

Assessing the Economic Impact of a Robotic-Assisted Solution vs. a Manual Approach in Total Knee Arthroplasty in the UK

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Introduction

Total knee arthroplasty (TKA) is an effective surgical procedure, with an estimated 135,000 surgeries performed annually in the UK.¹ However, TKA is resource-intensive, with revision rates of 5-6% for primary procedures. Revision knee surgery is not only more technically demanding but also carries a higher risk of postoperative complications compared with a primary knee replacement, resulting in costs that can be as much as three times higher.² Robotic-assisted TKA can improve implant alignment and positioning while providing insights to enhance efficiency and optimize healthcare resource utilization (HRU).³

This study aims to assess the economic impact of implementing the VELYS™ Robotic-Assisted Solution (VRAS) versus the manual approach in the UK.

Methods

A Markov model with a 7-year horizon was developed to compare the budget impact of VRAS and manual TKA. Health states were defined by the occurrence of revision. Inputs were sourced from real-world data, the UK National Joint Registries, NHS England tariffs, and published literature. HRU-related costs were combined with VRAS service and disposable costs to estimate savings from both hospital and payer perspectives. Deterministic and probabilistic sensitivity analyses (DSA and PSA) were conducted. The model assumed 500 patients/year undergoing primary TKA.

Table 1. Inputs for budget impact model

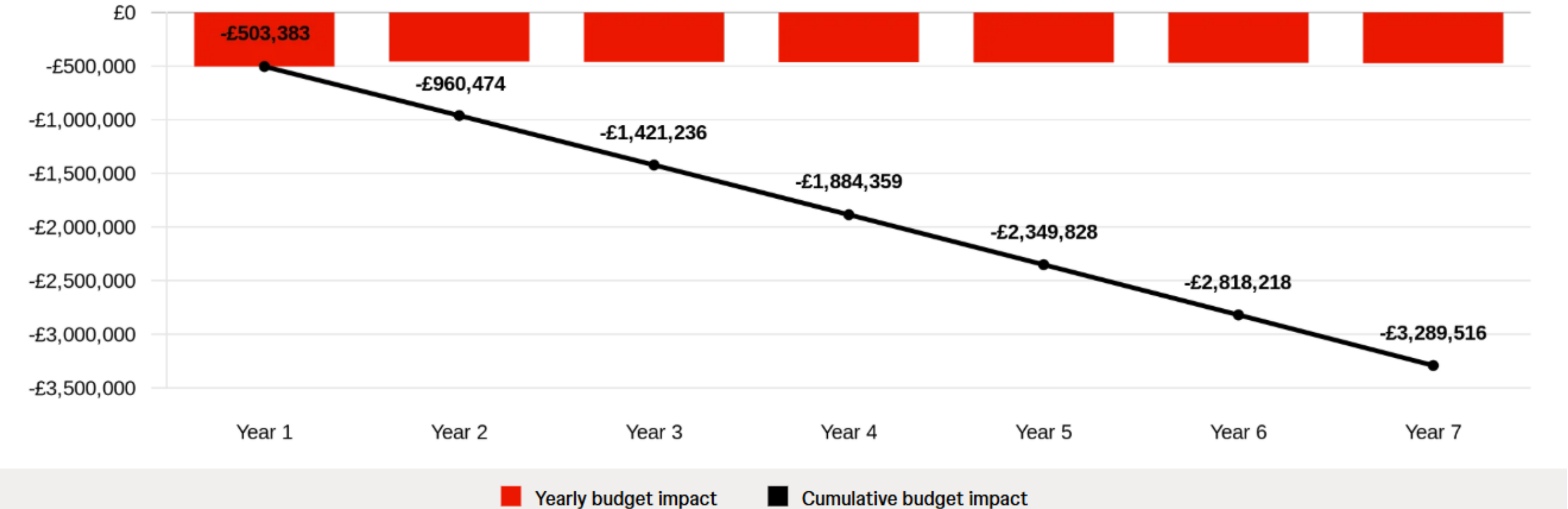
Input	Manual TKA	VRAS
Surgery cost (including service, disposables, surgical time) (£/patient)*	2,675 ⁴	2,701 ⁴
Mean length of stay (days)	4.1 ⁷	
Estimated reduction in mean length of stay with VRAS (%)		29% ⁸
Average cost per day for length of stay (£/day)	320 ⁹	
Number of trays used per TKA	7 ¹⁰	3 ¹⁰
Average cost per tray sterilization (£/tray)	140 ¹¹	
Baseline revision rate at 10 years (%)	3.82 ¹	
Relative reduction in revision with VRAS (%)		30% ¹²
Average hospitalisation cost for revision (£)	4,155 ^{2**}	
Average tariff for revision (£)	8,565	
3-month knee-related revisit (%)***	4.8 ¹³	2.7 ¹³
Revisit cost (£)	71 ⁹	
3-month knee-related readmission (%)***	1.5 ¹³	0.7 ¹³
Readmission cost (£)	135 ⁹	
Physiotherapist visit (number)***	8 ¹⁴	5 ¹⁴
Physiotherapist visit cost (£)	661 ⁹	

