Technoleg Iechyd Cymru
Health Technology Wales

Topic Exploration Report [1]

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

- Determine the quantity of evidence available for a technology of interest.
- Identify any gaps in the evidence.
- Inform decisions on topics that warrant fuller assessment by Health Technology Wales (HTW).

Topic exploration report number	TER546
Topic	Deontics Cancer MDT solution to streamline and support multi-disciplinary team meetings.
Summary of findings	Cancer multidisciplinary team (MDT) meetings provide opportunity for clinicians to discuss cancer patient cases, to agree upon treatment options and care pathways. Due to an increase in cancer cases and personalised medicine, these conversations have become more complex and time consuming. Therefore, development of artificial intelligence (AI) systems which can help triage patients with more straightforward cases directly to their treating clinician and away from MDT discussion, and provision of treatment recommendations for more complex cases would be beneficial. Health Technology Wales identified two meta-analyses and one systematic review covering four different computer decision support systems (CDSS) providing AI assistance to MDTs. In addition to this, five primary evidence sources were identified, three of which were not published in peer-reviewed journals. Concordance between CDSS and MDT decisions was variable, with results for different tumour types and grades fluctuating from around 60% to just around 95%. Adherence to clinical guidelines did appear to improve following addition of CDSS to the MDT workflow, but there did not appear to be a statistically significant improvement in patient outcomes. There was also variability in the acceptability of CDSS and other AI tools amongst clinicians attending MDT. There was a lack of economic evidence, however from the information that was identified, there appears to be a reduction in cost of care following use of CDSS, however the cost-effectiveness of this once the price of the technology are accounted for is unclear.

[1] Cyfieithu dogfennau HTW wedi'u cyhoeddi o'r Saesneg i'r Gymraeg
Translation of published technical HTW documents from English into Welsh

Introduction and aims

The UK NHS has mandated all cancer patients be discussed and treated via MDT meetings since 2000. As cases have become more complex, and available treatments more personalised, NHS England published guidance in 2020 which stated that patients who would be eligible for Standard of Care (SOC) treatment may be able to progress straight to treatment discussions with their clinician, negating the need for discussion about their care at MDT.

Health Technology Wales researchers searched for evidence on CDSS which can be used to streamline MDT meetings, with the key outcome being avoiding MDT discussion altogether where possible. Deontics Cancer MDT solution was the specific AI technology suggested by the topic proposer.

Evidence overview

Deontics Cancer MDT solution is a CDSS which triages cases prior to MDT meetings, enabling patients which can follow SOC treatment pathways to be referred immediately to their treating clinician and either avoid discussion at local MDT, or enable the MDT to be reduced to one or two clinicians supervising the CDSS tool. It also provides treatment recommendations for more complex patients for consideration at specialist MDT, to streamline discussions and improve efficiencies. A predecessor to Deontics was also noted within the literature, it was called multidisciplinary meeting Assistant and Treatment sElector (MATE), and was used in breast MDTs at Royal Free Hospital, London before being developed into Deontics. The evidence base identified so far indicates that Deontics has been tested mostly in breast and prostate cancer, but the company website states that the technology can work with all tumour types. During the literature search, several other CDSS were identified in addition to Deontics Cancer MDT solution, two of which came up repeatedly. These CDSS do not pre-triage patients and send some straight to their treating clinician, but may still help improve MDT efficiencies. The first is Watson for Oncology, which was a CDSS developed in the USA, but is no longer functional and is not available for use. Secondly, OncoDoc2 is a CDSS which was developed in France, and is designed to support MDT decisions for breast cancer patients. Other than Deontics Cancer MDT solution, which is CE marked, and Watson for Oncology, which is no longer available for use, the regulatory approval status of the other CDSS are unknown.

No Health Technology Assessments of this technology were identified. There were two meta-analyses identified, and one systematic review which also included a brief economic evaluation. In addition to this, five primary evidence sources were identified; two of which were conference abstracts, and one was a webpage which reported the results from the NIHR and NHS AI Award 2020, which were submitted in full to HTW via an unpublished report.

