National Germ Cell Group Conference 2023

Comparative cost-effectiveness of alternative imaging and surveillance schedules for testicular seminoma in the TRISST trial

Dacheng Huo[a], Robert Huddart[b], Fay H. Cafferty[c], Laura Murphy[d], , Gordon J.S. Rustin[e] , Syed A. Sohaib[b], Francesca Schiavone[d], Richard S. Kaplan[d], Johnathan K Joffe[f], Mark Sculpher[a], Pedro Saramago[a]

[a] Centre for Health Economics, University of York, York, U.K.; [b] The Institute of Cancer Research, Royal Marsden Hospital, Sutton, U.K; [c] The Institute of Cancer Research Clinical Trials and Statistics Unit, Sutton, U.K.; [d] The MRC Clinical Trials Unit, University of College London, London, U.K.; [e] Mount Vernon Hospital, Northwood, U.K.; [f] St James University Hospital, Leeds, U.K.

Corresponding authors: dacheng.huo@york.ac.uk; pedro.saramago@york.ac.uk

BACKGROUND

- Survival following orchiectomy in stage I seminoma is ~100%
- Use of CT surveillance avoids adjuvant treatment and has become an international standard of care
- The TRISST trial (NCT00589537) demonstrated that effective monitoring could be achieved with a reduced scan schedule or using Magnetic Resonance Imaging (MRI) instead of CT
- What about CT/MRI surveillance cost-effectiveness?

OBJECTIVES

- TRISST trial data was used to evaluate the economic consequences and health outcomes of different surveillance schedules in seminoma testicular patients in the UK

METHODS

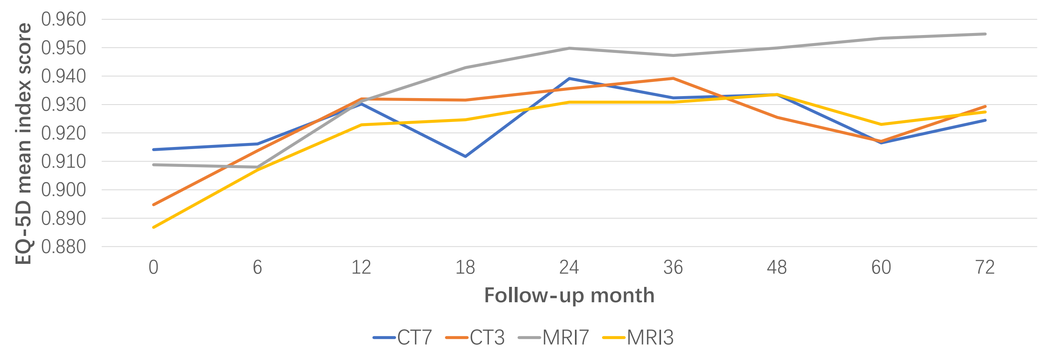
- **Economic analysis:** economic analysis aimed at comparing trial surveillance schedule alternatives (7CT (standard practice when TRISST was designed), 3CT, 7MRI and 3MRI)
- **Population:** patients with seminoma testicular cancer in the UK
- **Time Horizon:** over a period of 6 years after randomisation
- **Data:** TRISST trial data and published national sources for unit costs
- **Analysis framework and perspective:** Within-trial economic analysis under a UK NHS and personal social services (PSS) perspective and with cost and benefits discounted at a rate of 3.5% per year (NICE, 2022)
- **Cost-effectiveness outcomes and results:** quality-adjusted life-year (QALY); within-trial mean total costs; cost per QALY gained.
- **Uncertainty:** probability of alternative strategies being cost-effective
- **Health resource use and costs:**
  - Costs were estimated by multiplying health resources used in TRISST by respective unit cost (Table I)
  - Resources included: scans and tests, hospitalisation, treatment for relapse (chemo/radio/ surgery) and more prevalent adverse events (i.e neutropenia)
  - Econometric models (Generalised Linear Models (GLMs)) were used to model overall total costs, adjusted by baseline covariates: age, rete testis invasion and tumour size