* The model includes surgical time costs, estimating a 21% reduction⁵ in surgical time and a cost of £25 per minute⁶
**Calculated as mean revision cost minus tariff
***These inputs were included only in the payer perspective analysis

Results

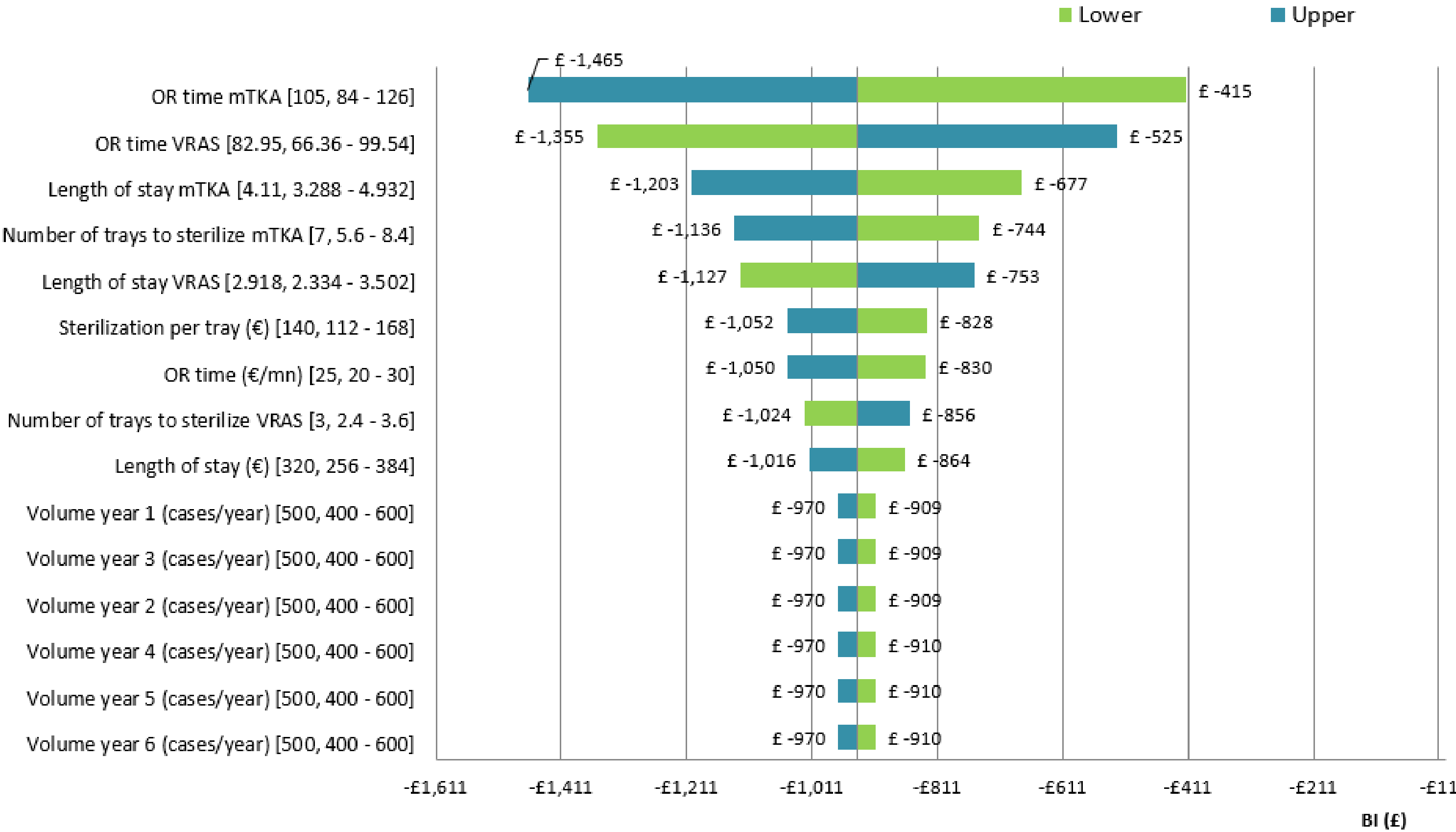
VRAS implementation led to a reduction of 1.19 days in the mean length of stay, a decrease of 22 minutes in mean surgical time, a reduction of 4 surgical trays per case, and a reduction of 1% in absolute revision risk. It was also associated with reduced rates of knee-related revisits (2.66% vs. 4.81%) and readmissions (0.69% vs. 1.46%) compared to the manual TKA. **Estimated cost savings were £940 per patient from the UK hospital perspective, and over seven years, it yields £3,289,516 in savings for the entire patient cohort.** PSA showed mean (95% CrI) savings of £934 (£106-£1794) from the hospital perspective.

