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The budget impact of introducing robotic-assisted surgery for spinal fusion procedures in Spain

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Objective

Robotic-assisted surgery provides several benefits, such as enhanced reproducibility and predictability through accurate execution of the preoperative plan, but it requires a high capital investment which limits its widespread use.

The aim of this analysis is to estimate the economic impact of introducing robotic-assisted surgery for spinal fusion procedures regardless of the indication, from a Spanish tertiary hospital perspective considering a 10-year time horizon.

Methods

- A cost analysis was developed based on previously published meta-analysis and a randomized clinical trial to assess the budget impact associated with replacing on a 1:1 basis conventional freehand surgery with robotic-assisted surgery.[1-3]
- Unit costs, obtained from different Spanish sources and expressed in €2023, were applied to health resource consumption comprising equipment, consumables, maintenance, surgical procedure, postoperative hospitalization, postoperative screw revisions and blood transfusions.[4-8] (Table 1)
- Deterministic sensitivity analysis was performed to assess the robustness of the results. Unit costs were varied by ± 10%.
- The model's inputs and assumptions were reviewed and endorsed by a Spanish expert panel.

Results

- For each treatment group, 300 procedures were considered annually over 10 years.
- Estimated mean total costs per patient undergoing robotic-assisted spine surgery or conventional freehand surgery were €13,650 and €13,922, respectively, resulting in mean total cost savings of €272 per patient. (Figure 1)
- The acquisition cost of the robotic guidance system was outweighed by the cost savings associated with potential shorter length of stay, reduced need for revision procedures and blood transfusions, which resulted in a cost decrease per patient of €1,611, €372, and €58, respectively. (Figure 2)
- These savings allowed a return on the capital investment from the sixth year following the acquisition.
- At 10 years, the savings associated with the use of robotic-assisted surgery reached €816,316 considering the total cohort of patients (3,000). (Figure 3)
- Results from univariate sensitivity analysis are shown in Figure 4. The results showed robustness of the cost saving for robotic-assisted surgery at 10 years when varying each parameter by 10%.

Table 1: Health resources and unit costs considered in the analysis.

Health resource	Freehand surgery	Robotic-assisted surgery	Unit cost (€ 2023)
Surgical procedure			
Operating room (hours)	3.3	3.4	€ 804.8[4]
Surgeon	1	1	€ 25.4[5]
Anaesthesiologist	1	1	€ 25.4[5]
Nurse	2	2	€ 14.7[5]
Nurse assistant	1	1	€ 10.3[5]
Postoperative hospitalization			
Length of stay (days)	9.8	8.3	€ 1,053.1[6]
Complications			
Revision surgery (%)	3.3	0.7	€ 14,308.8[7]
Blood transfusions (%)	46.7	33.3	€ 434.7[8]

Figure 1: Estimated mean total costs per patient undergoing robotic-assisted spine surgery or conventional freehand surgery.