Secondary evidence

Oehring et al. (2023) performed a systematic review and meta-analysis comparing CDSS to MDTs or clinician treatment decisions, or treatment guidelines. They included 31 studies covering 16,472 patients, which reviewed four CDSS systems; WfO (23 studies), OncoDoc, Lung Cancer Assistant and MATE, and multiple cancer types. Their key outcome was concordance between CDSS and MDT, and they performed a meta-analysis to identify differences between subgroups. Jie et al. (2021) performed a meta-analysis of studies which compared WfO and MDT treatment schemes. They included nine studies across 2,463 patients and included a range of cancers, with the key outcome being concordance. Klarenbeek et al. (2020) performed a systematic review of the CDSS system OncoDoc2 compared to MDT decisions, and included 9 studies across 7,985 patients. They included multiple cancer types, and key outcomes were process outcomes such as pain management and colony stimulating factor use in patients at risk of febrile neutropenia, guidance adherence, prescribing behaviour, clinical workload and

cost-effectiveness (which is explained further within the 'economic evaluations' section of this report).

Concordance between CDSS and MDT was variable depending on cancer type and stage. Jie et al. (2021) found that overall concordance at the 'recommended' and 'for consideration' level was 81.52%, and was highest for breast cancer. They also reported that overall concordance for stage I-III cancer was 86%, and stage IV was 80.87% (p = 0.20) . A subgroup analysis for cancer type was performed, with results varying; breast cancer had highest concordance and gastric cancer the lowest. Conversely, Oehring et al. (2023) found via meta-analysis of 18 studies that overall concordance between MDT and CDSS for stage I-II cancers at the 'recommended' or 'for consideration' level was 72.7%, compared to 73.4% for stage III-IV (p = 0.18). They therefore performed a subgroup analysis for cancer types and stage, splitting between stage I-II and stage III-IV... They found breast cancer and lung cancer had higher concordance (73% to 84% and 63% to 67% respectively) than colorectal (63% to 67%) or gastric cancer (45% to 55%). Oehring et al. (2023) also reported the results from one paper which noted that CDSS helped improve concordance between novice oncologists and MDT; with improvements from 75.5% without WfO, to 95.3% with WfO.

Klarenbeek et al. (2020) found that adherence to treatment guidelines was statistically significantly improved for breast cancer following introduction of OncoDoc2 (77.8% to 87.1%, p = 0.02), but not for prostate cancer (86.7% to 89.9%, p = 0.35). They also reported a change in initial breast cancer management in 31% of cases, all of which were directed towards improvement in patient management. There was also a reduction in clinician workload, with 12 months of colorectal cancer follow-up reducing from 64 minutes per patient per year for a clinician, to 23 minutes (no p value reported). There was no statistically significant difference in clinical outcomes identified by Klarenbeek et al. (2020): one included study reporting metastasis being identified in 13% of patients treated without CDSS compared to 9% with CDSS (p = 0.06), and median overall survival in another improving from 10.7 months to 11.2 (p = 0.08).

Primary evidence

Santis V. et al. (2021) reported results from a study undertaken using Deontics Cancer MDT Solution in prostate cancer, with the key outcome being concordance between MDT and clinical guidelines in the UK, USA, and Europe. 50 cases were reported, with overall clinical concordance being 76%, and the highest concordance being with UK NICE guidelines. Subgroups with significantly improved concordance between the CDSS and guidelines were those who were less than 75 years of age (p < 0.001, odds ratio (OR) 35), having a prostate volume of less than 46.5ml (p < 0.047, OR 4.9) and a Gleason score of 8 or less (p = 0.013, OR 12.3). This data was used to help inform the investigators application for the NHSx AI in Health and Care Award, summarised below.

Within the NIHR and NHSx Artificial Intelligence in Health and Care Award, Deontics Cancer MDT solution was used in several phases and use cases. Firstly, a retrospective analysis was undertaken to assess its efficacy. This was reported by Khattak A. et al. (2022), whose poster was provided by the topic proposer. Within this, there were 287 cases compared to a 'gold standard MDT', with overall concordance found to be 92%. They identified patients in which there was 100% concordance (103 patients, 36%), and therefore considered safe to triage away from MDT; these were patients who had a life expectancy of more than 10 years, a prostate specific antigen level of less than 9.1, were younger than 74 and had localised disease only. Following this research, the investigators moved on to the next phase of the award.

