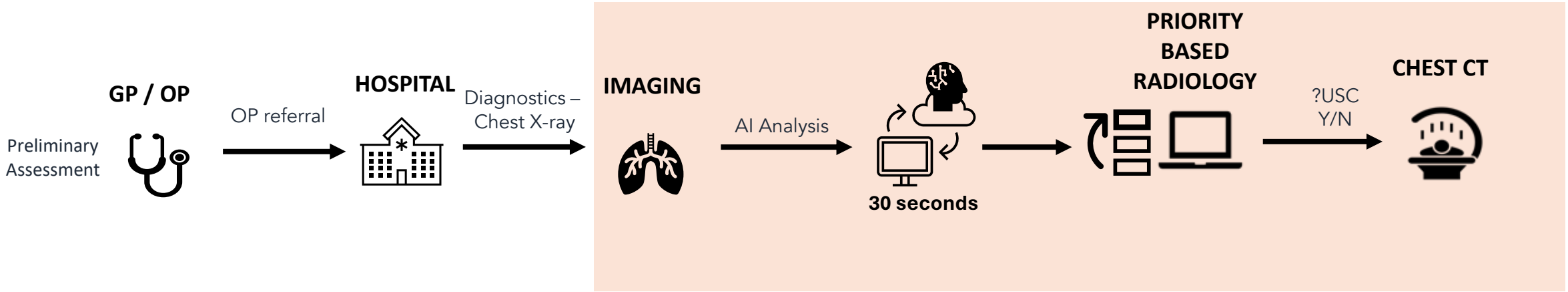
    AI solutions in research

AI solutions in imaging

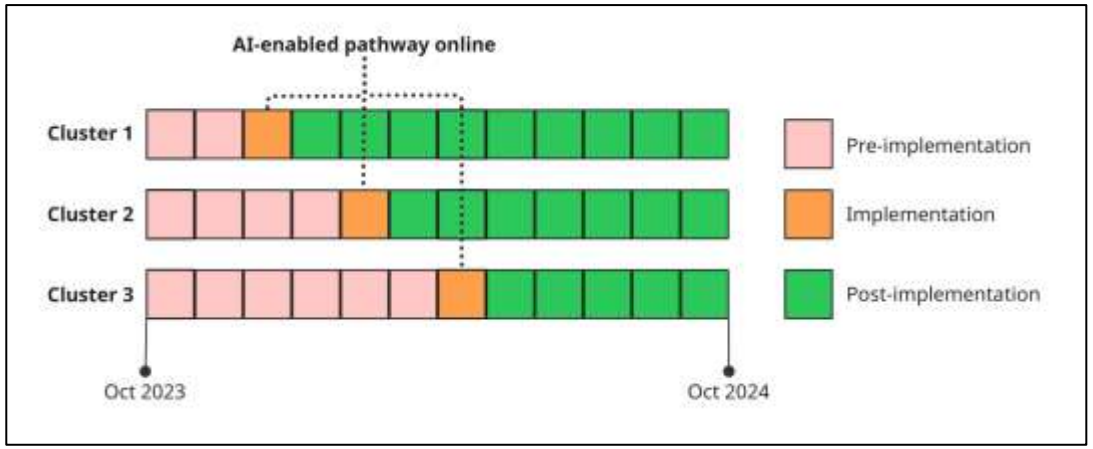
Use case 1

Radiograph Accelerated Detection and Identification of Cancer in the Lung (RADICAL)