Figure 1. Cumulative cash outflow path



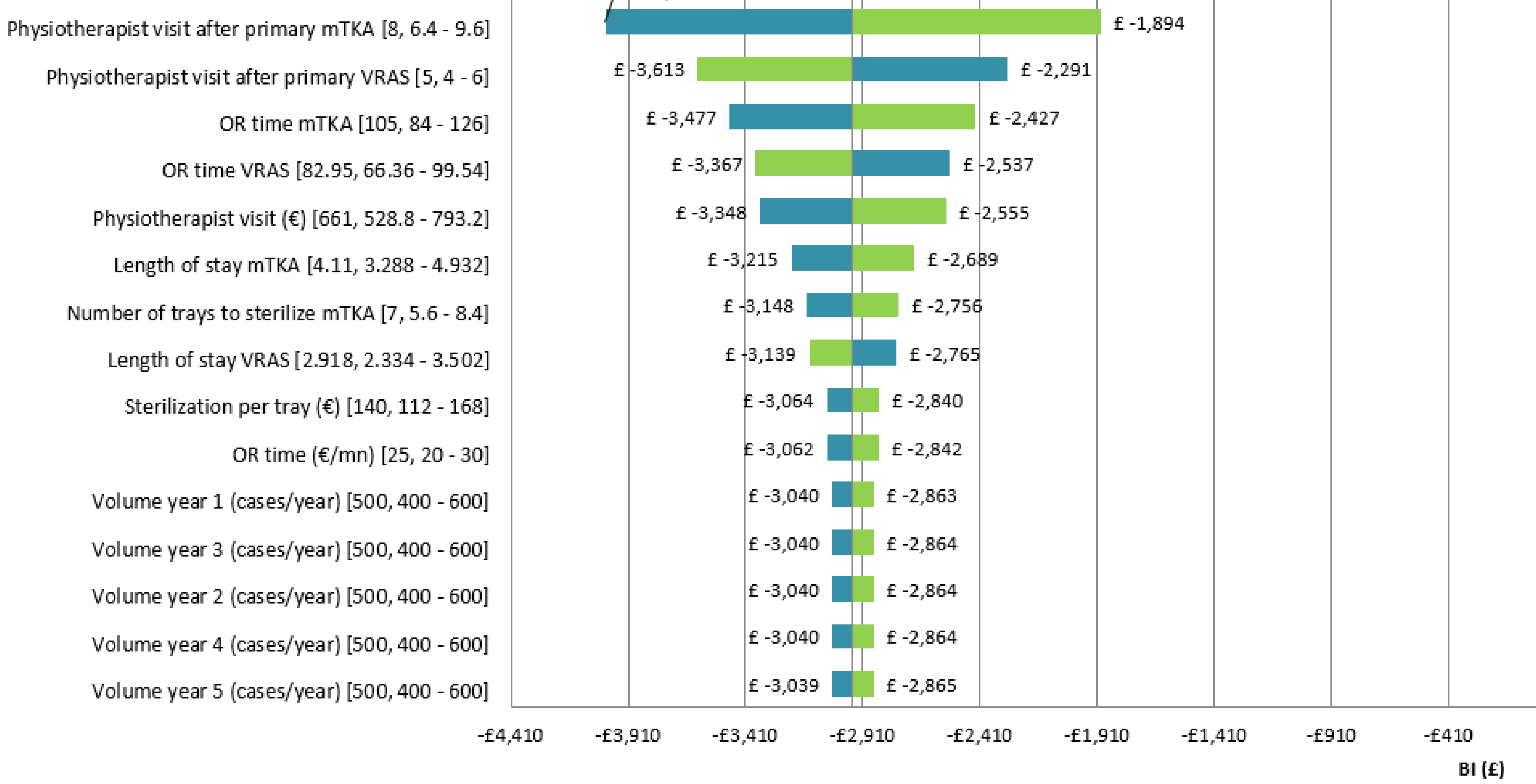
The Tornado diagram highlights that the dominant drivers of cost outcomes are length of stay and surgical time. Changes in these inputs produce the largest shifts in estimated savings. Results are particularly sensitive to surgical time and length of stay; improvements in surgical throughput and quicker discharge could significantly boost savings, while longer surgical times or longer stays could erode them. In short, the intervention looks cost-saving across a range of inputs, but the magnitude hinges mainly on surgical procedure efficiency and patient flow.

