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#141: Time-Driven Activity-Based Costing to Identify Factors Associated with Increased Cost of Outpatient Primary Hip Arthroscopic Labral Repair

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Disclosures

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- Arthroscopy Association of North America – Committee Member
- International Society for Hip Arthroscopy – Committee Member
- Arthroscopy – The Journal of Arthroscopic and Related Surgery – Editorial Board
- Stryker – Paid Consultant; Consulting fees
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Richard C. Mather

- AAOS: Board or Committee Member
- International Society of Hip Arthroscopy: Board or Committee Member
- North Carolina Orthopaedic Association: Board or Committee Member
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Introduction

- There is a paucity of data investigating factors influencing the cost of hip arthroscopy, especially cost efficiency.[1-6]

- Time-Driven Activity-Based Costing (TDABC) examines cost granularly by estimating two factors:
    1. Unit cost per minute of each resource (e.g. supply, personnel)
    2. Quantity of time used for each resource

  Cost of each resource is then aggregated to capture the total cost of the episode of care

- TDABC methodology has been used to identify drivers of cost and patient characteristics associated with high cost in multiple orthopaedic procedures.[7-14]

Purpose

Use TDABC methodology to:

1. Determine the average breakdown of surgical cost
2. Investigate drivers of cost variation
3. Elucidate preoperative and intraoperative factors associated with increased cost of outpatient arthroscopic hip labral repair

Methodology

- Retrospective analysis of a prospectively maintained registry of 151 patients undergoing primary hip arthroscopy from 2020-2021
  - Inclusion Criteria: Primary Hip Arthroscopy for labral repair between 2020 and 2021
  - Exclusion Criteria: Previous ipsilateral hip surgery, labral reconstruction, or labral debridement
- Cost accounting data was collected by a third-party organization, Avant-garde Health, using TDABC methodology [3,4]
  - Indexed TDABC data was used to represent cost of care breakdowns (Figure 1)
- Patients in the top-decile of cost were defined as high-cost, and cost category variance was determined as a ratio of the 10th to 90th percentile [7-8,15-16] (Figure 2)
- Multivariate linear regression modeling was used to test for associations with Indexed Total Cost (Table 1)
  - Preoperative factors: demographics, comorbidities, American Society of Anesthesiology [ASA] score, radiographic findings
  - Intraoperative factors: anesthesia selection, anchors, total stay time, operating room (OR) time
- Sub-analysis: Multivariate regression to test for procedures associated with increasing OR time (Table 2)

Results:
Cost Breakdown

- **OR Consumables** including implants (**61%**) & **Surgical Personnel** (**21%**) accounted for main proportion of cost
- **Anchors** were **18%** of total surgical cost