The next phase of the award was assessed in two use cases via a prospective study- as a triage tool across 416 cases and then as a clinical decision support in the MDT, with 130 patients included and randomised between MDT+AI recommendation vs MDT alone. The

results from these use cases were reported online (Guys and St Thomas' Biomedical Research Centre, 2023). Of the 355 triaged cases with data available, concordance between AI and MDT was 85.6%. A machine learning derived decision tree resulted in 22.3% (93) cases being triaged as 'not for discussion at MDT', and concordance was 97.8%. A clinically derived decision tree resulted in 33.8% (141) cases being 'not for discussion at MDT', and there was 96.3% concordance between AI and MDT recommendations. Of the 130 patients discussed at MDT, concordance between best practice guidelines when the AI was included was 91.23% (95% CI: 83.88%, 98.57) and MDT alone for 89% (95% CI: 81.88%, 96.21%), p = 0.680. The authors note that the lack of statistical significance was likely due to a reduced sample size of included cases, due to industrial strike and IT issues meaning a reduction of 24 patients, and no record of MDT discussions for another seven. Finally, a qualitative study was undertaken with staff. Responses included that the AI streamlines decision making process, introduced previously overlooked approaches, focuses attention on key points, and reinforced decision making. However, respondents did note that the user interface and complexity could add time to MDT discussion, clinicians may be reluctant to change, and that it could be difficult to integrate into workflows.

Martin et al. (2023) and Lee & Lee (2020) reported on outcomes following use of WfO. Martin et al. (2023) compared MDT to a two-person MDT with (Team 1) and without (Team 2) WfO, compared to WfO alone. They found WfO had high concordance with local best practice, with concordance for treatment plan decisions at 92% WfO alone vs 96% team 1 vs 92% team 2, but results were not significant. Treatment type decisions were also high, with 89% WfO alone vs 93% team 1 vs 82% team 2, again results were not found to be significant. They reported WfO could reduce MDT workload by up to 40%, with 40.2% cases correctly triaged to WfO for treatment plan, and 34.6% for treatment type recommendations.

Lee & Lee (2020) reported on hospital satisfaction and perception among 285 patients cared for by MDT (156 patients) compared to MDT with WfO assistance (129 patients) via a survey. There were a mix of cancer types included, most of which (38%) were colorectal, and 17% were breast cancer. The group for whom MDT decisions were supported by WfO reported a satisfaction level of 9.53 out of 10 points, which was higher than the MDT group (9.24 out of 10 points), and overall, they found satisfaction was higher in younger patients.

Patkar et al. (2012) reported on the use of MATE in breast MDTs at Royal Free Hospital, London via an audit and questionnaire. They noted that 61% more patients were identified as potentially eligible for clinical trials, and there was better concordance with clinical practice guidelines than MDT alone (97% MDT+MATE vs 93% MDT).

Economic evaluations

As part of their review, Klarenbeek et al. (2020) reported results from one USA study which stated a reduction in cost of care in the first 12 months following diagnosis of stage IV non-small cell lung cancer by $17,000, from $69,122 to $52,037.

Economic evaluations of the triaging function of Deontics Cancer MDT solution for prostate cancer were performed by King's Technology Evaluation Centre following the PROSAIC-DS study, and are expected to be published online in the near future(Guys and St Thomas' Biomedical Research Centre, 2023). They calculated cost-savings based on a decision tree analysis, assuming varying proportions of patients were triaged away from MDT and straight to speak with their treating clinician. Input parameters were based on NHS reference costs and company technology costs. With the assumption that 33% patients would be triaged away from MDT, they found a per-patient cost saving of £32 at Guy's and St Thomas' NHS Trust

Evidence overview

(input parameter of 480 patients), and a £30 cost saving at Kings College Hospital (input parameter of 415 patients), which increased as the proportion of patients triaged increased.

Areas of uncertainty

There was a limited amount of published peer reviewed evidence for Deontics Cancer MDT Solution, however there is peer-reviewed literature available for its predecessor MATE, and results from the NIHR funded trial (as reported by Guy's and St Thomas' NHS Trust) are due to be submitted to a peer-reviewed journal soon.

There were some economic evaluations undertaken by King's Technology Evaluation Centre as part the NHSx AI in Health and Care Award undertaken by Guy's and St Thomas' NHS Trust, which is due to be published on their website, particularly evaluating the cost-effectiveness of the triage function. The topic proposer notes that a more extensive economic analysis is planned for the next 12 months, to be published soon thereafter. Economic evaluations for other CDSS were not identified within the brief searches undertaken for this report.

One finding from the NIHR report indicates that it was challenging to engage clinicians in the use of CDSS at MDT. If clinicians are reluctant to use CDSS in practice, it would limit their effectiveness and equality of care between hospitals. The study Chief Investigator, in discussion with the topic proposer, noted that this was mostly due to the fact that there was a lack of time or allowance within the study to educate and support the MDT, but they have since been very supportive of Deontics use at the prostate MDT and that it will soon also be used in the breast MDT. Further work is required to understand which training and education may be required to enable clinicians to use AI tools such as these in practice. Other papers state that CDSS would need to be appropriately localised and validated before use, requiring support of various departments and individuals within an NHS Trust.

