

# Budget impact of the VELYS™ robotic-assisted solution compared to manual procedure in patients undergoing primary total knee arthroplasty in Spain

Jean-Baptiste Trouiller<sup>1</sup>, Gonzalo Hormías-Martín<sup>2</sup>, Natalia Robledinos-Antón<sup>2</sup>, Vito Paragò<sup>3</sup>

<sup>1</sup>Johnson & Johnson Medical, Paris, France

<sup>2</sup>Johnson & Johnson S.A., Madrid, Spain

<sup>3</sup>Johnson & Johnson Medical S.p.A., Pratica di Mare, Italy

## Introduction

- Primary Total Knee Arthroplasty (TKA) is one of the most common orthopaedic procedures worldwide<sup>1</sup>, with over 67,000 procedures performed in Spain in 2023.<sup>2</sup>
- Despite TKA being so common, up to 22.2% of patients indicate that they are not satisfied with their TKA one-year post-operatively.<sup>3</sup>
- Robotic TKA (rTKA) can improve implant alignment and positioning compared to manual TKA<sup>4,5</sup> as well as some studies have found that rTKA may reduce patient pain in the early post-operative period compared to manual TKA (mTKA)<sup>#,6</sup>.
- VELYS™ Robotic-Assisted Solution (VRAS) is designed to help support precision and accuracy without the need for pre-operative imaging<sup>#,7-10</sup> and facilitates a patient specific alignment, which may improve patient reported outcome measures<sup>#,11-14</sup>.
- However, studies investigating the economic impact of VRAS remain limited in European countries due to its novelty.

#Product(s) may not be commercially available in all markets. This content may not be used externally in those markets where regulatory approval has not been granted for all the products referenced.

## Objective

The objective of this study was to assess the budget impact of VRAS compared to manual TKA (mTKA) in patients undergoing primary TKA from both the hospital and the global payer perspective in Spain.

## Methods

- We developed a **budget impact model** inclusive of all relevant potential primary TKA resources to estimate costs of primary TKA over **7 years**, corresponding to the robot lifespan.
- Two payer perspectives in **Spain** were used in this analysis: **Hospital perspective** and **Global payer perspective**.
- The model assumed **250 patients/year** (1,750 patients, total) undergoing primary TKA for end-stage knee osteoarthritis.
- Clinical inputs, cost and resource use** were collected from literature, public databases and expert opinion (Table 1).

Table 1. Clinical inputs and resource use and cost inputs

|  | Scenario without VRAS | Scenario with VRAS                        |
|--|-----------------------|---|
| <b>Surgery costs</b>                                 |                       |   |
| Overall cost (€/patient)                             | 1,168                 | 2,335                                     |
| <b>Hospital resource use</b>                         |                       |   |
| Length of stay (days) <sup>2</sup>                   | 3.57                  | 2.53*<br>(Reduced by 29% <sup>16</sup> )  |
| Cost per length of stay (€/day) <sup>16</sup>        | 1,170                 |   |
| Trays sterilized <sup>†</sup>                        | 8                     | 3   |
| Sterilization cost (€/tray) <sup>17</sup>            | 75                    |   |
| <b>Post-Hospital resource use<sup>‡</sup></b>        |                       |   |
| Annual revision risk <sup>18</sup>                   | 0.68%                 | 0.48%*<br>(Reduced by 30% <sup>20</sup> ) |
| Revision cost (€) <sup>16</sup>                      | 22,891                |   |
| 3-month knee-related revisit rate <sup>20</sup>      | 4.81%                 | 2.65%                                     |
| Knee-related revisit cost (€) <sup>16</sup>          | 98                    |   |
| 3-month knee-related readmission rate <sup>20</sup>  | 1.46%                 | 0.69%                                     |
| Knee-related readmission cost (€) <sup>16</sup>      | 4,726.80              |   |
| Physiotherapy visits after primary TKA <sup>21</sup> | 11                    | 6   |
| Physiotherapy cost (€/visit) <sup>16</sup>           | 37                    |   |

