HTA133

The impact of implementing AI-assisted contouring on radiotherapy staff and workflows

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Introduction

Clinical context

- Rising cancer incidence
- Workforce pressures (attrition, high vacancy rates and insufficient training numbers)
- Radiotherapy optimizes targeted delivery to cancerous tissue minimizing dose to healthy tissue (organs at risk, OARs).
- AI offers the potential to accelerate and standardize this tasks,
  - reducing pressure on workforce
  - easing pressure on squeezed workflows.
- Range of AI tools in use but no multi-centre evidence to robustly characterise its impact.
- This real-world, multi-vendor evaluation compared the use of AI auto-contouring tools with manual contouring of organs at risk (OARs) on workflows, staff and services.

Aims and objectives:

Measure impact of AI tools for contouring on standardisation of RT treatment plans across centres (i.e. impact on time, affect on workflow (capacity, efficiency), affect on staff).

To address evidence gaps highlighted in NICE's early value assessment for AI tools (HTE11)[1]:

- Clinical acceptability of contours; number of edits needed
- Time saving, including time for review and edits
- Resource use (defined by professionals' role, grade and time)

Qualitative interview analysis

Interviews were conducted via MS Teams and lasted 30-90 minutes. Questions were structured across three key domains:

1. **Workforce dynamics:** *how standard practices are maintained, modified or reshaped to facilitate adoption of AI technology*
2. **Trust in the AI system:** *identifying concerns related to over- or under-confidence in the AI tools' capabilities*
3. **Training and communication:** *how interprofessional interactions and educational processes are adapted to manage AI contouring.*

Reflexive thematic analysis generated **12 codes** and **5 themes**: advantages of AI tools, challenges of AI tools, impacts on professional roles, impacts on patients, and implementation of AI tools.

"I think we'd be a bit stuffed if we all of a sudden lost auto-contouring in terms of just capacity and how long it would take us to manually outline." [CL03]

"…it really does free me up for peer review, which is now part of our national standards to be peer reviewing every single head and neck cancer case, and it allows us time to do that, because our outlining is just so much quicker." [NC08]

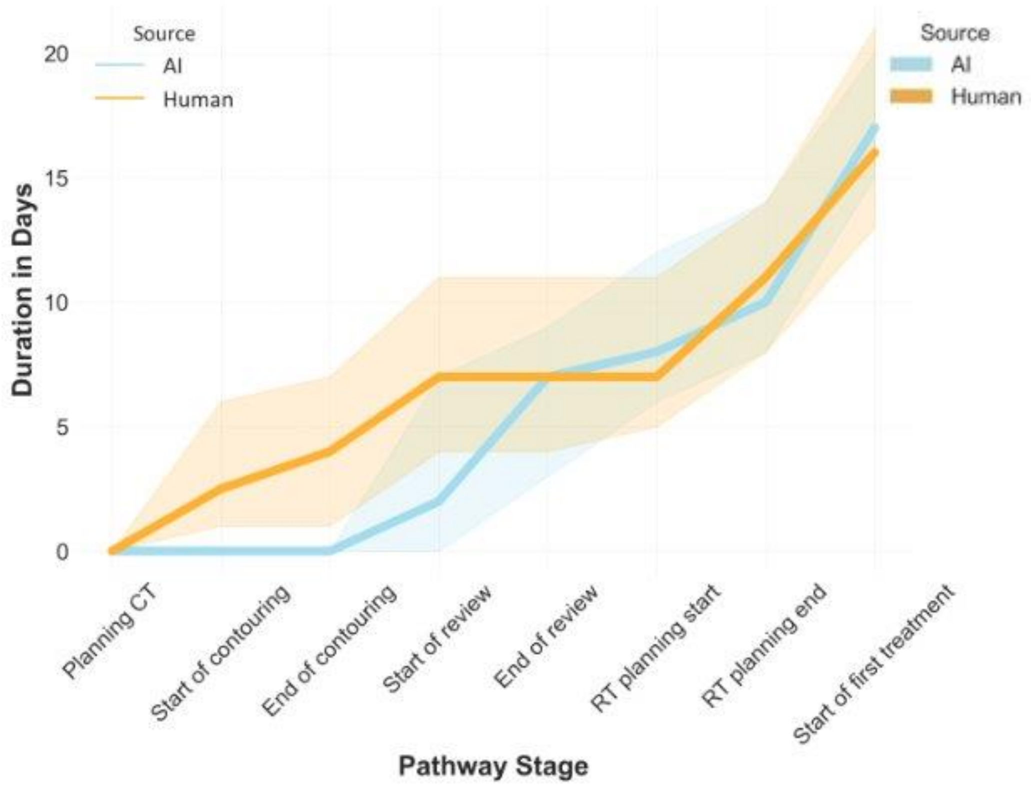
"We've also seen an increase in the complexity of the treatments we can offer, which take a bit more time to do and, again, we're able to absorb that [using AI] […] ideally it would be freeing up people to do service improvement projects, quality improvement projects – in practice I think a lot of it is just absorbed with ever increasing clinical demands." [CL01]