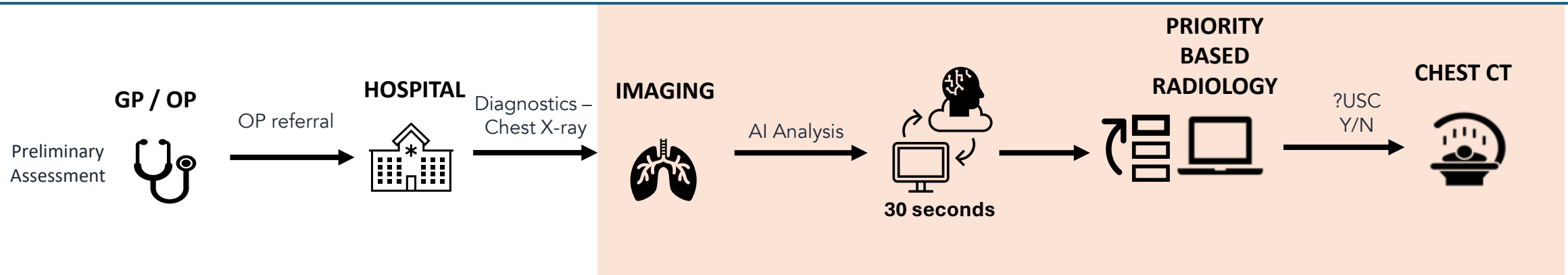




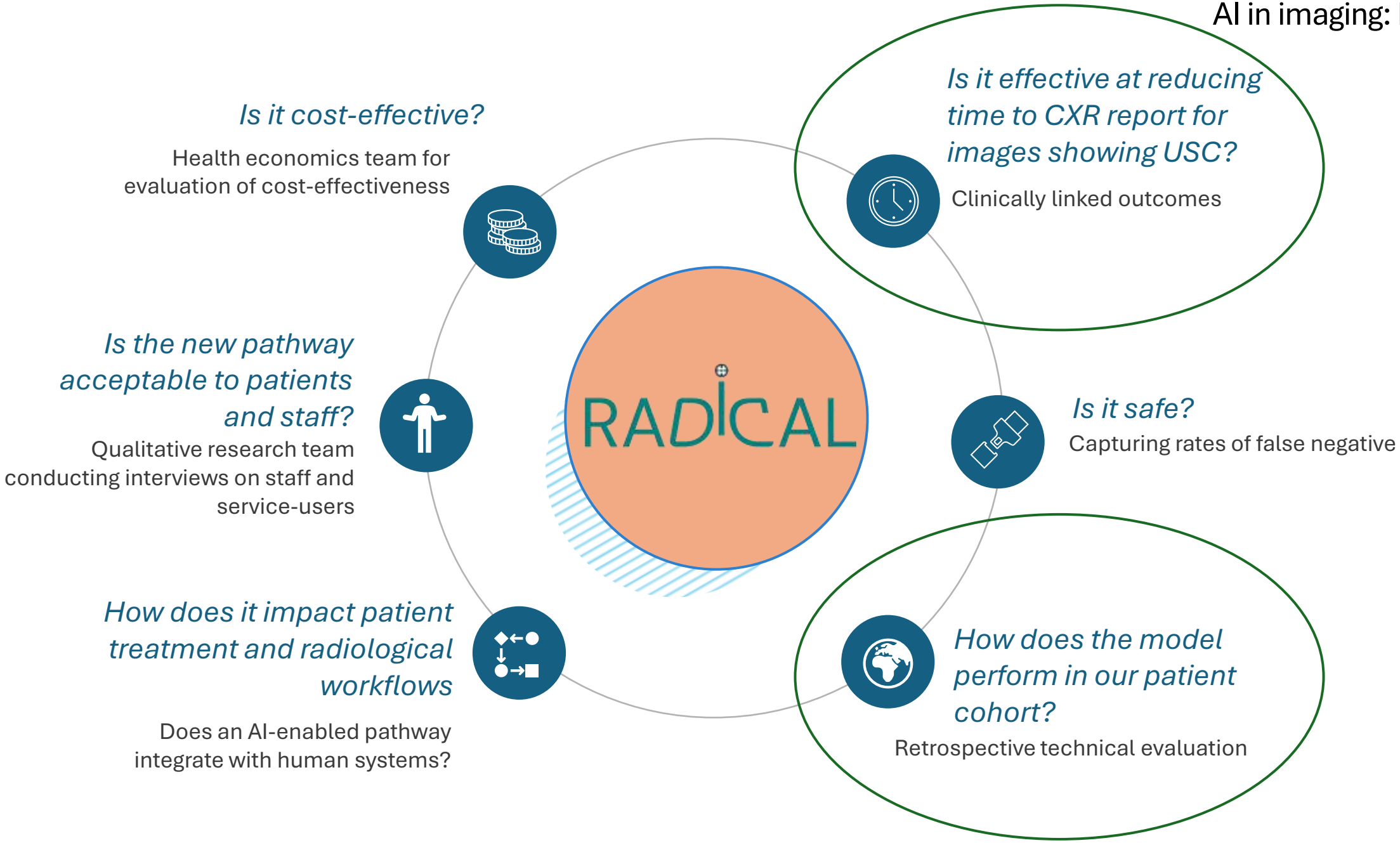
Prospective evaluation



- Stepped-wedge design
  - 9 hospitals separated into 3 clusters
    - North, South and Clyde
  - Implementation periods to allow for technical integration
- **87,893 x-rays** from GP and outpatient clinic service over 12 months
  - October 2023 to October 2024

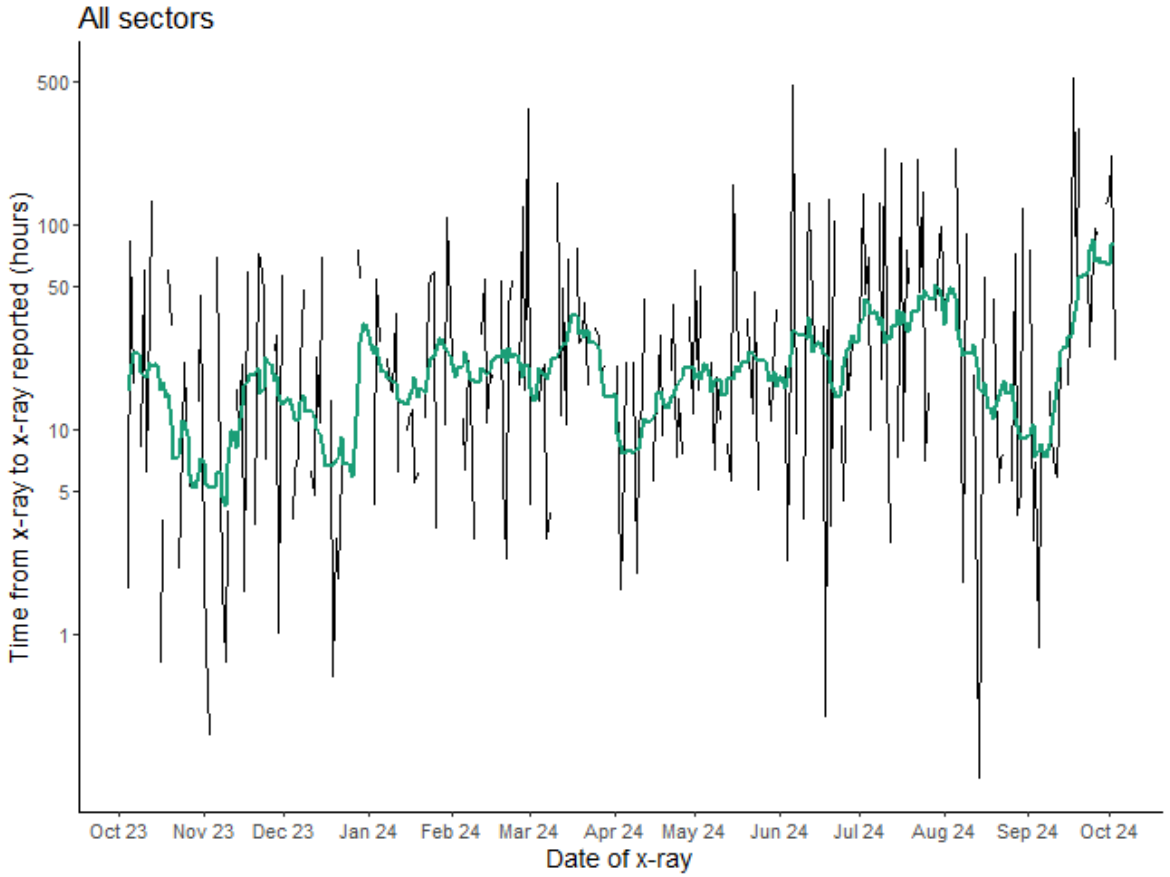


AI in imaging: RADICAL



Prospective evaluation - Primary outcome

Sector	Median time from CXR acquisition to CXR reporting for **USC by radiologist** images (hrs)	
	Pre-implementation (n)	Post-implementation (n)
Clyde	**3.7** (39)	**49.1** (274)
North	**22.9** (110)	**83.6** (230)
South	**73.1** (151)	**5.1** (272)



