University Hospital Southampton NHS Foundation Trust

University of Southampton

Fellowship in Clinical AI
NHS Digital Academy Programme

MACHINE LEARNING DECISION SUPPORT FOR OESOPHAGEAL CANCER MDT

AUTHORS

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01 CLINICAL QUESTION

Multidisciplinary Team (MDT) meetings are central to the management of oesophageal cancer, bringing together oncologists, surgeons, radiologists, pathologists, and specialist nurses to determine personalised treatment plans based on multimodal clinical data.

However, time pressure is a major challenge: with 10–20 patients per session and just 2–3 minutes typically allocated per case, there is limited opportunity for deep deliberation. Despite the complexity of disease and variation in patient fitness, decisions must be made rapidly, risking inconsistency and cognitive shortcuts.

This time-constrained environment affects thousands of patients annually and underscores the need for decision-support tools that enhance consistency, reduce bias, and make best use of the rich data already available.

02 AI SOLUTION

A machine learning model has been developed at the University of Southampton using 10 years of data from 893 patients with oesophageal cancer. The model uses inputs of patient age, performance status, tumour histology and staging. It predicts the likely MDT decision, such as palliation, chemotherapy, chemo-radiotherapy, endoscopic therapy, or surgery, and gives a percentage likelihood for each option, acting as a marker of confidence. This output has the potential to improve MDT consistency and enable prioritsation of cases based on projected outcome.

The model is now running in shadow mode during the Southampton oesophageal MDT, making real-time predictions that are not shared with clinicians. This allows us to assess its accuracy, check if the required data is available and reliable, and explore how well it fits into routine clinical workflows, without influencing patient care.

03 RESEARCH METHODOLOGY

We aim to test whether the model's research-level accuracy (AUC 0.88–0.99) holds in real-time MDT settings. In shadow mode, the model uses only data already available to the MDT, with no changes to clinical practice or attempts to fill in missing data.

We will track when key variables are missing or become available during the meeting, to understand data flow and availability. Alongside this, we'll explore how data collection fits into the clinical workflow and where it can be improved.

Finally, we will conduct a qualitative study with clinicians and patients to assess the model's clinical utility, usability, and acceptability in this complex and sensitive setting.

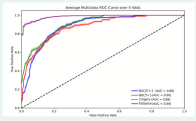

Figure 1. ROC Curve for oesophageal cancer MDT outcome tool. The plots demonstrate the improved specificity and sensitivity of the model for labelling palliative outcomes .

04 SHADOW MODE RESULTS

In shadow mode testing, the model achieved an overall accuracy of 71%. It performed particularly well in identifying patients selected for palliative care, with a sensitivity of 91.7% and a specificity of 92.6%. These results suggest the model is highly effective at distinguishing when palliation is appropriate, while also correctly recognising when it is not.

However, the model's input variables do not fully capture the nuance of every case. It may misclassify patients who are being re-discussed after initial treatment, or where previous interventions and evolving goals of care shape the MDT's recommendation. These limitations highlight areas for refinement, particularly in incorporating longitudinal clinical context and treatment history.

05 PROJECT TIMELINE

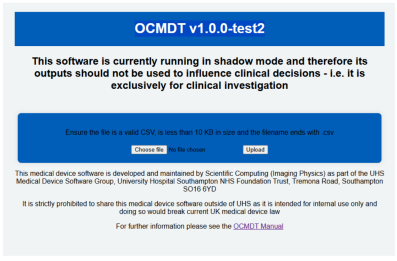

Figure 2. Welcome page of the Oesophageal Cancer MDT Support tool. This web app was developed by James Leighs and Riannach Semple, incorporating inbuilt protocols for data correction and curation. This inhouse project was designed inline with local and national medical device regulations.

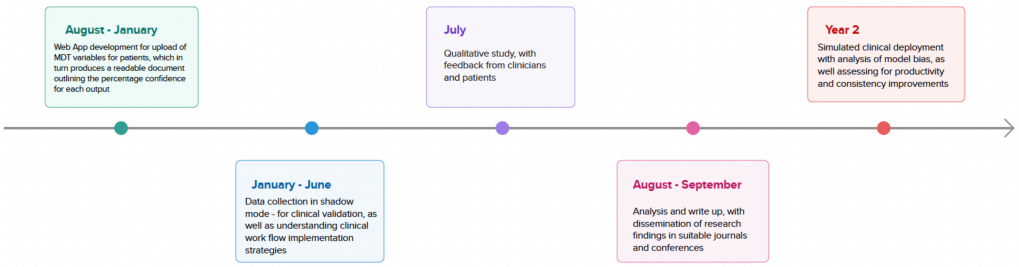

Figure 3. Timeline of project milestones and objectives, spanning the 12 months of the Clinical AI fellowship and beyond

06 CONCLUSION

- The model demonstrates reasonable accuracy in a real-world MDT setting, though performance is lower than in the original research environment.
- It is most accurate at identifying cases where palliation is the likely outcome.
- The research framework does not fully account for the dynamic nature of MDTs, where patients may be rediscussed multiple times or influenced by external clinical inputs not captured in the data.
- The clinical utility of the model remains under evaluation — key questions include whether pre-meeting predictions are desirable, how they might influence clinical behaviour over time, and how we address challenges like data drift, automation bias, and individual patient preferences.

Thavanesan N, Farahi A, Parfitt C, Belkhatir Z, Azim T, Vallejos EP, Walters Z, Ramchurn S, Underwood TJ, Vigneswaran G. Insights from explainable AI in oesophageal cancer team decisions. Computers in Biology and Medicine. 2024 Sep 1;180:108978.

Thavanesan N, Bodala I, Walters Z, Ramchurn S, Underwood TJ, Vigneswaran G. Machine learning to predict curative multidisciplinary team treatment decisions in oesophageal cancer. European Journal of Surgical Oncology. 2023 Nov 1;49(11):106986.

Thavanesan N, Bodala I, Walters Z, Ramchurn S, Underwood TJ, Vigneswaran G. Machine learning to predict curative multidisciplinary team treatment decisions in oesophageal cancer. European Journal of Surgical Oncology. 2023 Nov 1;49(11):106986.