Table I – Unit Costs

Service		Unit Cost (updated to 2021 value)	Source
Scan & Test	CT scan	£178	UK NHS Reference Costs 2019/20
	MRI scan	£231	
	Blood sample	£4	
	Clinical investigation	£187	
	X-ray Scans	£34	
hospitalisation & surgery	Outpatient	£193	
	hospitalisation-critical care per day	£1,276	
	Other hospitalisations per day	£910	
	Neutropenia-Adverse Effect	£3,582	
	General Surgery	£8,331	
Radiotherapy & Chemotherapy delivery	Radiotherapy –delivery	£124	
	Radiotherapy –preparation	£739	
	Chemotherapy-parental delivery	£414	
	Chemotherapy-subsequent delivery	£346	
Regimens Procurement	SAC-BEP-Procurement	£325	UK National Tariff Chemotherapy Regimens List 2017/18
	EP-Procurement	£288	
	VIP-Procurement	£342	

- **Health benefits:**
  - EQ-5D index scores from (participant reported) EQ-5D 3L questionnaires were estimated using UK population norms (Kind et al, CHE 1999)
  - Missingness was addressed via multiple imputations by chained equations, considering within and between participant correlation
  - As for costs, GLMs were used to model overall total benefits, adjusted by the same baseline covariates: age, rete testis invasion and tumour size
  - QALYs were obtained via multiple imputed EQ-5D index scores, and assumed to be 0 for timepoints after death for all deceased trial participants

Figure I – EQ-5D mean index scores over the trial follow-up period (after multiple imputation)



KEY RESULTS

- Most health resource consumption (76%) happened during the disease-free period, due to the small number of relapses (n=82, 12%)
- Marginal differences in QALYs across the follow-up period and between surveillance strategies (Figure I)
- Individuals undergoing 7 MRIs yielded, on average, slightly higher health benefits (5.17 QALYs) but at higher costs (£5,750, see Table II).
- Compared to 7 CTs, 7 MRIs was estimated to have 67% probability of being cost-effective at a cost-effectiveness threshold of £20k/QALY gained
- 3 MRIs had similar total costs and benefit to 7 CTs, whereas 3CTs was more expensive than 7 CTs and 3 MRIs, providing marginal additional benefits

Table II – Cost-effectiveness results summary

Strategy	Predicted Total Cost* (£, mean(sd))	Predicted Total QALYs* (mean(sd))	Incr. Costs	Incr. QALY	ICER (£/QALY gained) vs 7CT	Prob. CE (£20k/QALY gained)
3MRI	5, 083 (399)	5.10 (0.06)	--	--	Dominated: slightly higher costs, and slightly less benefits	
3CT	5,600 (599)	5.11 (0.05)	--	--	Extendedly dominated: Higher ICER than 7 MRI	
7CT	5,029 (297)	5.10 (0.06)	--	--	--	33%
7MRI	5,750 (328)	5.17 (0.04)	720	0.07	10,381	67%

* Results were based on the total cost and benefits prediction for each strategy by non-parametric bootstrapping methods

CONCLUSIONS

- Overall, differences in QALYs across the follow-up period and between surveillance strategies were marginal. A 7-scan MRI schedule yielded more health benefits than other strategies but at higher costs
- Considering possible system capacity constraints with MRI, the reduced radiation exposure relative to CT scanning and non-inferiority for clinical outcomes in the primary trial analysis, a 3-scan MRI schedule may be the best option to replace the current CT-based longer surveillance practice

ACKNOWLEDGEMENTS

- This research has been funded by Cancer Research UK (C17084/A8690) and the Medical Research Council Clinical Trials Unit at UCL (MC_UU_12023/28)
- Special thanks to the trial participants and their families, and to all investigators and research teams at participating centers

REFERENCES

- Kind, P., Hardman, G. and Macran, S., 1999. UK population norms for EQ-5D. CHE Discussion Paper 172;
- Joffe, J.K., Cafferty, F.H., Murphy, L., Rustin, G.J., Sohaib, S.A., Gabe, R., Stenning, S.P., James, E., Noor, D.,Wade, S. and Schiavone, F., 2022. Imaging Modality and Frequency in Surveillance of Stage I SeminomaTesticular Cancer: Results From a Randomized, Phase III, Noninferiority Trial (TRISST). Journal of Clinical Oncology, 40(22):2468-2478.
- NHS Improvement. National tariff payment system 2017/18 and 2018/19. annex A: the national prices and national tariff workbook.
- UK Department of Health. 2012. NHS reference costs: financial year 2011 to 2012.
- National Institute for Health and Care Excellence (NICE). 2022. Guide to the methods of technology appraisal.