Feature selection

1. 5 baseline features

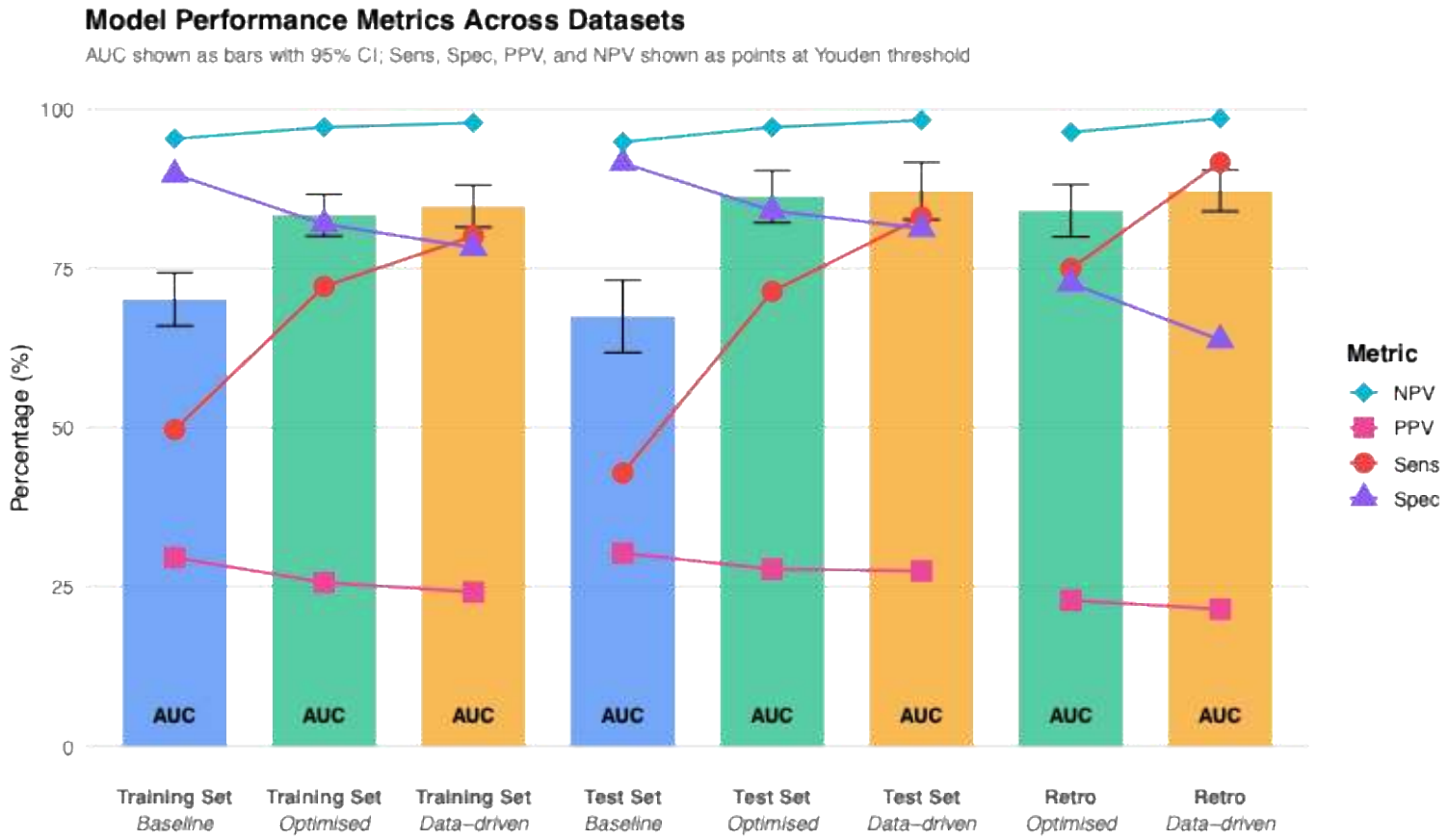
- Radiologist consensus
- Mass, nodule, cavity, hilar enlargement and mediastinal widening

2. Optimised expert model

- *Same 5 features, weighting based on contribution*

3. Data driven model

- *Full features set, weighting based on contribution*



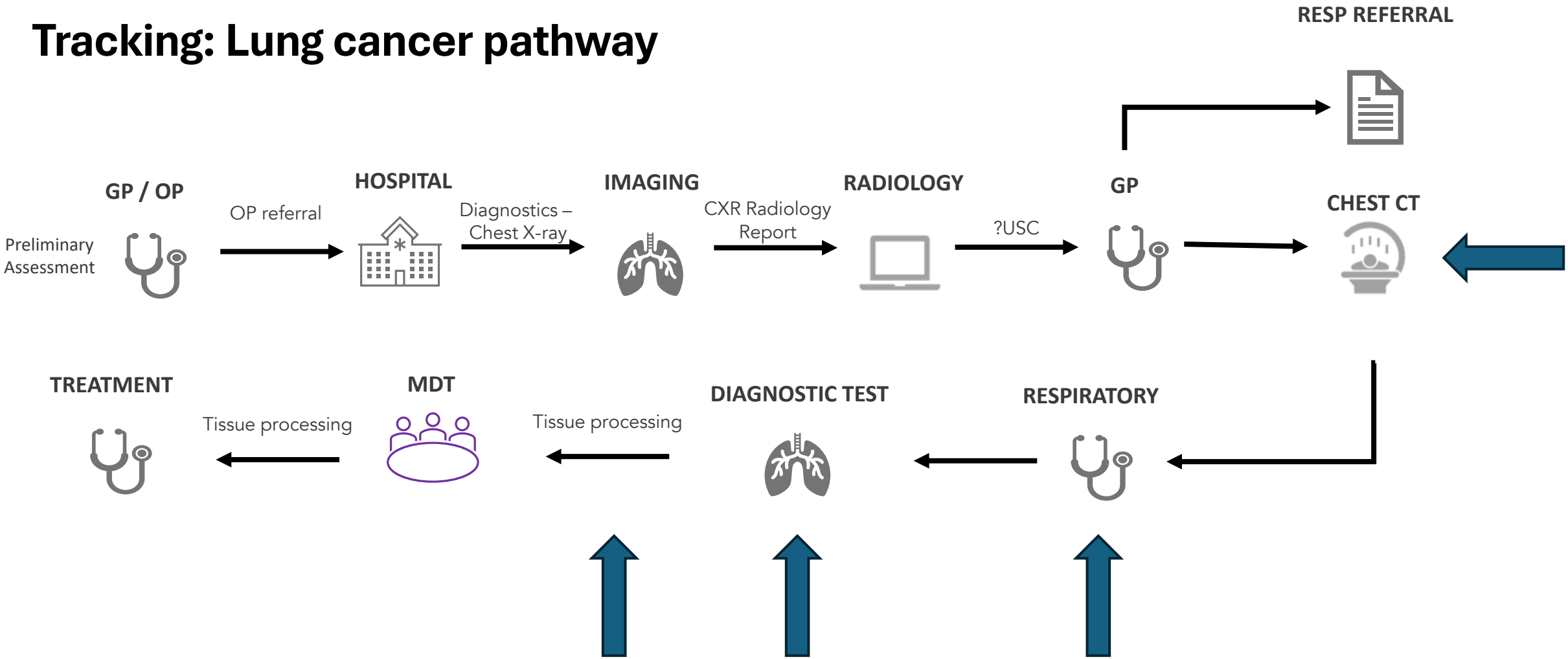
Lessons from RADICAL

- Real world deployment and research into AI solutions is messy
- Adoption of AI solutions are dependent in human interaction and contribution
- Optimisation of algorithm in specific populations and scenarios may markedly improve performance

