Cost-effectiveness of Anterior-Based Muscle-Sparing (ABMS) total hip arthroplasty when compared to Posterolateral (PA) & Direct Anterior Approaches (DAA)

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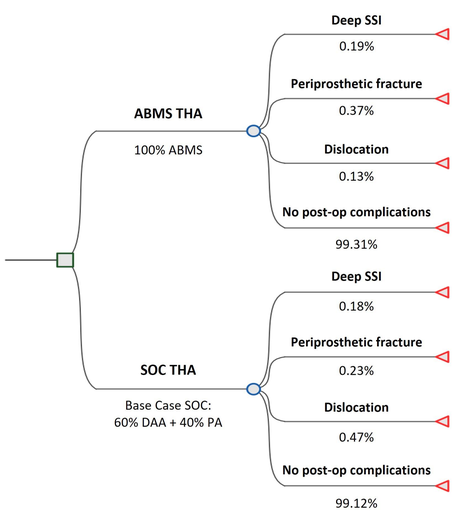
Background and aims

- Total Hip Arthroplasty (THA) remains one of the most effective treatment for end-stage osteoarthritis (OA). It is projected that between 2005 and 2030 demand for THAs will grow 174%, resulting in a predicted 527,000 THA procedures per year in 2030 in the United States (US) [1].
- Using data from the Centers for Medicare & Medicaid Services (CMS), a study by Shichman et al. (2023) extended this projection, and predicted THAs would see a 28.84% increase in procedure volume every 5 years following 2020, reaching 1,982,099 cases per year by 2060 in the US [2].
- Given increased THA utilization, it is important to understand the economic implications of these trends. While THA is proven to successfully improve patient joint function and satisfaction, it is associated with a considerable economic cost [3].
- Through the implementation of the Anterior-Based Muscle-Sparing (ABMS) approach, also known as the ABLE◊ advanced anterior approach, a recent study has found improved quality of surgical outcomes while reducing these key cost drivers [4].
- A growing body of research supports the cost-effectiveness of muscle sparing techniques for THA, such as the anterior or direct anterior (DAA) approach. However, to our knowledge the cost-effectiveness of the ABMS technique is yet to be investigated [5-9].
- The purpose of this study was to determine whether the ABMS approach, is a cost-effective strategy when compared to all other THA approaches from a US payor perspective.
- A combination of hip arthroplasty procedures, consisting of the DAA and Posterolateral Approach (PA), will be referred to as standard of care (SOC).

Methods

- A decision-analytic model in the form of a decision tree (Figure 1) was utilized to estimate intraoperative outcomes (i.e., length of procedure, length of stay, and transfusion rates) as well as 90-day postoperative complications (deep surgical site infection (SSI), periprosthetic fracture, and dislocation). In addition, discharge to Skilled Nursing Facility (SNF) and Inpatient Rehabilitation Facility (IRF) was considered. Figure 1 shows the base case analysis where SOC is assumed to consist of 60% DAA and 40% procedures.
- Data relating to postoperative complications, intraoperative outcomes, and costs (uplifted to 2023 USD) were obtained from the literature.
- We conducted both One-Way Sensitivity Analysis (OWSA), varying each parameter individually within a specific range, and Probabilistic Sensitivity Analysis (PSA) where all parameters were varied simultaneously within a defined distribution.
- In scenario analysis, the ABMS approach was also compared to PA and DAA approaches individually.

Figure 1: Model Structure



An economic analysis demonstrated that the ABMS or ABLE◊ approach to total hip arthroplasty, when compared to PA and DAA approaches, provides a cost saving of $3,851/patient after 90-days from a US payor perspective.

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Results

- Table 1 lists 90-day outcomes for all effectiveness inputs using an example cohort of 1,000 patients. Intraoperative and discharge disposition effectiveness/cost parameters make up the largest proportion of cost savings when using the ABMS approach over SOC. OWSA confirmed these inputs as the main drivers of the model that have the biggest impact on results. Changes in major complications make up a small proportion of the total cost savings from ABMS.
- The base case model cost savings are shown in Table 2. Compared to SOC, ABMS is cost-saving and reduces the total cost by $3,851 per patient.

Table 1: Deterministic model results - outcomes

Outcome	SOC	ABMS	Absolute difference
Length of surgery (minutes per 1,000 patients)	85,400	65,000	-20,400
Length of stay (days per 1,000 patients)	2,000	1,400	-600
Transfused (number per 1,000 patients)	30.20	7.00	-23.20
Discharge to SNF (number per 1,000 patients)	134.40	56.20	-78.20
Discharge to IRF (number per 1,000 patients)	9.80	9.60	-0.20
Total number of major complications (SSIs + Fractures + Dislocations) per 1,000 patients	8.76	6.90	-1.86

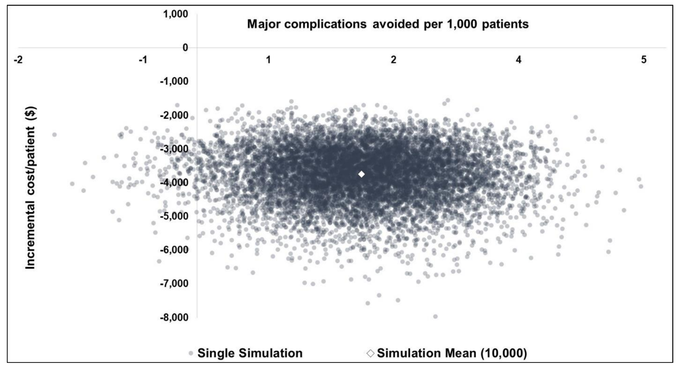
Table 2: Deterministic model results - costs

Outcome	SOC	ABMS	Cost saving (2023 US$)
Total costs per 1,000 patients	$12,240,926	$8,389,748	-$3,851,178
Total costs per patient	**$12,241.93**	**$8,389.75**	**-$3,851**

Sensitivity analysis

- Figure 2 illustrates the results of PSA. This shows graphically that using ABMS, as opposed to SOC, reduces 90-day costs and the number of major complications as the majority (98.29%) of the 10,000 simulations are in the south-east quadrant of the cost-effectiveness plane. The south-east quadrant indicates an improvement in health outcomes at a lower cost and means that the ABMS approach dominates SOC in 98.29% of simulations.
- Furthermore, since all simulated results/scatter points fall in the two southern quadrants, where ABMS is cost-saving when compared to SOC, there is a 100% probability that ABMS is cost-saving.
- In scenario analysis where the comparator arm was formed of only PA or DAA procedures the cost saving/patient became $4,766 and $3,242, respectively.

Figure 2: Cost-effectiveness plane showing incremental cost and complications avoided



Conclusion

- The ABMS THA approach was found to be cost-saving from a US payor perspective using 90-day outcomes. Cost saving per patient was estimated at $3,851 in the base case analysis and between $3,242 and $4,766 when changing the procedures to DAA and PA, respectively.
- Cost savings between the two arms was driven by differences in intraoperative outcomes and discharge disposition as major complication rates in both ABMS and comparator arms were low.
- Further research and head-to-head studies would improve the robustness of study findings.

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