\* Calculated on basis of reported reduction rate

† Expert opinion

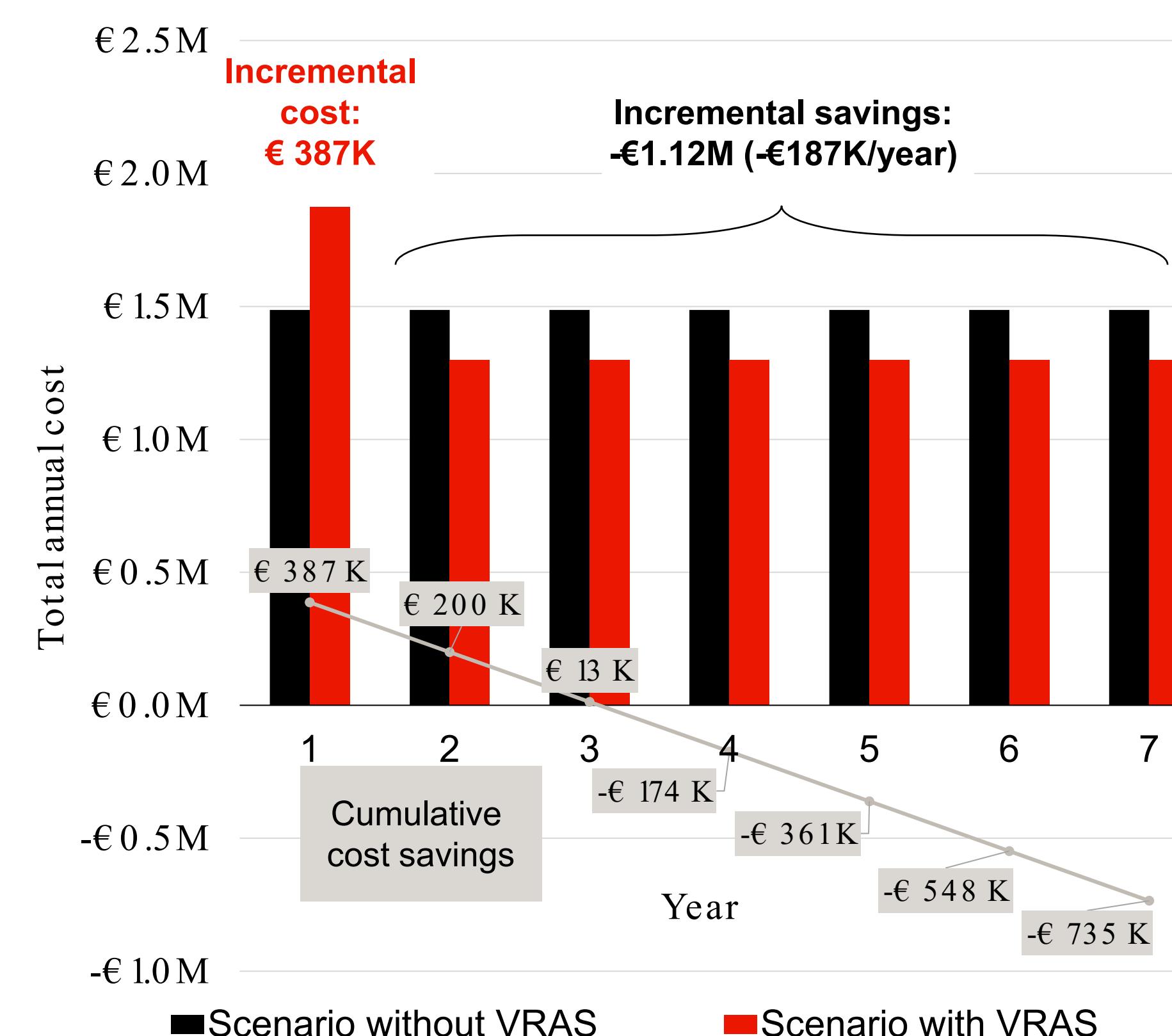
‡ Global payer perspective only

## Results

### Hospital perspective

- From the hospital perspective, the adoption of VRAS had a cumulative **savings of -€735,308 by year 7** (Fig. 1), for mean savings of -€420/patient over the time horizon.
