Targeted intraoperative radiation therapy as an adjuvant to surgery for the treatment of breast cancer in England: A UK-based cost-effectiveness analysis of INTRABEAM

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Introduction

Whole-breast external beam radiotherapy (WB-EBRT) is the standard of care in the UK among patients with early invasive breast cancer (BC) following breast-conserving surgery but is associated with short- and long-term adverse effects. The INTRABEAM® device may be used to deliver adjuvant targeted intraoperative radiation therapy (TARGIT-IORT) to patients with early BC at the time of surgery, while reducing treatment-associated burden, resource utilization, and exposure to radiation and relevant toxicities. An economic evaluation was performed to assess the cost-effectiveness of INTRABEAM over a lifetime horizon, from a UK National Health Service (NHS) perspective.

Methods

A Markov model was developed to estimate the long-term costs and effectiveness of INTRABEAM compared to WB-EBRT, among a patient population eligible for breast-conserving surgery. A six-state model structure was utilized to capture patient progression from recurrence-free to recurrent cancer health states, with breast and non-breast cancer-related mortality also modelled. Transition probabilities were informed by published literature, with parametric models used to estimate mortality based on patient-level data. The model was developed probabilistically to account for uncertainty in model parameters, with a Monte Carlo simulation performed. Incremental costs and quality-adjusted life-years (QALYs) were estimated, with results presented in the form of an incremental cost-effectiveness ratio (ICER).

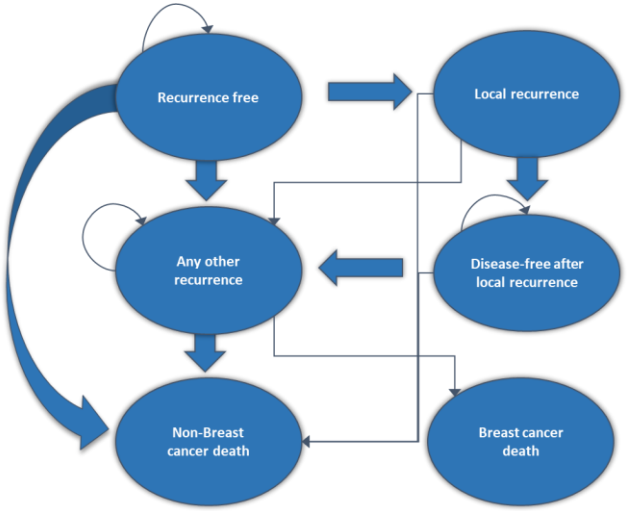

Figure 1: Model structure

Results

Base-case results indicated that the INTRABEAM device would be a cost-saving intervention compared to WB-EBRT over a lifetime, resulting in a cost saving of £1,748 (INTRABEAM = £5,730, WB-EBRT = £7,478). The estimated QALYs lived were comparable between the two groups (INTRABEAM = 11.04, WB-EBRT = 11.05). Univariate sensitivity analysis indicates that the cost and utility associated with the 'Distant and local Recurrence' health states were the most impactful parameters on overall results. The probabilistic sensitivity analysis results show that INTRABEAM is likely to be cost-effective across a range of willingness-to-pay (WTP) thresholds (78.5% probability of being cost-effective at the National Institute for Health and Care Excellence (NICE)-recommended £20,000 WTP threshold) and cost saving (100% probability of being cost-effective).

Table 1: Base-case discounted cost-effectiveness results over lifetime horizon

	INTRABEAM	WB-EBRT	Incremental Δ
Total costs per patient (£)	5,730	7,478	-1,748
Total life years lived (discounted)	14.219	14.235	-0.015
Total QALYs lived (discounted)	11.04	11.05	-0.01
Incremental cost/life year gained (£)	-	-	113,265
Incremental cost/QALY gained (£)	-	-	160,064
Probability of being cost-effective	-	-	78.5%
Probability of being cost-saving	-	-	100%

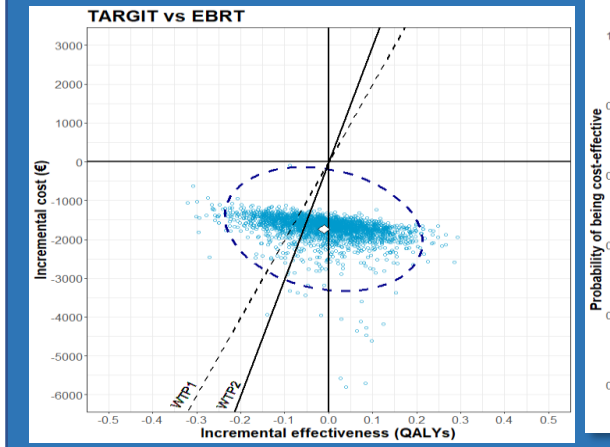

Figure 2: Cost-effectiveness plane

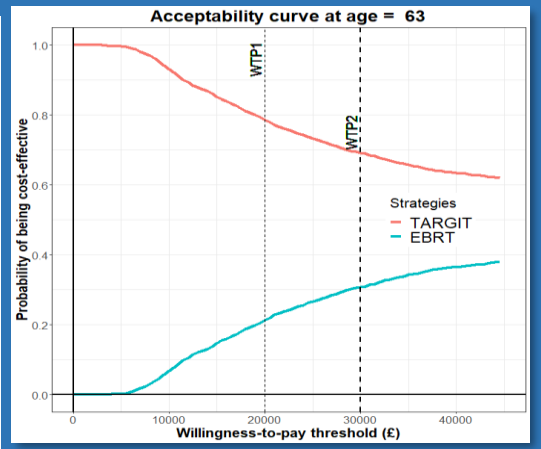

Figure 3: Cost-Effectiveness Acceptability Curve

Conclusion

Our results indicated that an innovative technology developed for the delivery of TARGIT-IORT (INTRABEAM) has the potential to reduce the costs to the National health service (NHS) in the UK among patients with early BC undergoing surgery, while providing comparable effectiveness.

Reference: 1- Vaidya JS, et al. Long term survival and local control outcomes from single dose targeted intraoperative radiotherapy during lumpectomy (TARGIT-IORT) for early breast cancer: TARGIT-A randomised clinical trial. BMJ. 2020 Aug 19;370:m2836. doi: 10.1136/bmj.m2836.
2-Vaidya JS, et al. New clinical and biological insights from the international TARGIT-A randomised trial of targeted intraoperative radiotherapy during lumpectomy for breast cancer. Br J Cancer. 2021 Aug;125(3):380-389. doi: 10.1038/s41416-021-01440-8. Epub 2021 May 25.