King's College London

NHS Fellowship in Clinical AI
NHS Digital Academy Programme

TRIAGE

DEPLOYING AI IN NHS RADIOLOGY

THE FIRST PARALLEL-SEQUENCE CLUSTER RANDOMISED CROSSOVER TRIAL OF AN AI IMAGING TOOL IN THE NHS

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IDENTIFY THE PROBLEM — Understand clinical need and workflow → **EVALUATE THE AI** — Develop and rigorously evaluate performance → **DEPLOY SAFELY AT SCALE** — Implement, evaluate impact and monitor in real-world NHS

1 THE PROBLEM: GROWING DEMAND, REAL CONSEQUENCES

9%
year-on-year increase in MRI demand[1]

>434,000
MRI & CT scans breached the 28-day reporting target in England (2023/24)[1]

~30%
projected consultant radiologist shortfall by 2027[2]

[1] NHS England. Diagnostics Waiting Times & Activity, 2023/24.
[2] The Royal College of Radiologists, 2022.
[3] Hanna TP, et al. Effect of Delay in Diagnosis on Survival in Cancers: Systematic Review. BMJ, 2020.
[4] Saver JL, et al. Time to Endovascular Thrombectomy & Outcomes in Ischaemic Stroke: Meta-analysis. JAMA, 2016.

Delayed reporting contributes to patient harm:

- **Cancer:** a 4-week delay in diagnosis is associated with a ~10% increase in mortality[3]
- **TIA / Stroke:** urgent assessment reduces 90-day stroke recurrence by ~80%[4]

This is both a workflow problem and a clinical problem.

WHY THIS MATTERS

Faster reporting of abnormal scans may enable faster diagnosis, treatment and improved patient outcomes.

WHO IS AFFECTED

Patients across every NHS region awaiting brain MRI reports — and the radiologists, clinicians and services carrying the reporting backlog.

2 THE AI SOLUTION: MIDI

MIDI: a deep-learning tool that 1) flags abnormal findings on adult brain MRI and 2) prioritises scans for reporting

Normal (Score < 0.5)

MIDI Report

Abnormality score: 0.483 (Normal)

Preview images aren't available due to the low abnormality score.

The radiologist still reviews the original MRI.

Abnormal (Score ≥ 0.5)

MIDI Report

Abnormality score: 0.641 (Abnormal) • Sequence: T2

Preview Images (Not for Diagnosis)

Image | Saliency Map | Graphical Output

Disclaimer: MIDI output is for use by appropriately qualified radiologists as an aid to case detection and prioritisation — not the sole means of assessment. It does not replace clinical judgement; always refer to the original imaging and clinical context.

How MIDI changes the reporting workflow

Current (chronological): MRI performed → Chronological worklist → Radiologist report

MIDI-prioritised (abnormal first): MRI performed → MIDI output normal/abnormal → Abnormal scans prioritised → Radiologist report

What the radiologist sees

Priority	Description
AI abnormal	MRI Head
AI abnormal	MRI Head
AI abnormal	MRI Head
AI abnormal	MRI Head + Gad
AI normal	MRI Head
AI normal	MRI Head
AI normal	MRI Head

Abnormal scans rise to the top of the worklist; normal scans remain lower for routine reporting.

3 FROM DEVELOPMENT TO DEPLOYMENT

1) Development
Retrospective model development & internal validation
>70,000 head MRI scans
AUC > 0.9

2) Generalisability
Prospective multisite evaluation (MIDI Study)
>37,000 patients
44 NHS sites
Sensitivity 0.95

3) Deployment
TRIAGE Trial - real-world evaluation across the NHS
Stakeholder target:
2-day TAT reduction

4 TRIAGE TRIAL

Study design

- Multi-centre cluster-randomised crossover trial
- >100,000 participants
- 12+ NHS sites
- MIDI ON vs MIDI OFF within sites

Primary outcome

Turnaround time for abnormal outpatient brain MRI scans

Secondary outcomes

- Health economics
- Acceptability / usability
- Turnaround time for all scans
- Safety ('critically abnormal')
- Accuracy

Clinical Outcomes

- O7 TIA / Stroke
- O8 Brain tumour / metastases

5 O7/O8: CLINICAL OUTCOME DESIGN

Demonstrating that faster MRI reporting for abnormal scans can confer clinical patient benefit.