- After a first-year incremental cost of €386,956 following the introduction of VRAS, annual total savings of -€187,044 are seen from Year 2 onwards (Fig. 1).
- In the scenario with VRAS, the break-even point was **3.1 years** (Fig. 1).

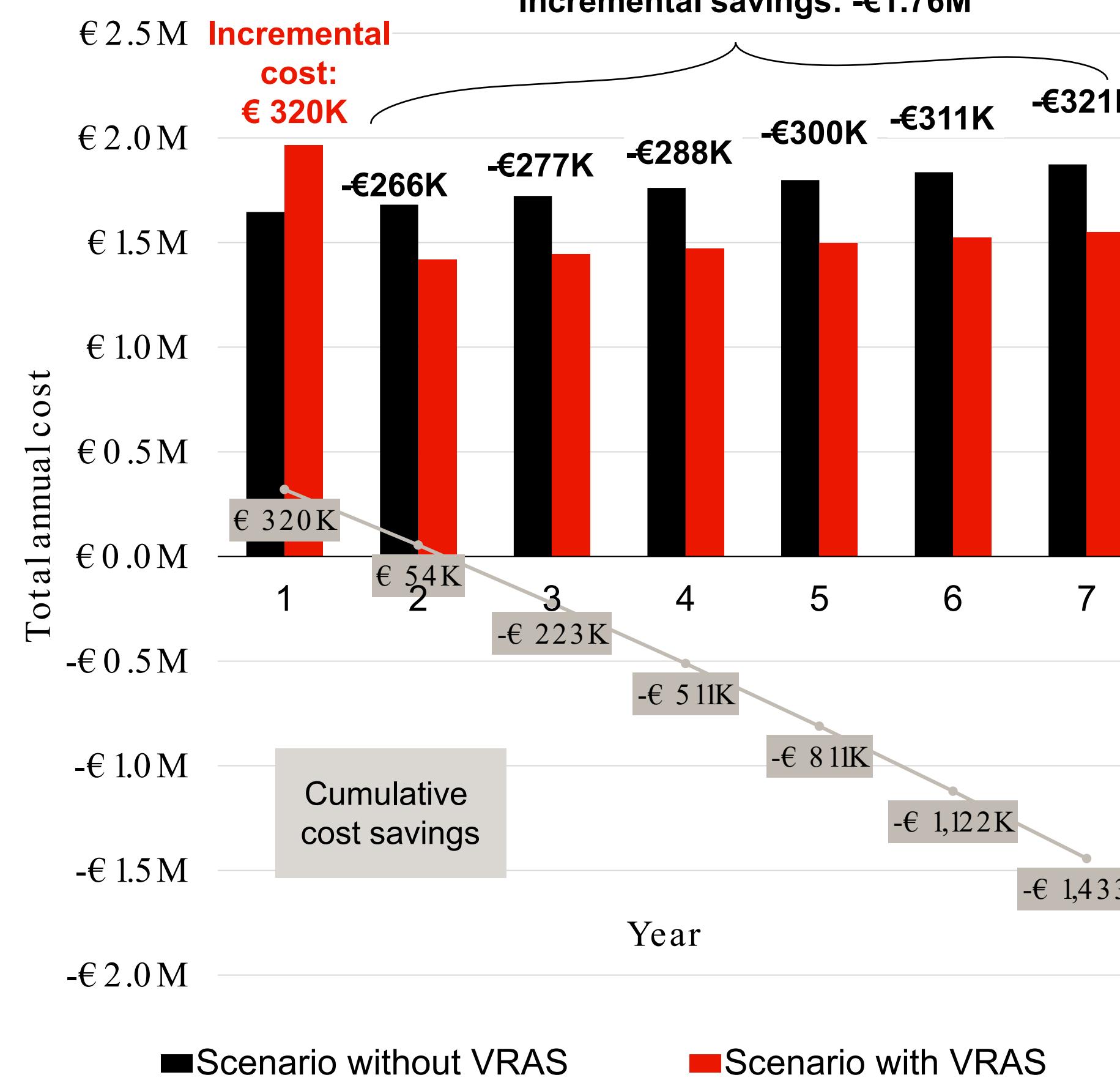
Figure 1. Cumulative and annual budget impact - Hospital perspective