"It's the only bit of software in a very, very long time where I've had people knocking on the door saying can we use it." [NU02]

"It's not perfect, as I found out while testing, and I feel like there is certain reliance on using auto-contouring to create certain structures and just presumption that they're fine, they are correct." [CL02]

Change to workflows and processes

AI tools substantially quicker than manual methods but did not translate to overall shorter pathway durations.



Fixed scheduling of tasks along the pathway (fig. 1) is one solution to help meet cancer treatment waiting standards.

Instead, several departments used time released to increase capacity and redeploy staff to other essential patient facing tasks.

Methods

We used the 'Engineering for Better Care' systems engineering approach (iitoolkit.com, University of Cambridge)[2] a mixed-methods evaluation :

- Pathway mapping via unstructured interviews
- Quantitative semi-structured interviews with staff
- Likert assessment of acceptability of AI-generated contours (no edits, minor edits, moderate edits, major edits)[3]
- Time taken to complete the treatment planning pathway *(fig.1)* per scan (n=626), using oncology information system data

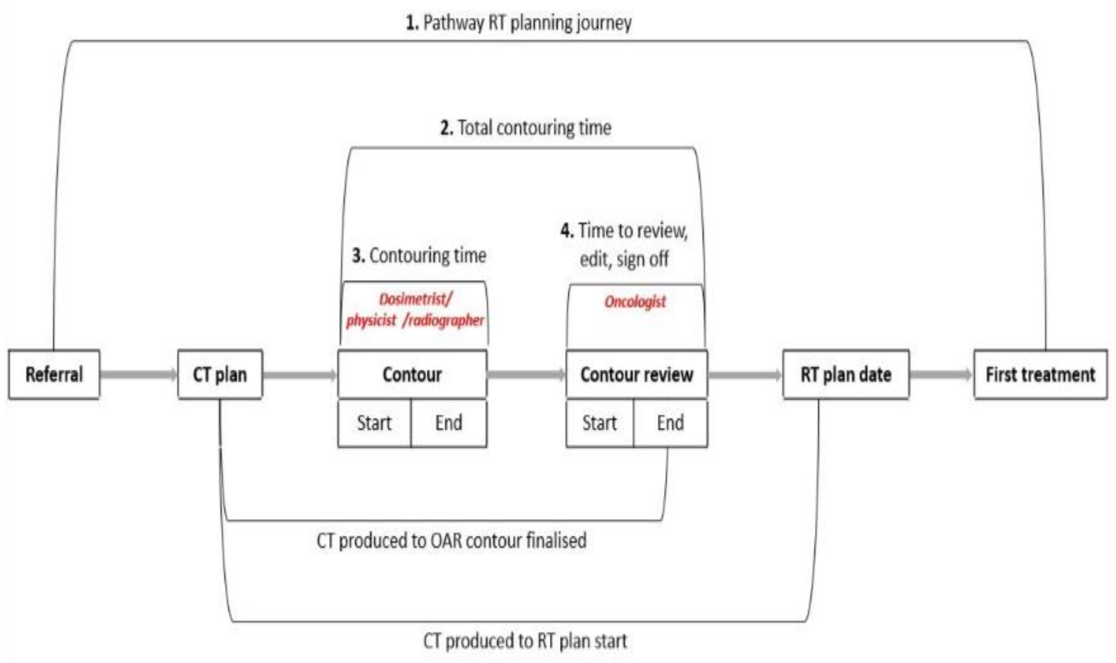
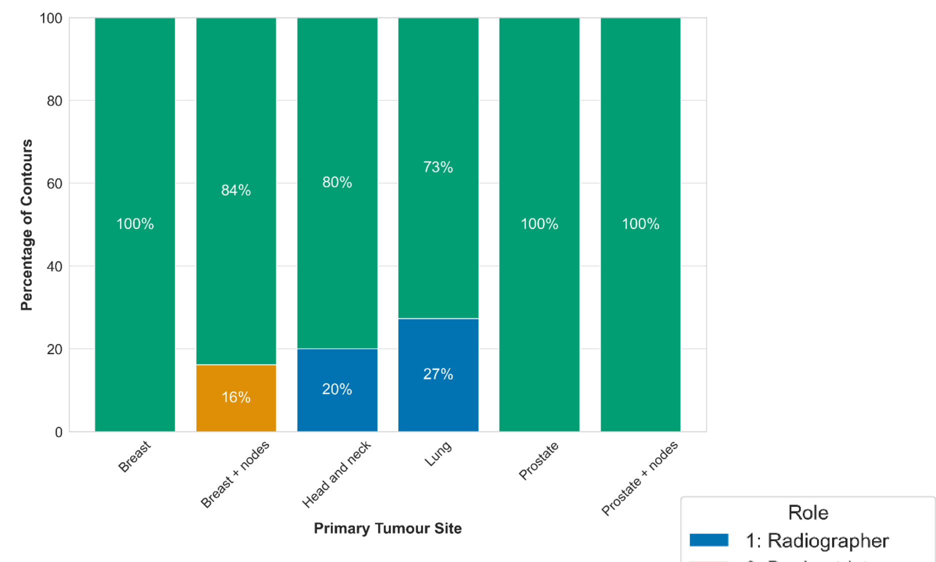