Software/AI solutions in MDT, tracking and lung audit

Use case 2

Tracking: Lung cancer pathway



Multiple data sources

- *Patient tracking pathways*
  - 28/31/62 day pathways
  - Manually derived
- *Lung audit*
  - Drawing multiple data fields from a variety of EPRs
  - Manually derived
- *Heterogenous MDT software*
  - An MS Excel spreadsheet
  - Manually derived, fields incomplete
  - Contains much of the information for tracking and lung audit

Optimising lung cancer MDT

NextGen MDT/patient pathway solution

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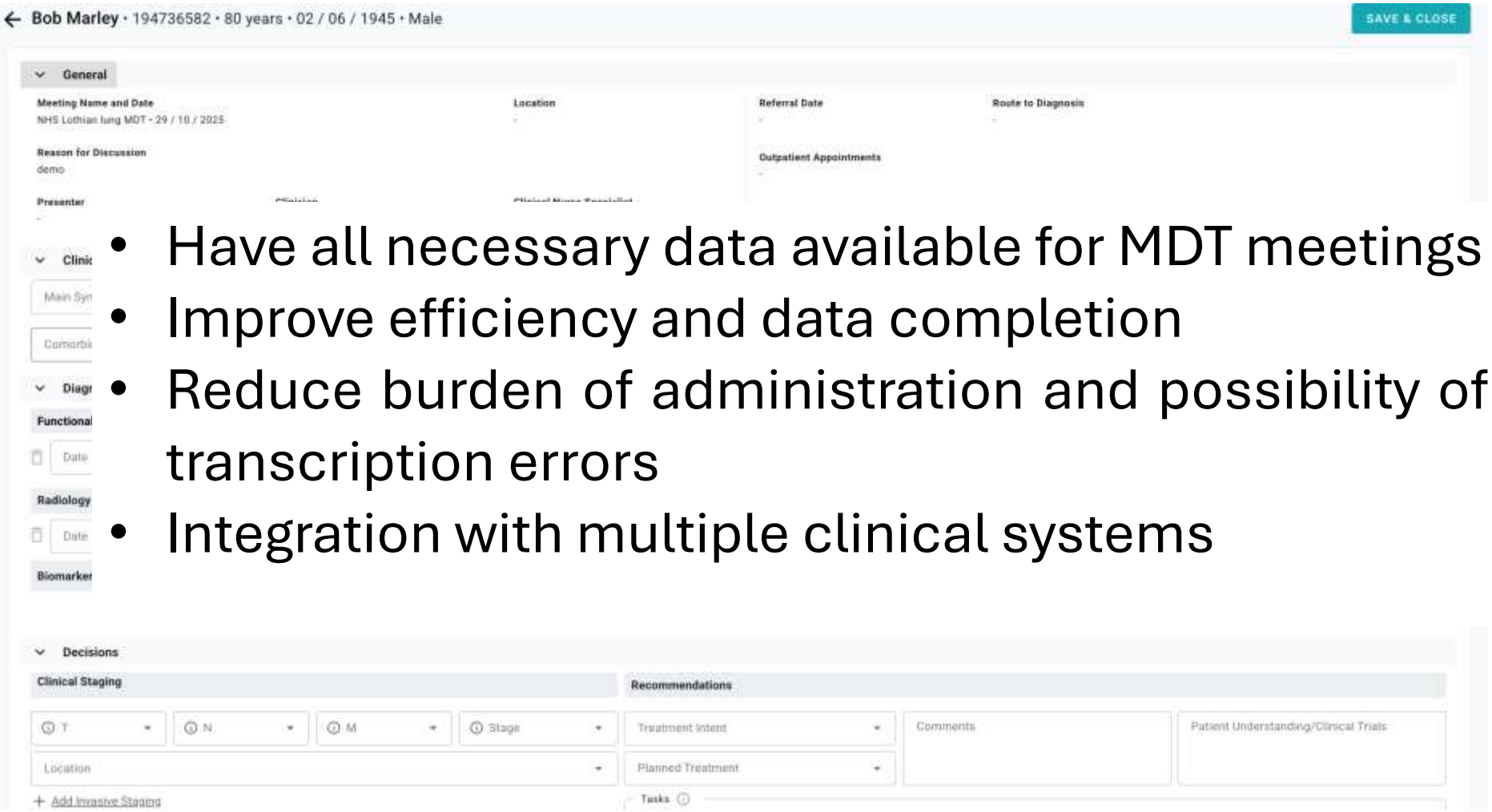