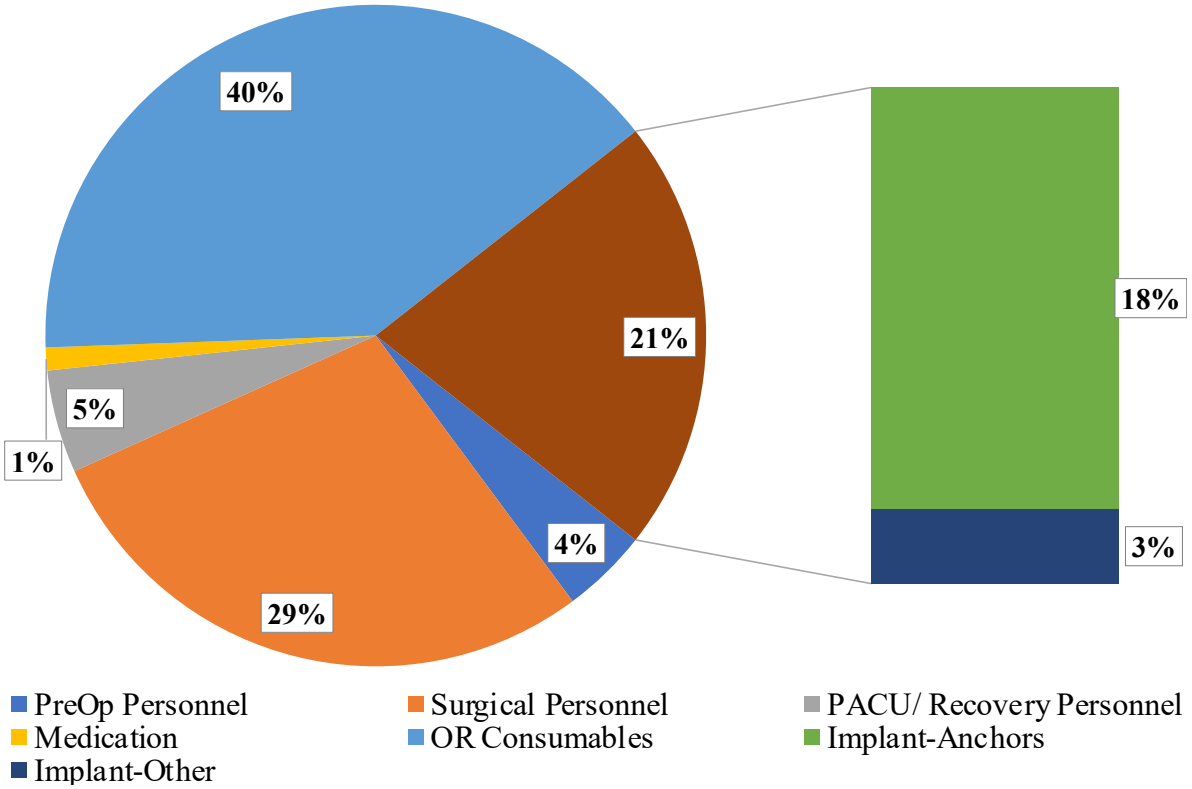


Figure 1. Proportion of total cost of outpatient primary hip arthroscopic labral repair.

Results:
Cost Variation

- **19% Difference** between 10th and 90th percentiles of cost
  - **34% Difference** in **Implant** cost
  - **18% Difference** in **OR Consumables** and **Surgical Personnel** cost
  - **7% Difference** in **Medication** cost

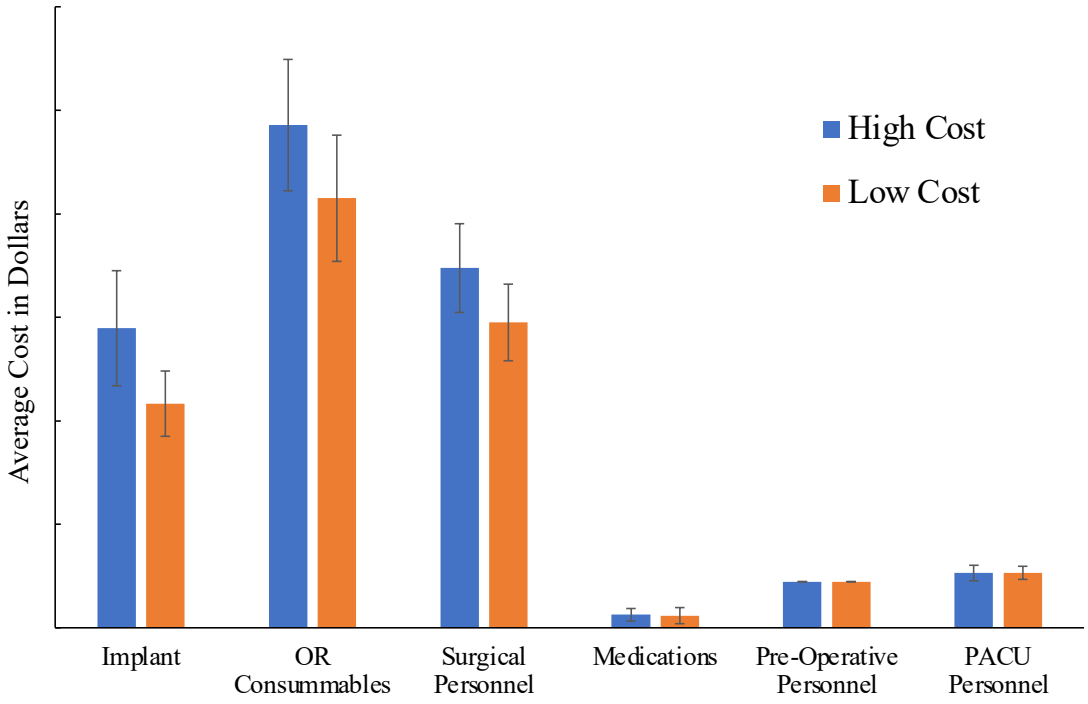


Figure 2. Average cost in dollars for each subcategory of cost. Dollar amounts are unable to be reported to protect confidentiality. Averaged costs were used to calculate percent difference in cost between high and low-cost patients.