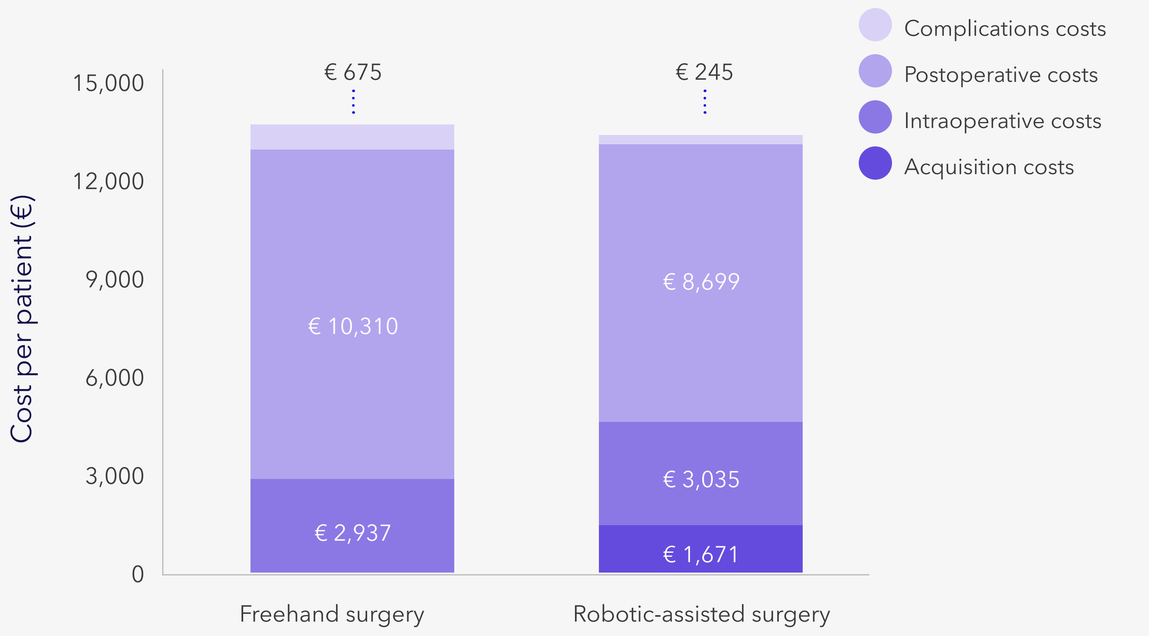


Figure 2: Cost increase/decrease per patient treated with robotic-assisted surgery compared to conventional freehand surgery.

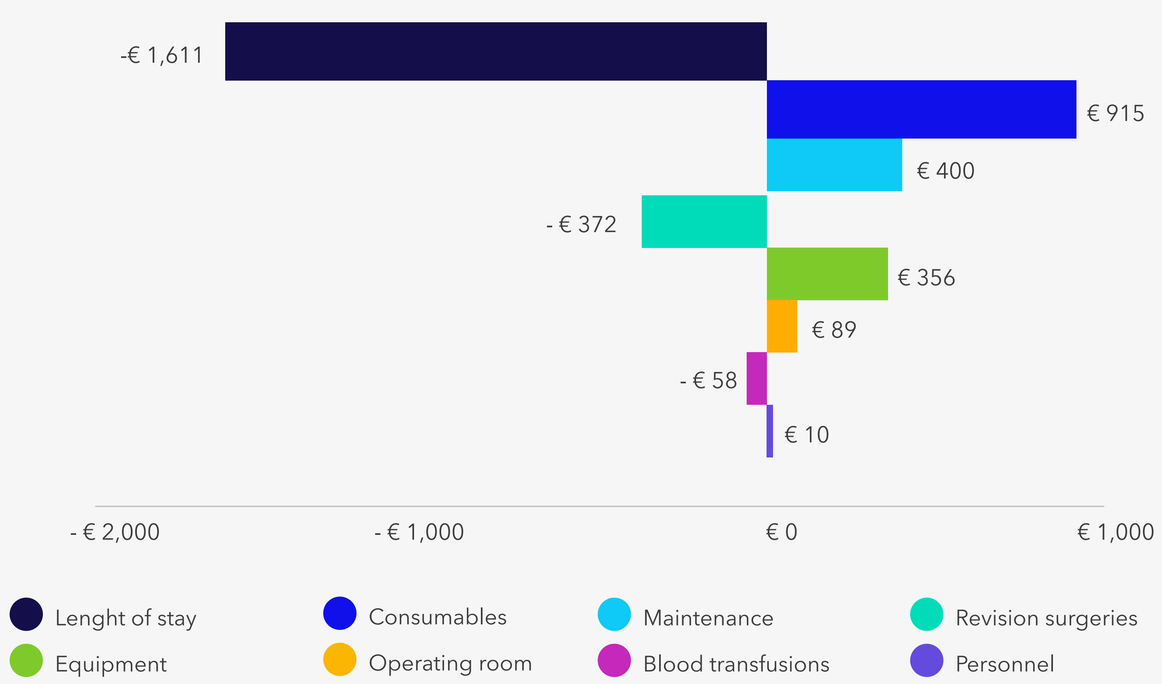


Figure 3: Cost impact from the use of robotic-assisted surgery considering the total cohort of patients after 10 years.