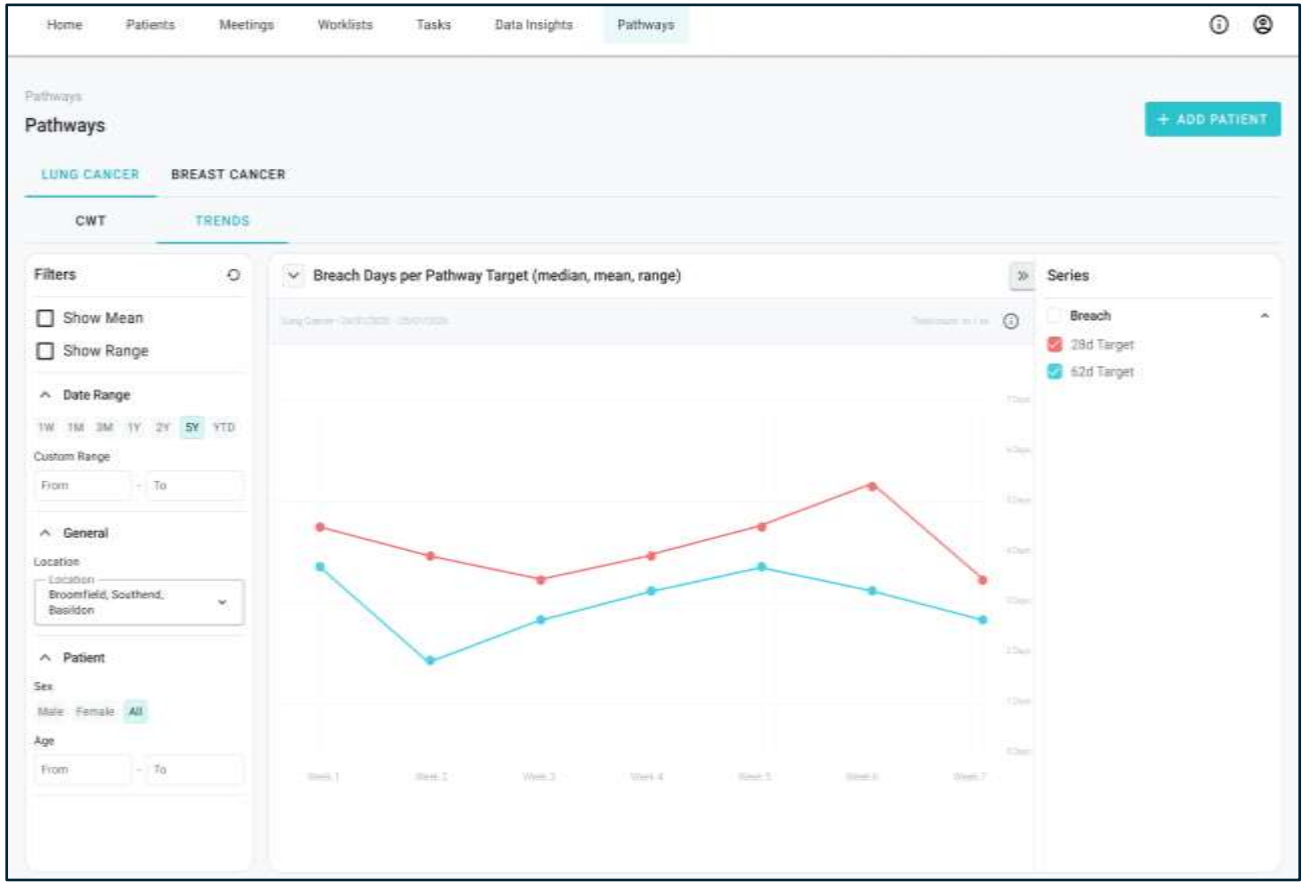
- Have all necessary data available for MDT meetings
- Improve efficiency and data completion
- Reduce burden of administration and possibility of transcription errors
- Integration with multiple clinical systems