Figure 2. Tornado diagram for hospital perspective



From the payer perspective, the dominant drivers are the associated perioperative inputs, such as physiotherapist visits and OR time, for both manual TKA and VRAS; these items produce the biggest swings in **estimated savings for the payer, leading to £2,952 per patient.** PSA showed mean (95% CrI) savings of £2,962 (£2,167-£3,789).

Figure 3. Tornado diagram for payer perspective



Conclusion

Robotic-assisted TKA offers a viable pathway to cost savings in the UK from both hospital and payer perspectives, according to this study, by delivering more efficient HRU and a potential reduction in revision rates. Using a robotic-assisted solution in TKA could deliver cost savings and efficiency gains in the UK through improved HRU and lower revision rates.

References

- The National Joint Registry 22nd Annual Report 2025.
- Alexiadis, A., Reynolds, P., Al-Mouazzen, L., Toms, A., Phillips, J., & Waterson, B. (2024). Revision total knee replacement finances: A detailed cost-analysis of operative practice at a regional tertiary referral centre. BMC Health Services Research, 24(1), 19. <https://doi.org/10.1186/s12913-023-10890-7>
- Chin BZ, Tan SSH, Chua KCX, Budiono GR, Syn NL, O'Neill GK. Robot-Assistedversus ConventionalTotal and UnicompartmentalKneeArthroplasty: A Meta-analysisofRadiologicaland FunctionalOutcomes. J KneeSurg. 2020.
- DePuy Synthes. (n.d.). Johnson & Johnson price data on file.
- Nottingham Spire Hospital. (n.d.). VRAS J&J Case Study.
- Radcliffe, G., Trouiller, J. B., Battaglia, S., & Larrainzar-Garjio, R. (2024). Cost-effectiveness and budget impact of cement augmentation for the fixation of unstable trochanteric fractures from a European perspective. Injury, 55(12), 111999. <https://doi.org/10.1016/j.injury.2024.111999>
- Wainwright, T. W. (2021). The current status of day case hip and knee arthroplasty within the English National Health Service: A retrospective analysis of hospital episode statistics data. Annals of the Royal College of Surgeons of England, 103(5), 324-331. <https://doi.org/10.1308/rcsann.2020.7071>
- Severson E, Tan Z, English A, Reimer J, Goldstein L, Etter K. Healthcare resource utilization for VELYS™ robotic-assisted solution compared to manual surgery for total knee arthroplasty. J Robot Surg. 2025 Aug 31;19(1):539. doi: 10.1007/s11701-025-02510-2. PMID: 40886191; PMCID: PMC12399716
- NHS England. (2024). 2023/25 NHS Payment Scheme: 2024/25 prices workbook (Annex A).
- Expert Opinion. (n.d.).
- Attard, A., Tawy, G. F., Simons, M., Riches, P., Rowe, P., & Biant, L. C. (2019). Health costs and efficiencies of patient-specific and single-use instrumentation in total knee arthroplasty: A randomised controlled trial. BMJ Open Quality, 8(2), e000493. <https://doi.org/10.1136/bmqo-2018-000493> (inflated to £2024)
- The Dental and Pharmaceutical Benefits Agency. Health economic assessment done on VELYSTM Robotic-Assisted Solution.Dnr 3598/2023
- Huang, P., Gupta, A., Intwala, D., Ruppenkamp, J., & Hoeffel, D. (2024). Early clinical and economic outcomes of VELYS robotic-assisted solution (VRAS) compared to manual total knee arthroplasty. Unpublished manuscript.
- Kayani B, Konan S, Tahmassebi J, Pietrzak JRT, Haddad FS. Robotic-arm assisted total knee arthroplasty is associated with improved early functional recovery and reduced time to hospital discharge compared with conventional jig-based total knee arthroplasty: a prospective cohort study. Bone Joint J. 2018;100-B(7):930-938