Deontics Cancer MDT Solution appeared to have been used predominantly in prostate and breast cancer thus far, so despite company suggestions that it could be used in multiple cancer types, the only evidence available so far is in these limited groups. Similarly, OncoDoc2 also appears to have been primarily tested in breast and prostate cancer and MATE in breast cancer. WfO seems to have been tested in a wider variety of cancer types. Only Deontics Cancer MDT Solution was identified to have achieved CE marking, with the other AI technologies status unclear in this regard. Therefore, further consideration should be given as to which CDSS and which cancer types should be included if this topic is progressed.

There was limited evidence on patient outcomes identified, for example in how assisting and streamlining MDT decision making can impact upon time taken for patients to commence treatment, and how this affects overall outcome. The topic proposer notes that Deontics will start to be used in the breast cancer MDT at Guys and St Thomas' NHS Trust and they aim to start measuring patient outcomes, if possible- noting that there may not be sufficient follow-up time to do so.

Literature search results

Health technology assessments and guidance
Nothing found
Evidence reviews and economic evaluations
Jie Z, Zhiying Z, Li L. (2021). A meta-analysis of Watson for Oncology in clinical application. Sci Rep. 11(1): 5792. https://doi.org/10.1038/s41598-021-84973-5 Klarenbeek SE, Weekenstroo HHA, Sedelaar JPM, et al. (2020). The Effect of Higher Level Computerized Clinical Decision Support Systems on Oncology Care: A Systematic Review. Cancers (Basel). 12(4). https://doi.org/10.3390/cancers12041032 Oehring R, Ramasetti N, Ng S, et al. (2023). Use and accuracy of decision support systems using artificial intelligence for tumor diseases: a systematic review and meta-analysis. Front Oncol. 13: 1224347. https://doi.org/10.3389/fonc.2023.1224347
Individual studies
Lee K, Lee SH. (2020). Artificial Intelligence-Driven Oncology Clinical Decision Support System for Multidisciplinary Teams. Sensors (Basel). 20(17). https://doi.org/10.3390/s20174693 Martin M, Kristeleit H, Ruta D, et al. (2023). Augmentation of a multidisciplinary team meeting with a clinical decision support system to triage breast cancer patients in the United Kingdom. Future Medicine AI. https://doi.org/10.2217/fmai-2023-0001 Patkar V, Acosta D, Davidson T, et al. (2012). Using computerised decision support to improve compliance of cancer multidisciplinary meetings with evidence-based guidance. BMJ Open. 2(3). https://doi.org/10.1136/bmjopen-2011-000439 Santis V., Enting D., Patkar V., et al. (2021). Abstract PO-095: The PROState AI Cancer–Decision Support (PROSAIC-DS) pilot study: Clinical decision support technology and its role in prostate cancer MDT meetings. Available at: https://aacrjournals.org/clincancerres/article/27/5_Supplement/PO-095/32795/Abstract-PO-095-The-PROState-AI-Cancer-Decision [Accessed 08 May].
Ongoing research
None identified
Other
Provided by company: Khattak A., Makanjuola J., Ruta D., et al. (2022). P8-2: PROSAIC-DS: Artificial Intelligence and the Future of Prostate Cancer MDT's. https://doi.org/10.1177/20514158221077479 [Accessed 08 May 2024]. NIHR report- not published or publicly available, but found via Google at: Guys and St Thomas' Biomedical Research Centre. (2023). Findings: The PROSAIC-DS trial. Available at: https://www.guysandstthomasbrc.nihr.ac.uk/microsites/prosaic/findings/ [Accessed 08 May].

Date of search	03/05/2024
Concepts used	Deontics, artificial intelligence, multidisciplinary team/ meeting, computer decision support system/ CDSS, PROSAIC DS, Watson for Oncology

Proposed research question and evidence selection criteria (if selected)

Proposed Research question	Clinical and cost effectiveness of Deontics Cancer MDT solution to streamline and support multi-disciplinary team meetings.

	Inclusion criteria	Exclusion criteria
Population	Patients on cancer pathway	
Intervention	AI pre-MDT triaging tool AI computer decision support system	
Comparison/ Comparators	MDT review for all patients, with no AI support	
Outcome measures	Proportion of patients avoiding MDT discussion Change in patient management Concordance between AI and MDT/ best practice guidelines MDT efficiency/ duration Time to start of treatment Patient outcomes (survival, metastasis, side effects) Health related QoL Resource use Economic outcomes	

Proposed specialities	Cancer, Health service organisation and delivery