Fig.1: schematic radiotherapy treatment planning pathway with timeline metrics collected from oncology information systems.

Change in staff use

In the **manual contouring pathway:**



In the **AI-enabled pathway**,

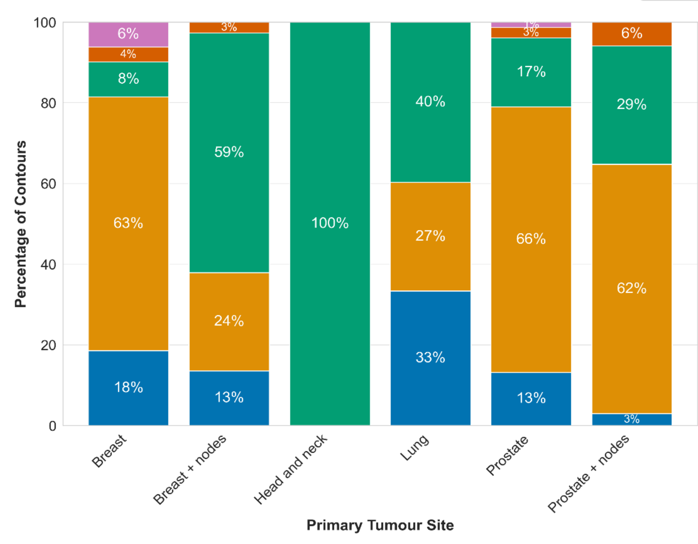


Fig.4: change in staff involvement in organ at risk contour review between manual contouring pathways ***(left)*** *and AI-enabled contouring pathways* ***(right)****.*

The diversification of staff allows

- greater flexibility within departments,
- frees up particularly oncologists to focus on other tasks
- advanced or extended practice to support CPD radiographers/dosimetrists.

Conclusions

Qualitative findings found strong preference for AI contouring tool. Staff unanimously and unambiguously **reported time savings** working with AI contouring tools, citing their utility in addressing caseload and capacity pressures, **ability to contour for more complex treatment planning** within constrained systems, and **supporting work/life balance and wellbeing**. However, some staff raised **concerns about over-trust in AI** contours.

Compared to manual contouring, **AI auto-contouring was completed faster at all departments, but this benefit was not realised across the treatment planning pathway** and was dependent on local pathway planning and priorities.

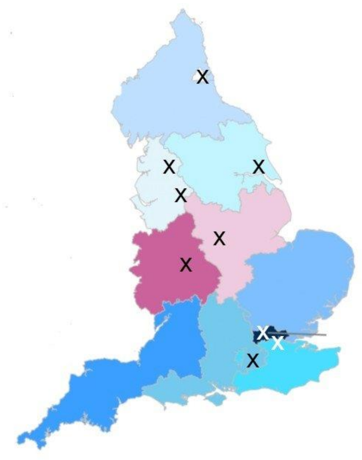
Acceptability of AI-generated contours, rated by the reviewer, **showed variation across anatomical sites**, with no or minor edits required for 100% breast cases versus 66.1% no or minor edits and 5.1% major edits required for head and neck contours.