axana

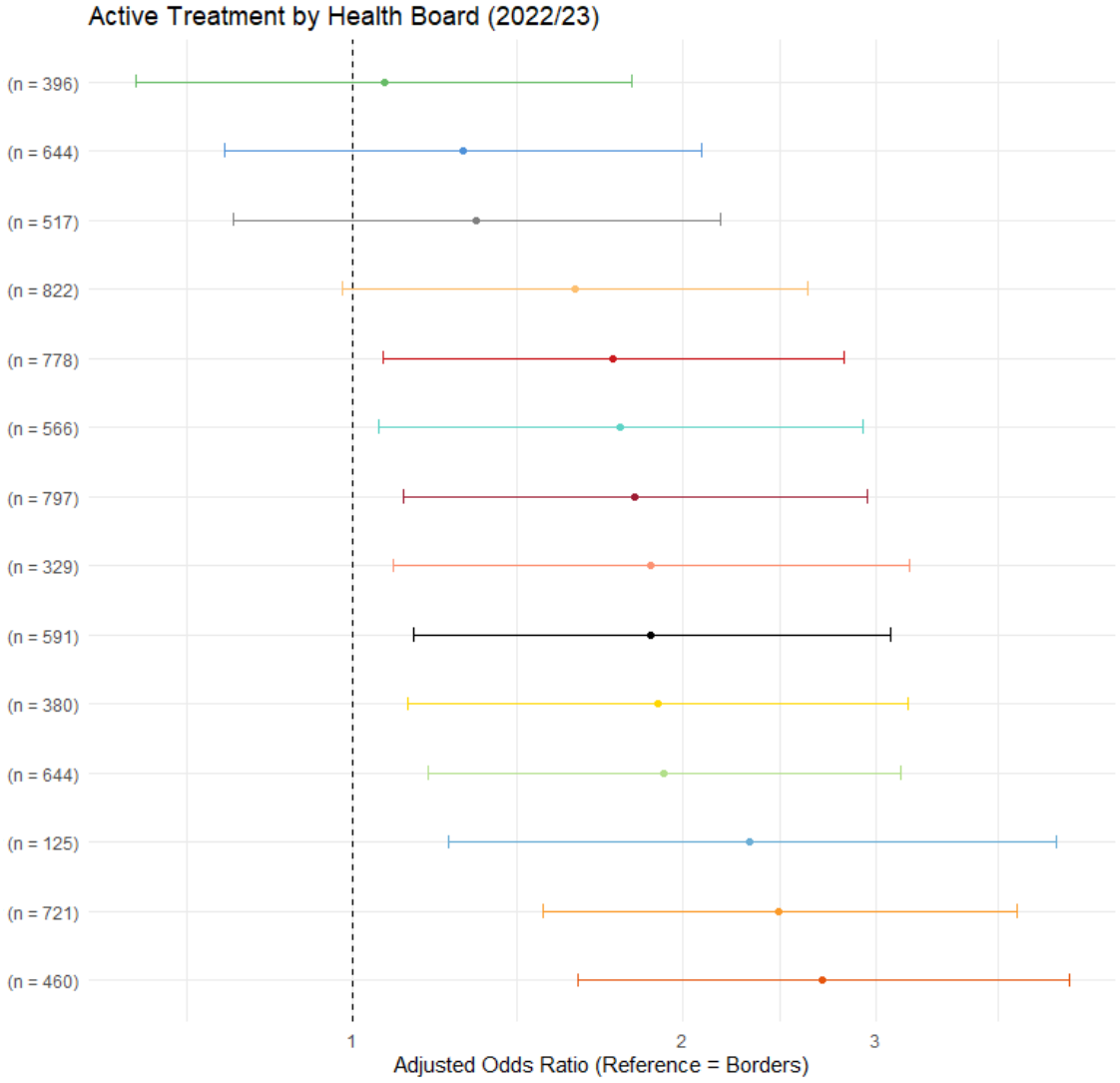
Optimising lung cancer MDT

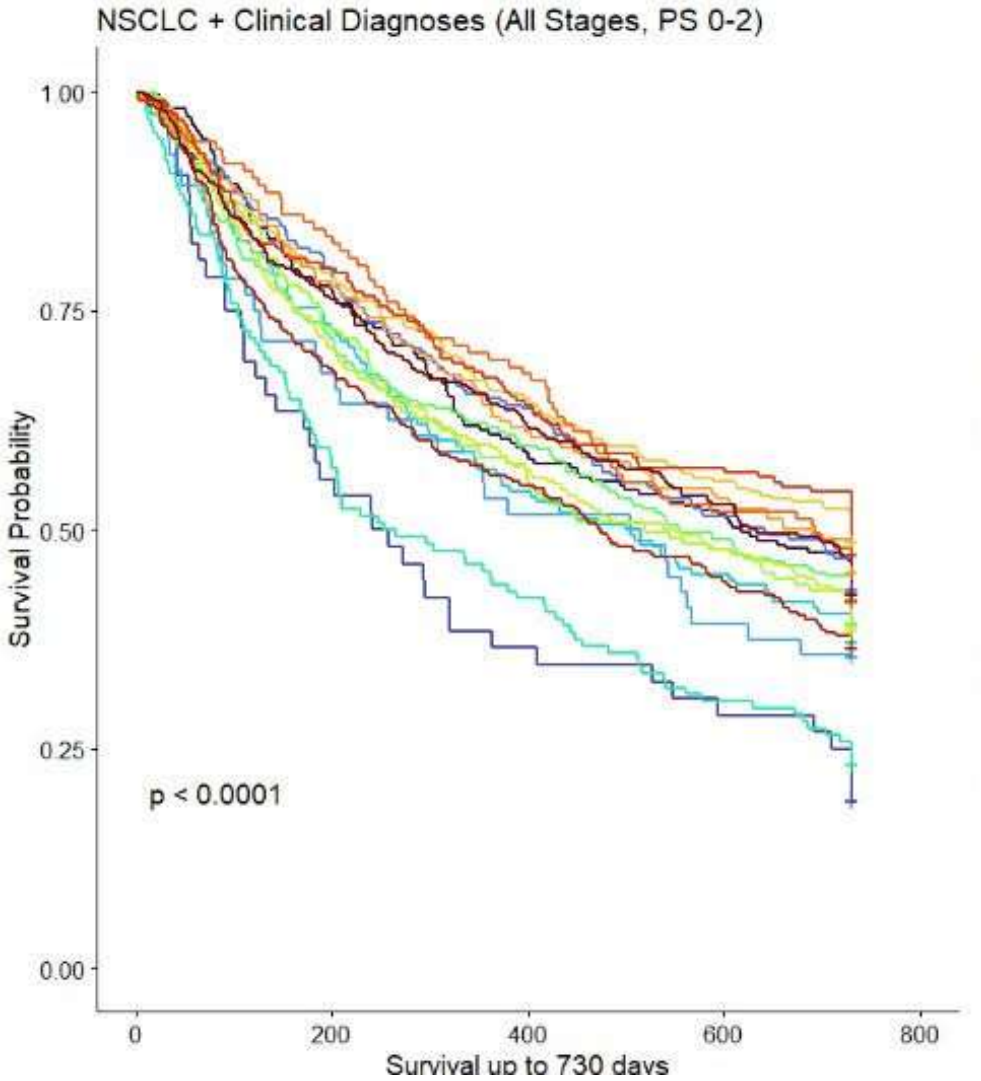
NextGen MDT/patient pathway solution

- Accurate and automated patient tracking to determine bottlenecks
- Improve data collection locally, regionally and nationally
- Automatically generate real time statistics about MDT throughput and performance
- Innovation – AI driven staging using radiology reports, extracting data from clinic letters for MDT form



Lung audit and MDT
Increasing complexity = Treatment variability and survival





AI solutions in research – multi-omics

Use case 3

Radiogenomics project

UKRI funded Living lab exemplar project

- Primary objective – to establish a multimodal dataset comprising of pseudonymised unconsented NHS data suitable for radiogenomic research
- 1000 surgically resected lung cancer patients
- 620 stage 3 patients treated with radical RT

