

COMPARATIVE EFFECTIVENESS OF POWERED SURGICAL STAPLING IN PATIENTS UNDERGOING MINIMALLY INVASIVE THORACIC SURGERY

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INTRODUCTION

Studies have shown that powered staplers used in thoracic VAT procedures were more effective than manual staplers. The environmental impact of surgery can be greatly reduced by using multiple-use staplers compared to single-use staplers. The objective of the study is to compare the effectiveness of two powered staplers – Single-Use (**SU**) versus Multiple-Use (**MU**)- in patients treated with VATs thoracic procedures

METHODS

Data Sources: PINC AI™ Healthcare Data 2019-2023

Study population: Patients who underwent primary minimal-invasive (MIS: robotic-assisted or thoracoscopic; thoracoscopic only) thoracic procedure, used either single-use (SU, Echelon™ 3000, Echelon™ Flex Power Plus, Echelon™ Flex Power Vascular) or multiple-use (MU, Signia™ Power Handler) powered stapling. Inclusions: elective procedures with non-zero costs.

Outcomes measurement: (Effectiveness measurement)

- Clinical outcomes (CO): incidence rates of blood transfusion, bleeding, air leak, and pneumothorax.
- Healthcare resources utilization (HRU): cost (all costs were converted to 2023 USD), operating room time (minutes), lengths of stay (days)

Patient and provider characteristics:

Gender, race and ethnicity, payer, lung cancer diagnosis, Charlson comorbidity index (CCI), census region, urban/rural, bed size, teaching status, hospital/surgeon annual thoracic procedure volume, surgeon’s specialty

Statistical Analyses

A propensity score matching (PSM) method with a caliper of 0.2 and 1:1 nearest neighbor matching without replacement for patients who used SU and MU was performed. We used patient and provider characteristics to calculate PS. The Chi-square or Fisher exact test and paired t-test were used to examine the CO/HRU variations in post-matched cases.

Sensitivity analysis was done using multivariable generalized linear model analysis methods.

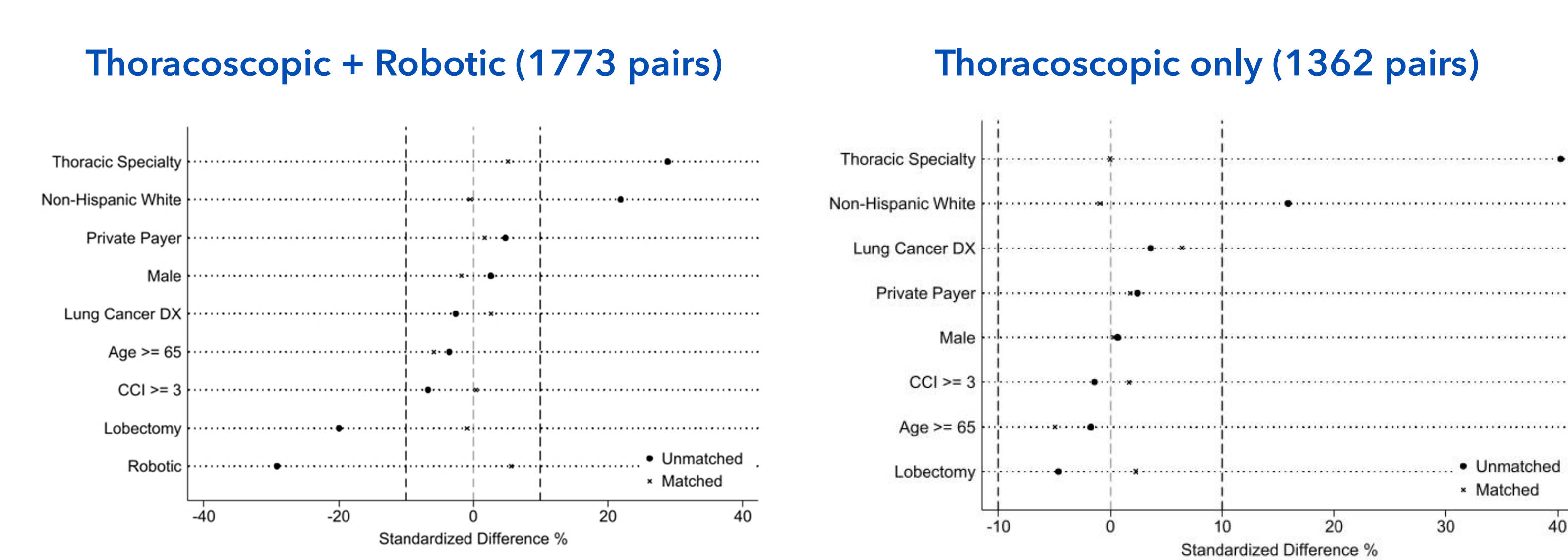
Statistical software: All analyses were conducted using SAS 9.4 and Stata 18.5 using 2-sided statistical tests. P-values equal to or less than 0.5 are considered statistically significant.