Participation

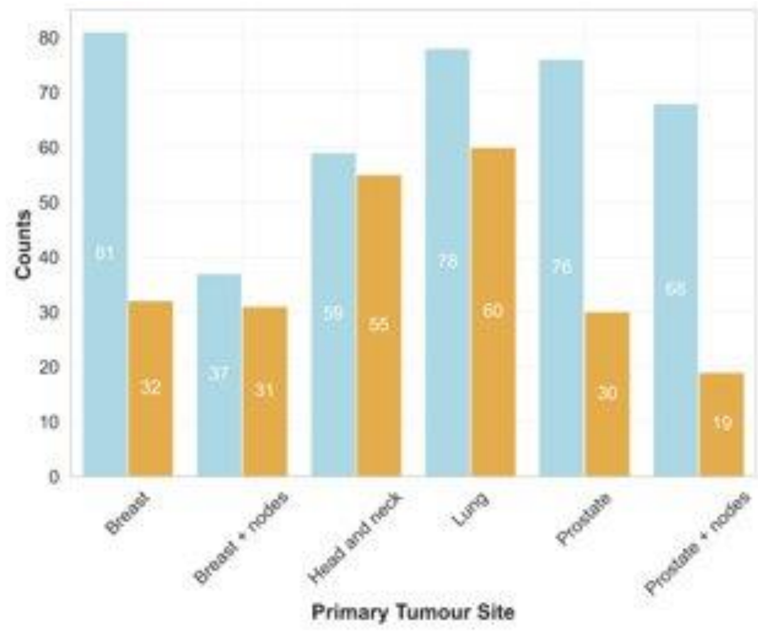
10 radiotherapy centres across 8 of the 11 Operational Delivery Networks in NHS England

Cross sectional design: experienced AI centres, non-AI centres, new to AI auto-contouring centres.

Some centres had changed from one auto-contouring tool provider to another prior to the evaluation, or in two cases, during the course of the evaluation.



Heterogenous pathways across centres: fixed or variable scheduling; different staffing resource and arrangements; different equipment resources (hardware and software).



To support generalizability of results across the NHS, all these data were included in quantitative and contextual analysis.

Acceptability to staff

Across tumour sites, from the 396 acceptability scores of AI-generated contours from Reviewer 1 (the first human reviewer of a set of contours):

- 63 contours (15.9%) required no further edits
- 255 (64.4%) contours required minor edits
- 64 (16.2%) contours required moderate edits
- 14 contours (3.5%) required major edits

Acceptability was related to tumour anatomical site ($\chi^2 = 100.99$, df = 15, $p < 0.0001$). Acceptability was lower for anatomical sites with smaller, elongated OARs e.g. in the head and neck.

Breast contours required the least edits. Breast cancer is the most common cancer in the UK and therefore implementing AI for this indication is anticipated to be cost saving.

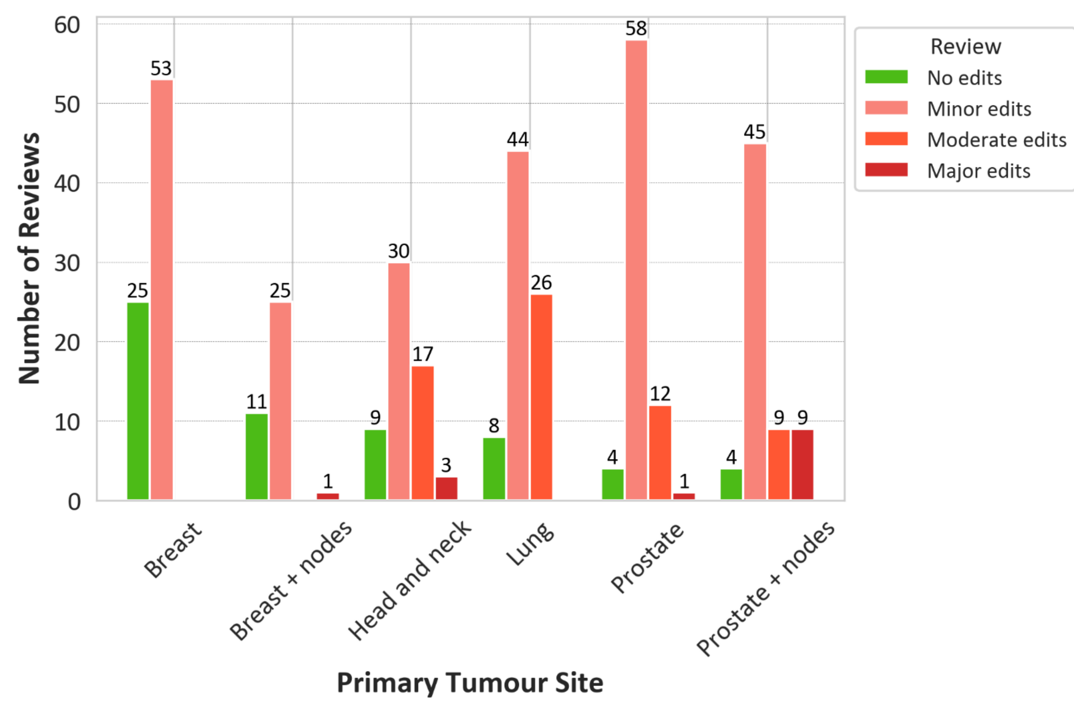


Fig.3: Frequency of acceptability scores assigned by staff reviewing AI-generated OAR contours, grouped by anatomical site.

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