Blyth - Resp

Le Quesne - Path

Cowell - Radiology

Jamieson - Spatial

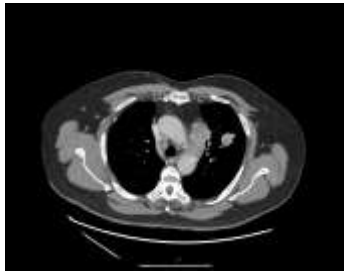
Yuan – Computer science

Duncan – Oncology

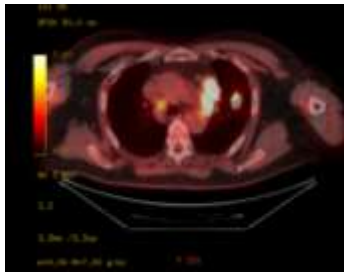
Radiogenomics project

CLINICAL DATA

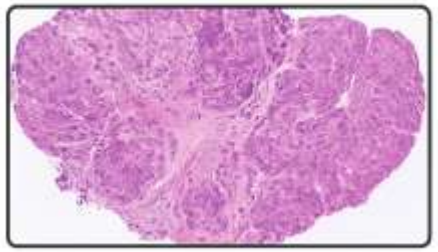
CT



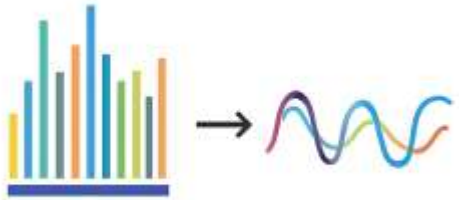
PET-CT



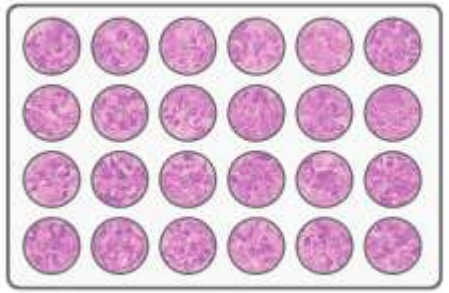
WHOLE SLIDE IMAGES



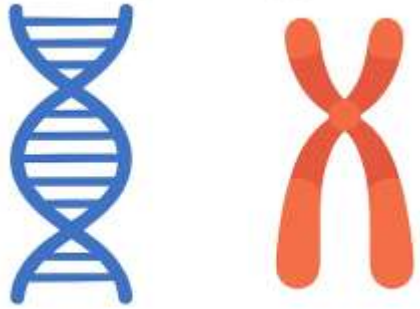
TRANSCRIPTOMICS



TISSUE MICROARRAYS

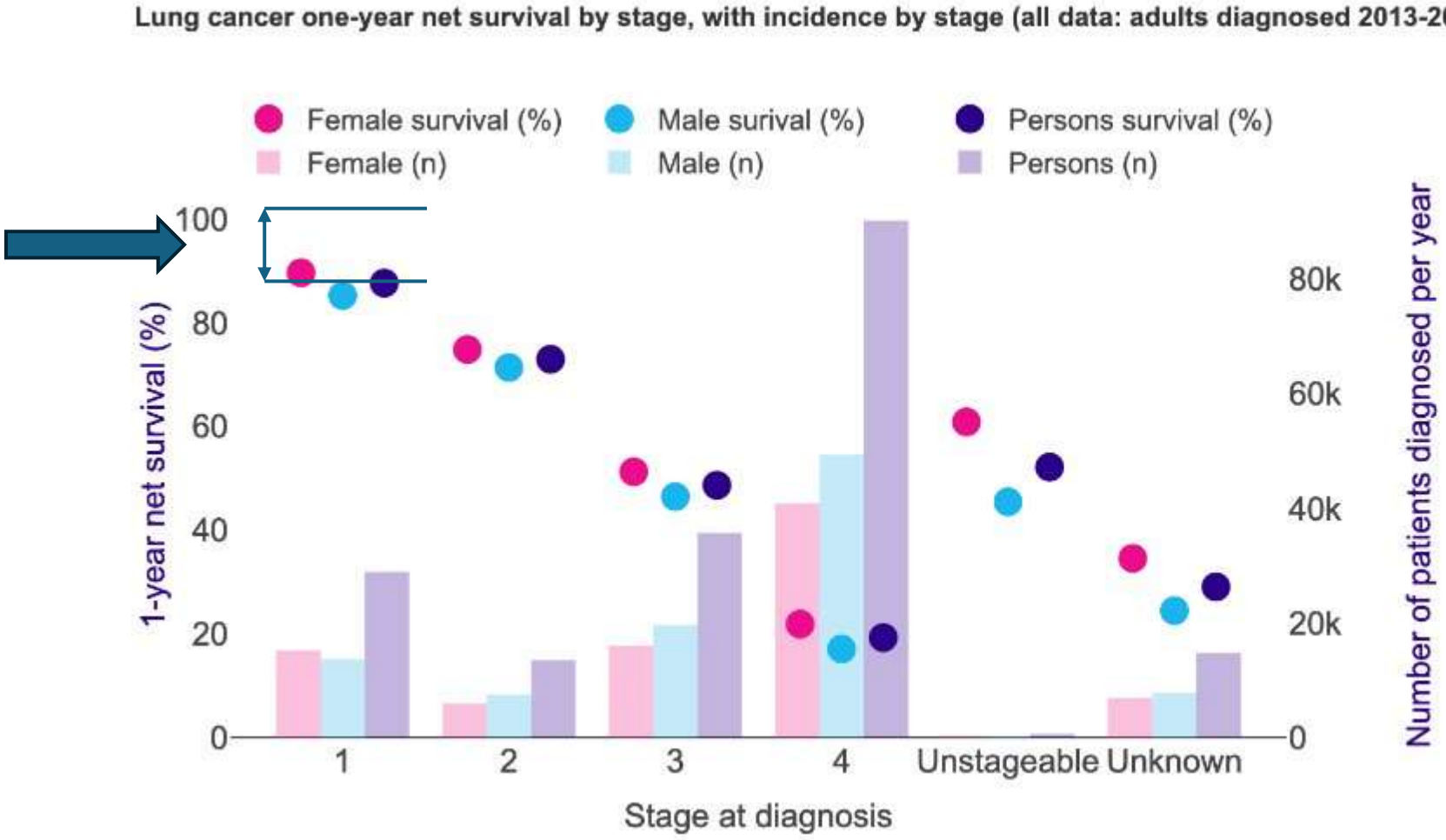


GENETICS



Radiogenomics project

- Data housed on TRE
- Working with academic and commercial collaborators including Canon Medical
- Data is available for other researchers to apply for access to answer research questions via a Data Access Board



Duncan – Oncology

https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/lung-cancer/survival#heading-Three

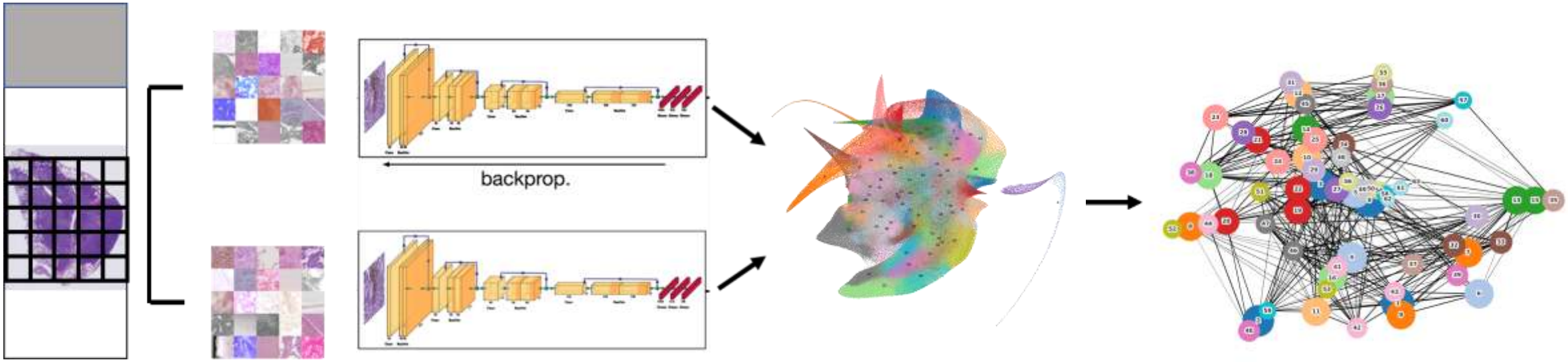
AI in Research

Le Quesne - Path

Yuan – Computer science

Mapping the landscape of histomorphological cancer phenotypes using self-supervised learning on unannotated pathology slides