### Global payer perspective

- From the global payer perspective, the adoption of VRAS had cumulative **cost savings of -€1,442,949** (Fig. 2), and mean savings of -€825/patient over the time horizon.
- After a first-year incremental cost of €319,820 following the introduction of VRAS, annual cost savings increased in magnitude from -€265,720 in Year 2 to -€321,434 in Year 7 (Fig. 2).
- In the scenario with VRAS, the break-even point was **2.2 years** (Fig. 2).

Figure 2. Cumulative and annual budget impact – Global payer perspective



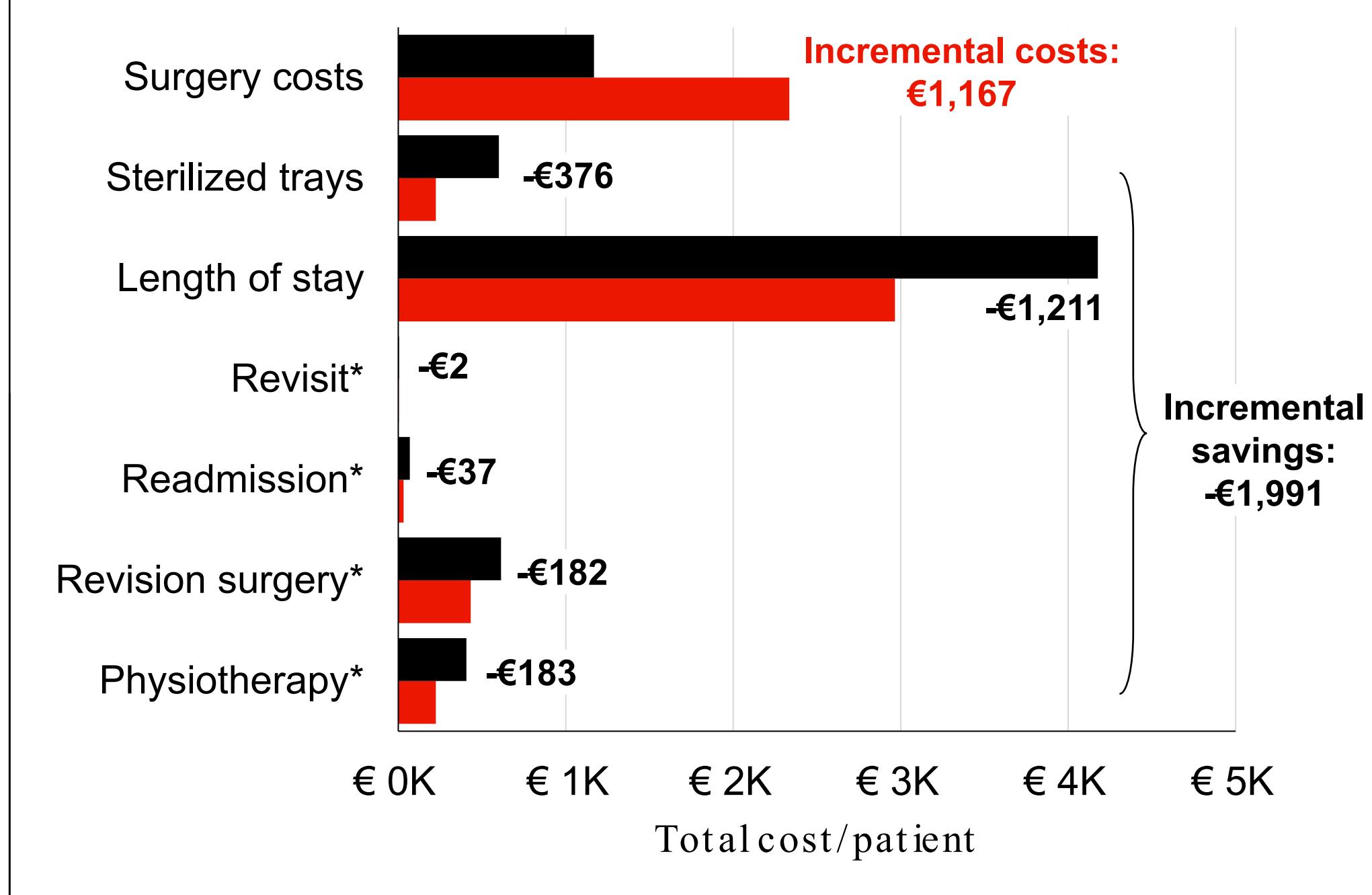
### References

1. Le Stum M, Le Goff-Pronost M, Stindel E, Dardenne G (2025) Incidence rate of total knee arthroplasties in eleven European countries: Do they reach a plateau? PLOS ONE 20(1): e0312701.
2. Ministry of Health. Subdirección General for Health Information. Registry of Specialized Care Activity – RAE-CMHD.
3. Muerliza M, Cai X, Ji B, Aimaiti A, Cao L. Factors contributing to 1-year dissatisfaction after total knee arthroplasty: a nomogram prediction model. J Orthop Surg Res. 2022 Jul 28;17(1):367.
4. Chin BZ, Tan SSH, Chua KXC, Budiono GR, Syu NL, O'Neill GK. Robotic-Assisted versus Conventional Total and Unicompartmental Knee Arthroplasty: A Meta-analysis of Radiological and Functional Outcomes. J Knee Surg. 2020.
5. Doan GW, Courtney RP, Wyss JG, Green EW, Clary CW. Image-Free Robotic-Assisted Total Knee Arthroplasty Improves Implant Alignment Accuracy: A Cadaveric Study. J Arthroplasty. 2022; 37(4): p. 795-801.