Why clinical outcomes are challenging?

AI output → Report authorised → Clinical decision → Patient outcome

Clinical signal appears only if MRI reporting is the rate-limiting step.

From clinical hypothesis to protocol endpoints

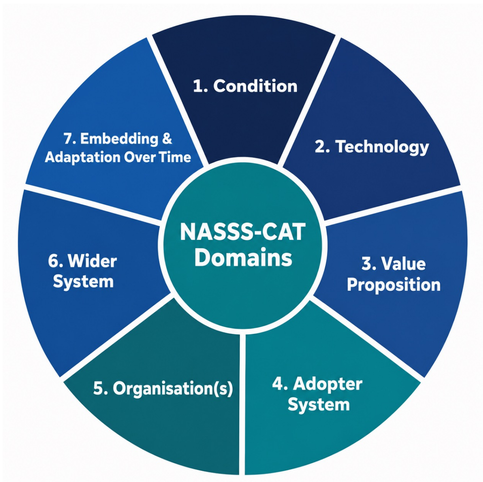
1. **Focused literature review** — Identify time-sensitive pathways
2. **Stakeholder pathway mapping** — Find where reporting delay matters
3. **Feasibility filter** — Meaningful, measurable, collectable
4. **Protocol endpoints** — Timing, treatment type, QoL, 28/90-day outcomes

O7/O8 pathway outcomes

O7: Stroke / TIA
- Time to diagnosis
- Time to treatment change

O8: Brain tumour
- Time to diagnosis/treatment
- Treatment type
- Mortality
- ECOG/KPS & QoL (EORTC)

6 IMPLEMENTATION USING THE NASSS-CAT FRAMEWORK



Led deployment of the NASSS-CAT implementation tool:

- ✓ Built a core stakeholder group (AI fellows, Chief Investigator, project manager, clinical scientific computing team, radiologist PIs)
- ✓ Mapped implementation complexity across all seven NASSS-CAT domains via targeted stakeholder workshops

Health Economists | PPI / Patient Advocates | Governance Experts | AI Leaders | Implementation Scientists

Key implementation insights

- ✓ Site readiness varies markedly across the NHS
- ✓ RIS/PACS and vendor-neutral platform integration differs across sites
- ✓ Trust, explainability, liability and governance matter
- ✓ Benefits may shift pressure downstream to clinics and MDTs
- ✓ Deployment requires persistence, coordination and local problem-solving
- ✓ Benefits in Radiology may shift pressure downstream to clinicians/MDTs

7 MY FELLOWSHIP CONTRIBUTIONS

A. ACHIEVEMENTS THIS YEAR

- Designed O7/O8 clinical outcome frameworks for the trial
- Led stakeholder engagement & clinical pathway mapping
- Led NASSS-CAT Phase 1 implementation work
- Contributed to site set-up, feasibility & governance (DCB0129, DCB0160, DPIAs)
- Presented at the RCR Global AI Conference

B. HOW I WAS SUPPORTED

- Local host team: supervisor, Chief Investigator, Project & Trial Managers
- Wider research MDT: radiologists, neurosurgeons, data scientists, statisticians, health economists
- FCAI faculty support throughout the year
- Protected time (2 days/week) funded by the NHS Fellowship (Deanery)

C. NEXT STEPS

- Complete NASSS-CAT Phase 2 (mitigation of complexity)
- Finalise O7/O8 sites & cCRFs via liaison with stakeholders and research teams
- Complete governance approval at all sites (DCB0160, DPIAs)
- Follow the project through the AI lifecycle: deployment, evaluation & post-market surveillance

KEY MESSAGES

- AI imaging tools can have differing value depending on clinical pathways and local context.
- Pathway mapping and stakeholder engagement are crucial to efficient, cost-effective implementation.
- Multi-site AI implementation in the NHS is complex.
- Proactive identification & mitigation of complexity using implementation frameworks may improve success.