Results: Predictors of Increasing Total Cost

- **Operating Room Time (min)** (Unstandardized β = 0.049, P < 0.001)
- **Number of Anchors** (Unstandardized β = 1.316, P < 0.001)

Linear Regression Model for Preoperative and Intraoperative Factors Associated with Indexed Total Cost

Parameter	Unstandardized Beta †	95% CI	Standardized Beta ‡	P-Value
Age	0.024	-0.004 to 0.053	0.129	0.091
Male Sex	0.189	-0.418 to 0.796	0.046	0.539
Body Mass Index (BMI)	-0.058	-0.121 to 0.005	-0.137	0.073
ASA Score > 2	-0.055	-1.520 to 1.410	-0.005	0.941
Allergy	0.395	-0.124 to 0.914	0.096	0.135
Anxiety or Depression	0.414	-0.174 to 1.001	0.096	0.166
Bleeding Disorder	-0.317	-1.725 to 1.090	-0.028	0.656
Diabetes	0.925	-0.670 to 2.519	0.073	0.253
Hypertension	-0.048	-1.126 to 1.029	-0.007	0.929
Thyroid Disorder	-1.069	-2.201 to 0.064	-0.124	0.064
Rheumatoid Arthritis	0.732	-1.527 to 2.991	0.042	0.522
Any Prior Surgery	-0.383	-0.938 to 0.171	-0.088	0.173
Tönnis Grade > 0	**-1.139**	**-2.004 to -0.273**	**-0.185**	**0.010***
Alpha Angle	-0.016	-0.044 to 0.013	-0.078	0.275
LCEA	0.000	-0.060 to 0.061	0.001	0.994
Tönnis Angle	-0.023	-0.089 to 0.044	-0.064	0.501
Total Stay (days)	-0.750	-8.038 to 6.537	-0.013	0.839
Operating Room Time (min)	**0.049**	**0.032 to 0.065**	**0.466**	**< 0.001***
General Anesthesia	-0.132	-0.717 to 0.453	-0.029	0.657
Number of Anchors	**1.316**	**0.914 to 1.718**	**0.456**	**< 0.001***

Table 1. Linear regression model for pre-operative and post-operative factors associated with indexed total cost. ASA, American Society of Anesthesiology; LCEA, Lateral Center Edge Angle. ($F(20, 129) = 7.497$, $P < 0.001$, Adjusted $R^2 = 0.466$)

*Denotes statistical significance at $P < 0.05$. † Beta coefficient values with 95% confidence intervals, signifying the strength of association between the dependent variable and the variable of interest. ‡ Standardized beta coefficient, weighted to allow for comparison of the relative strength of association with the dependent variable between the variables of interest.

Results: Predictors of Increasing OR Time (min)

- **Femoroplasty** (Unstandardized β = 15.274, P < 0.05)
- **Chondroplasty** (Unstandardized β = 8.860, P < 0.01)
- **Excision of OS Acetabuli** (Unstandardized β = 13.619, P < 0.05)
- **Trochanteric Bursectomy** (Unstandardized β = 21.176, P = < 0.01)

Linear Regression Model For Procedures Associated with Cut to Close Time

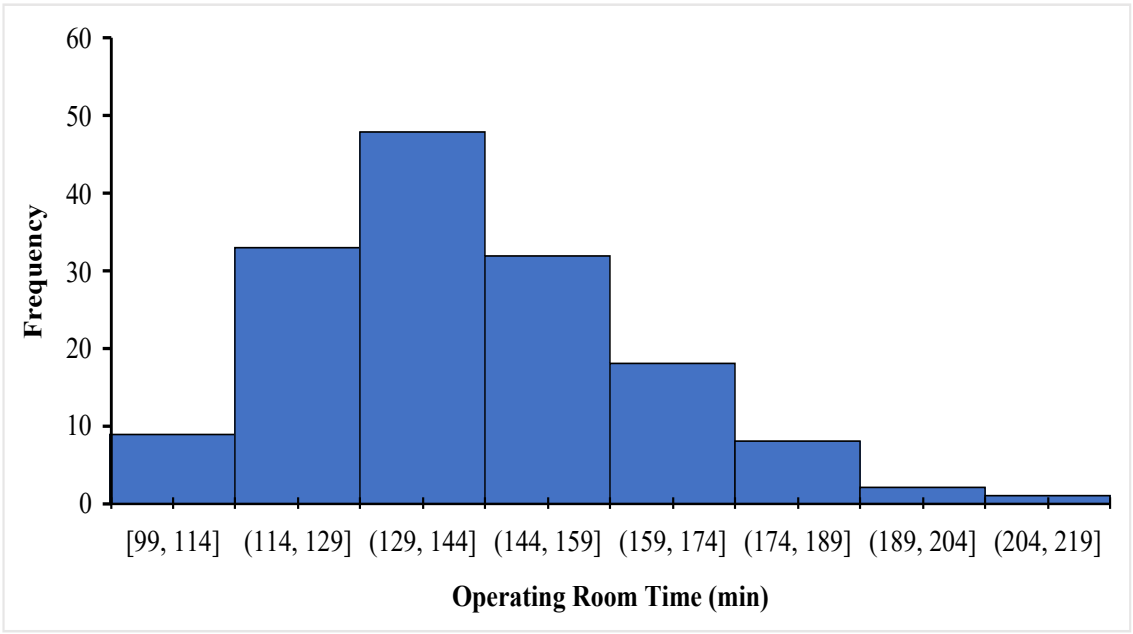
Parameter	Unstandardized Beta †	95% CI	Standardized Beta ‡	P-Value
Acetabuloplasty	3.634	-3.379 to 86.481	0.079	0.312
Femoroplasty	**15.274**	**3.772 to 26.557**	**0.205**	**0.010***
Chondroplasty	**8.860**	**2.352 to 15.374**	**0.218**	**0.009***
Microfracture	7.7253	-1.658 to 17.109	0.129	0.109
Excision of Os Acetabuli	**13.619**	**0.671 to 26.557**	**0.158**	**0.041***
Synovectomy	0.8292	-5.484 to 7.124	0.020	0.799
Subspine Decompression	0.2136	-8.877 to 9.305	0.214	0.963
Trochanteric Bursectomy	**21.176**	**5.535 to 36.816**	**0.213**	**0.009***
Other Procedure	-2.7394	-13.827 to 8.348	-0.040	0.629

