Artificial Intelligence for diagnostics in radiology practice: A rapid systematic scoping review

Dr Rachel Lawrence (1), Emma Dodsworth (2), Dr Efthalia Massou (4), Chris Sherlaw-Johnson (2), Dr Angus I G Ramsay (1), Dr Holly Walton (1), Dr Tracy O'Regan (3), Professor Fergus Gleeson (5), Dr Nadia Crellin (2), Dr Kevin Herbert (4), Pei Li Ng (1), Holly Elphinstone (1), Raj Mehta (6), Joanne Lloyd (6), Amanda Halliday (6), Professor Stephen Morris (4), Professor Naomi J Fulop (1)

(1) University College London, (2) Nuffield Trust, (3) The Society and College of Radiographers, (4) University of Cambridge, (5) University of Oxford, (6) Public Contributor

RSET rapid service evaluation team
FUNDED BY NIHR | National Institute for Health and Care Research



1 Background

- Artificial Intelligence (AI) is being used in medical imaging to support the detection of irregularities and clinical diagnoses [1-3].
- The aim is that AI works alongside reporting staff to help improve accuracy, reduce time spent on routine tasks and facilitate a more efficient diagnostic pathway [1-3].
- However, the evidence is inconsistent and studies evaluating AI in practice are limited [4]. It is important to build a strong evidence base before AI can be used consistently in radiology systems.

Study aims: To understand how AI is being implemented and used globally for diagnostics in radiology, the effectiveness of these technologies, how much they cost and how they are experienced and perceived.

2 Research Questions

1. How has the evidence on implementation, experiences, perceptions, quantitative outcomes and cost of AI been ***measured***, ***collected*** and ***analysed***?
2. How have AI tools been ***implemented*** to support diagnostics in radiology?
3. How have AI tools supporting diagnostics in radiology been ***experienced*** and ***perceived*** (e.g., by patients, clinical staff)?
4. What evidence exists on ***effectiveness*** and ***cost*** of AI tools to support diagnostics in radiology?
5. What do **stakeholders** (radiology professionals and members of the public) **think** about review findings?

3 Methods

- A rapid systematic scoping review conducted in April 2024, across Medline-Ovid, CINAHL plus, PsycInfo and Web of Science Core Collection) and the grey literature.
- Eligible studies: i) Focused on AI for diagnostics in radiology, ii) Were empirical studies reporting findings on implementation, stakeholder experiences/perceptions, quantitative or cost outcomes , iii) Published between January 2020-24th April 2024.
- We conducted two workshops (with professionals in radiology and members of the public) to discuss review findings.

4 Results

6,099 studies were identified and 114 included (see Table 1). Review findings were analysed using narrative synthesis.

Topic/s covered	Total (*N*)
Implementation	*N*=6
Experiences	*N*=12
Perceptions	*N*=59
Quantitative impact and effectiveness	*N*=43
Cost studies	*N*=5

Table 1. *Study topics covered and number of included studies. Note: Some covered multiple topics and are included more than once*

5 Main Findings

Implementation. Four studied process of clinical implementation, 2 experiences of implementation. AI was used as a diagnostic support tool, not with autonomy. AI was integrated into existing radiology workflows and systems. All qualitative studies.

Perceptions. AI was generally viewed favourably. In the literature, there was a consistent view that AI should compliment and not replace. Patient and public trust was reliant on human oversight. Mainly survey data, some qualitative.

Experiences. Staff and trainees reported AI could help reduce reading times and improve accuracy but were concerned about limited evidence, false positives and reduced efficiency. Mix of qualitative and survey methods, no studies on patient, carer or public experiences.

Impact and effectiveness. Of the 43 quantitative studies, 16 evaluated effectiveness in a live pathway. In many studies, AI improved diagnostic accuracy and reduced interpretation times. However, improvements in workflow efficiency were variable. No studies addressed health inequalities.

Cost. Four studies demonstrated that the use of AI was cost-effective (depending on willingness-to-pay). One study found AI was not cost effective, as more invasive treatment approaches generated costs over a patient's lifetime.

Factors influencing adoption. Challenges: High technical demand, lack of knowledge, training, evidenced guidance and human connection, inconsistencies in who is responsible for AI. ***Facilitators***: Transparency (training staff and explaining AI to patients & public), AI champions/experts.

Stakeholder workshops. Stakeholders felt review findings reflected current early implementation, described as the *'wild west',* where people are learning as they go. The mixed findings were what they expected. The relevance of the review was highlighting limitations and evidence gaps, especially as AI is viewed as a transformative solution, despite the mixed evidence.

6 Implications & Future Research

- Limited evidence in real-world settings. There needs to be a balance between implementing AI safely with evaluations in place, to ensure future use can be evidence informed.
- ***Future research should:*** Evaluate the process of implementing AI into live clinical pathways, including how stakeholders experience AI (particularly patients, carers and the public), AI's effect on patient outcomes and wider hospital systems, the long-term sustainability of AI.

For more information, please contact: Dr Rachel Lawrence, rachel.lawrence@ucl.ac.uk. Use the QR code to visit our website

Funding statement: This project is funded by the National Institute for Health and Social Care Research, Health and Social Care Delivery Research programme (Ref: NIHR156380). The views and opinions expressed are those of the authors and do not necessarily reflect those of the NIHR or the Department of Health and Social Care.

References:
(1) Geis, J.R., et al., Ethics of Artificial Intelligence in Radiology: Summary of the Joint European and North American Multisociety Statement. Radiology, 2019. 293(2): p. 436-440.
(2) Brady, A.P., et al., Developing, purchasing, implementing and monitoring AI tools in radiology: Practical considerations. A multi-society statement from the ACR, CAR, ESR, RANZCR & RSNA. J Med Imaging Radiat Oncol, 2024. 68(1): p. 7-26.
(3) Gleeson, F., et al., Implementation of artificial intelligence in thoracic imaging-a what, how, and why guide from the European Society of Thoracic Imaging (ESTI). Eur Radiol, 2023. 33(7): p. 5077-5086.
(4) He, C.L., W. Xu, Jing. Huang, Y. Dong, Z. Wu, Y., Efficiency, accuracy, and health professional's perspectives regarding artificial intelligence in radiology practice: A scoping review. IRadiology, 2024. 2(2): p. 156-172.