6. Agarwal N, To K, McDonnell S, Khan W. Clinical and Radiological Outcomes in Robotic-Assisted Total Knee Arthroplasty: A Systematic Review and Meta-Analysis. J Arthroplasty. 2020 Nov;35(11):3393-3409.
7. DePuy Synthes. ROBONY Cadaveric Accuracy and Soft Tissue Study. 14 Dec 2021. Windchill #103720852.
8. DePuy Synthes. Robony Design Rationale. Windchill #103672172.
9. Alton T, Severson E, Ford M, Leslie I, Lesko J, Delanois R. Assessment of Accuracy and Early Outcomes During the Adoption Phase of a Novel Image-Free Robotic-Assisted System for Total KneeArthroplasty. British Orthopaedics Association, Sept 2023. Poster #376.
10. Hallak A, Schichman I, Benady A, Warschawski Y, Gold A, Snir N. Accuracy of a Novel Imageless Guided Robotic System Using Patient-Specific Alignment. American Association of Hip and Knee Surgeons 2023 Poster #355.
11. Clatworthy M. Patient-Specific TKA with the VELYS Robotic-Assisted Solution. Surg Technol Int. 2022, 40.
12. Collares T, Bauer K, Stukerberg-Colsman C, Windhagen H, Budds S, Ellinger M. PSI kinematic versus non PSI mechanical alignment in total knee arthroplasty: a prospective, randomized study. Knee Surg Sports Traumatol Arthrosc. 2016;DOI: 10.1007/s00167-016-4136-8.
13. Dossett HG, Estrada NA, Swartz GJ, LeFevre GW, et al. A randomised controlled trial of kinematically and mechanically aligned total knee replacement. BoneJoint J. 2014;90:97-913.