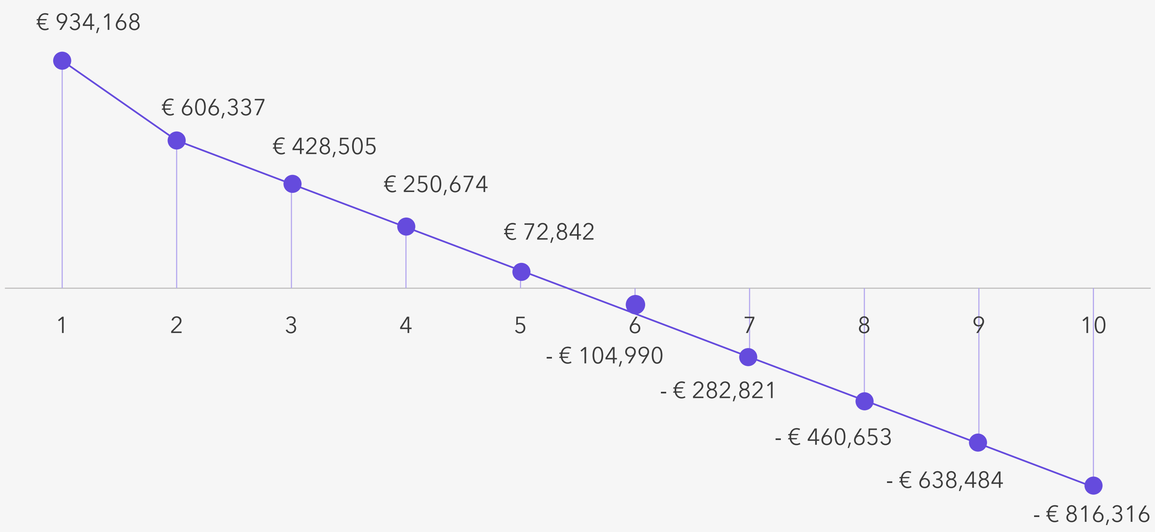
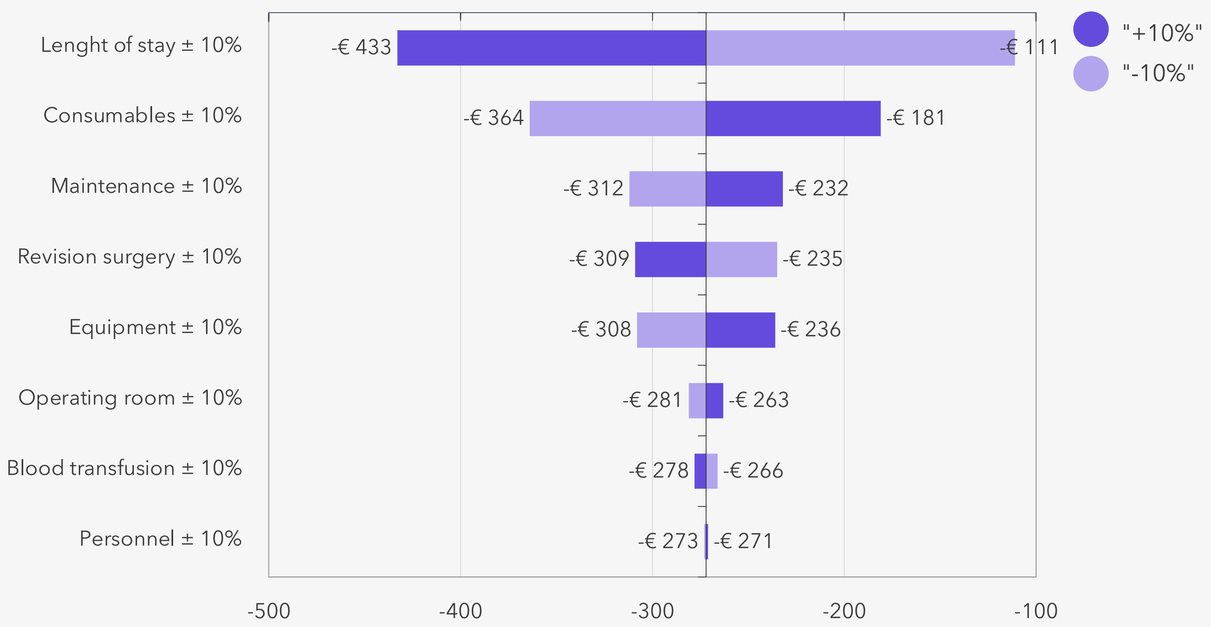


Figure 4: Tornado diagram of the univariate sensitivity analysis.



Conclusion

From a Spanish hospital perspective, upfront costs of performing robotic-assisted surgery for spinal fusion in comparison with conventional freehand surgery were estimated to be totally offset after the sixth year of investment.

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