Table 2. Linear regression model for procedures associated with operating room time in minutes (cut to close). Procedures performed < 5 times listed under "Other Procedure". (F(9, 139) = 3.945, P < 0.001, Adjusted R^2 = 0.152)

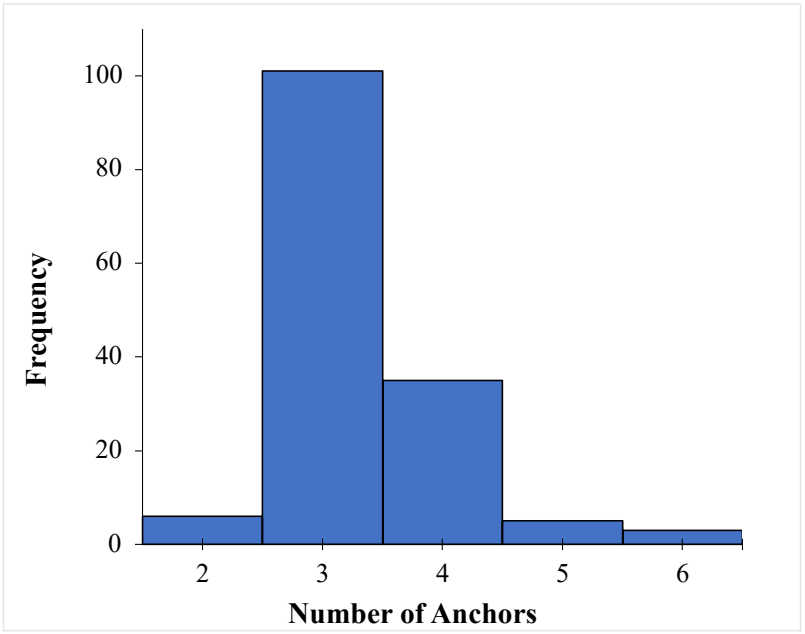
***Denotes statistical significance at P < 0.05. † Beta coefficient values with 95% confidence intervals, signifying the strength of association between the dependent variable and the variable of interest. ‡ Standardized beta coefficient, weighted to allow for comparison of the relative strength of association with the dependent variable between the variables of interest.**

Results:
Study Sample Distributions

- **Mean Surgical Time (min)**
  142.4 ± 20.0



- **Mean Number of Anchors**
  3.3 ± 0.7



Discussion & Conclusion

- **OR Consumables** were the **main proportion of cost,** with large variation between top decile of cost and remaining cohort
- **Implant Costs** had the **largest percent difference** between patients in the 10th and 90th percentiles of cost
- **OR Time & Quantity of Anchors** were significant **predictors of increased cost** for outpatient arthroscopic hip labral repair
- Strengths:
  - Clinical data combined with the application of TDABC methodology
  - Generalized TDABC methodology that captures the entire process of surgical care
- Limitations:
  - Retrospective study
  - No outcomes data
  - Limited generalizability
- Reducing OR time & judicious use of consumables, especially anchors, may help control costs and increase cost efficiency. Must be weighed against clinical need for adequate repair
- Further studies needed to correlate clinical outcomes

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