## Cost breakdown

- In the scenario with VRAS, there were higher surgery costs (including direct VRAS expenses, disposable, operating theatre) over the 7-year time horizon (€1,167/patient) (Fig. 3).
- Lower costs were observed for all other categories, with a major **reduction in hospitalization costs of -€1,211/patient**, translating to **-€2.12M for all patients** (Fig. 3).

Figure 3. Costs breakdown for each patient over 7 years



\*Global payer perspective only

## Resource use breakdown

Cost savings over the 7-year time horizon in the scenario with VRAS derive from considerable reductions in

- surgical trays
- healthcare interactions (revisions, revisits, readmissions, and physiotherapy sessions)
- duration of hospital stays (Table 2).

Table 2. Resource use savings in the scenario with VRAS

| Resource                                  | Scenario with VRAS |
|---|--------------------|
| Number of bed days saved                  | 1,812              |
| Number of trays saved                     | 8,750              |
| Number of physiotherapy sessions avoided* | 8,663              |
| Number of revisits avoided*               | 38                 |
| Number of readmissions avoided*           | 14                 |
| Number of revisions avoided*              | 14                 |

\*Global payer perspective only

## Conclusion

Over a 7-year time horizon, VRAS rTKA was found to reduce overall costs and resource use compared to mTKA under both hospital and global payer perspectives in Spain. The largest cost-saver was the reduction in hospitalization costs.

14. Clatworthy M. Outcome & Survival Analysis of Conventional Measured Resection, Neutral Alignment Attune TKA vs CAS Anatomic Tibia, Balanced Femur, Constitutional Alignment Attune TKA. Orthopaedic Journal of Sports Medicine. 2017; 5(6\_suppl5): p. 232596711770015.
15. Severson E, Tan Z, English A, Reimer J, Goldstein L, Eller 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/s11701-025-02110-2. PMID: 40886191; PMCID: PMC12399716.
16. Resolution SLT4/583/2024, by December, which publishes the review of public prices corresponding to the health services provided by the Catalan Health Institute.
17. Von Eiff MC, von Eiff W, Roth A, Ghannem M. Process optimization in total knee arthroplasty procedures : Impact of size-specific instrument sets on costs and revenue. Orthopade. 2019 Nov;48(11):963-968. English. doi: 10.1007/s00012-019-03803-9. PMID: 31506824.
18. Burn E, Prieto-Alhambra D, Hamilton TW, Kennedy JA, Murray DW, Pinedo-Villanueva R. Threshold for Computer- and Robot-Assisted Knee and Hip Replacements in the English National Health Service. Value Health. 2020 Jun;23(6):719-726. doi: 10.1016/j.jval.2019.11.011. Epub 2020 May 25. PMID: 3254229.
19. The Dental and Pharmaceutical Benefits Agency. Health economic assessment done on VELYS™ Robotic-Assisted Solution.Dnr 3598/2023.
20. Huang P, Cross M, Gupta A, Intwala D, Ruppenkamp J, Hooffel D. Early Clinical and Economic Outcomes for the VELYS Robotic-Assisted Solution Compared with Manual Instrumentation for Total Knee Arthroplasty. The journal of knee surgery. 2018;10:930-937.
21. Kaya N, Konan S, Tahmasebi J, Pidzak JRT, Hadzidimitriou F. 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 Jul;100-B(7):930-937.

## Acknowledgements

Medical writing support was provided by Amaris Consulting