Quiros et al, Nature Comms, 2024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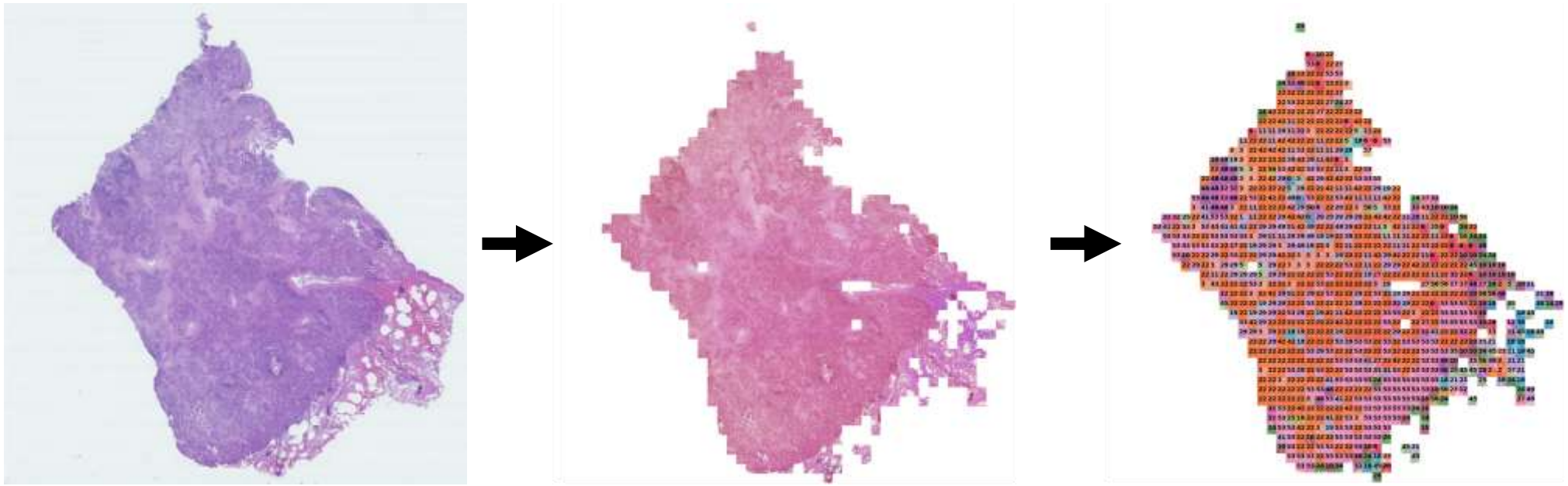

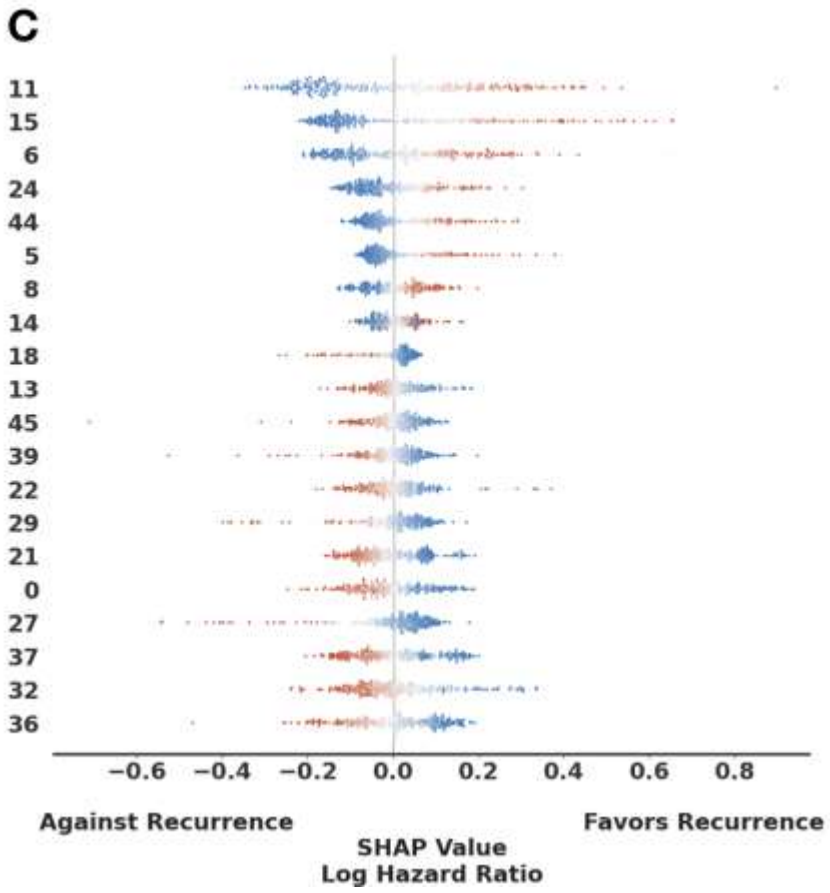
C
11
15
6
24
44
5
8
14
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13
45
39
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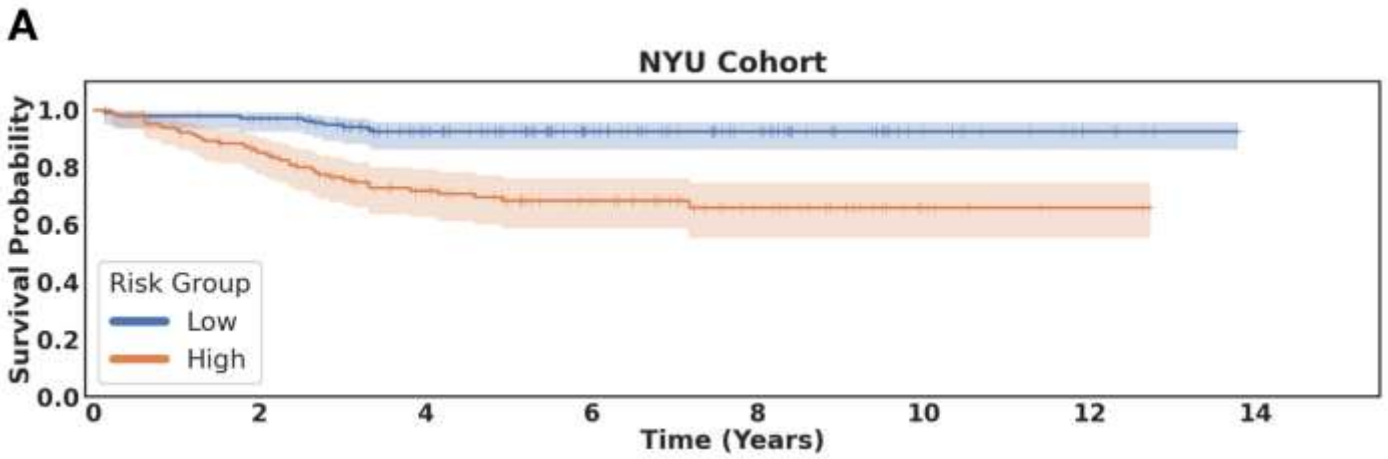
29
21
0
27
37
32
36
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
0.8
Against Recurrence
Favors Recurrence
SHAP Value
Log Hazard Ratio


A
NYU Cohort
Survival Probability
1.0
0.8
0.6
0.4
0.2
0.0
Risk Group
Low
High
0
2
4
6
8
10
12
14
Time (Years)

Summary

Use case 1: AI solutions in imaging

- AI:human interaction is crucial
- AI solutions require optimisation depending on deploying environment

Use case 2: AI solutions in MDT, tracking and audit

- Well designed software can improve efficiency
- Well curated data can aid pathway optimisation and MDT outcome review in real time

Use case 3: AI solutions in research

- AI can recognise patterns in routinely collected data that can help select patients for more personalised investigation and treatment