RESULTS

Figure 1: Cohort Selection



Figure 2: Baseline Standard differences before and after PSM



*Surgeon’s specialty is highly correlated with hospital/surgeon volume, teaching status, and hospital bed size; therefore, cases are only matched with the surgeon’s specialty

Clinical outcomes:

Patients who used SU-powered staplers had higher incidence rates of bleeding, postoperative air leak, and pneumothorax than MU-powered staplers in both MIS and thoracoscopic-only cohorts. (Figure 3) SU-powered stapling was likely to have an increase in the incidence rates of bleeding (2.7%-2.9%), postoperative air leak (3.72%-4.55%), and pneumothorax (4.57%-6.68%) compared to MU-powered stapling. (Table 2) Also, there are equivalent clinical outcomes between MU and SU in blood transfusion, conversion, and 30-day readmission.

Healthcare utilization:

- MU-powered staplers used in patients who underwent thoracic procedures were more likely to save average OR time (11-12 minutes) and length of stays (0.6-0.7 days) than SU-powered staplers. (Figure 4, Figure 5, and Table 3)
- There is no difference in total inpatient costs between MU and SU used in thoracic procedures.

CONCLUSIONS

The study shows that multiple-use powered staplers are more effective than single-use powered staplers, with equivalent total inpatient costs and more efficient use of healthcare resources.

Figure 3: Incidence rates (%) of complications in Single-use(SU) and Multiple-use (MU) powered staplers

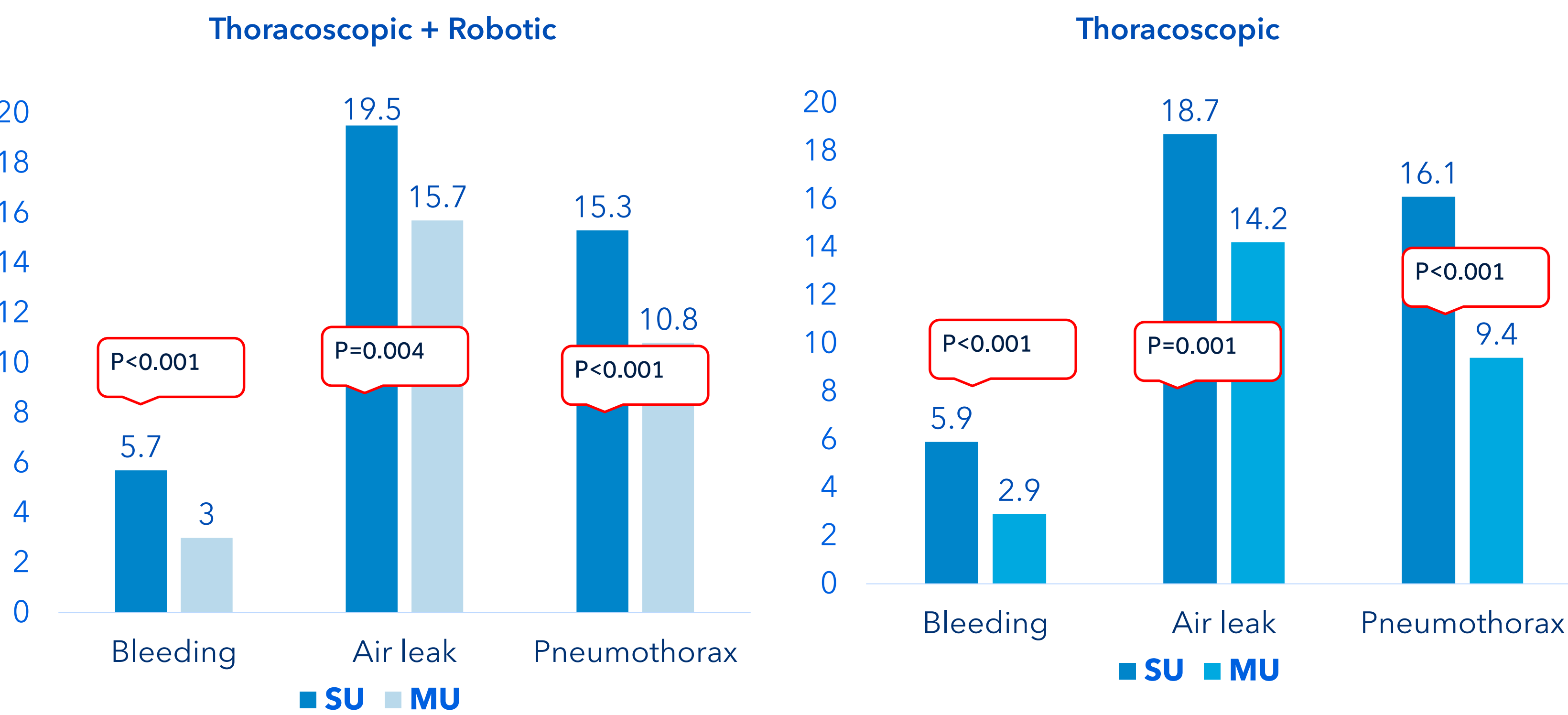


Table 2: Differences in clinical outcomes between SU and MU powered staplers

SU-MU incidence rates	Thoracoscopic + Robotic	p-value	Thoracoscopic	p-value
	Differences (95% CI)		Differences (95% CI)	
Bleeding	2.7%(1.37%-4.04%)	<0.001	2.9%(1.40%-4.47%)	<0.001
Air Leak	3.72%(1.22%-6.23%)	0.004	4.55%(1.77%-7.33%)	0.001
Pneumothorax	4.57%(2.36%-6.78%)	<0.001	6.68%(4.19%-9.17%)	<0.001

Figure 4: Operating room time (minutes) by SU and MU powered staplers

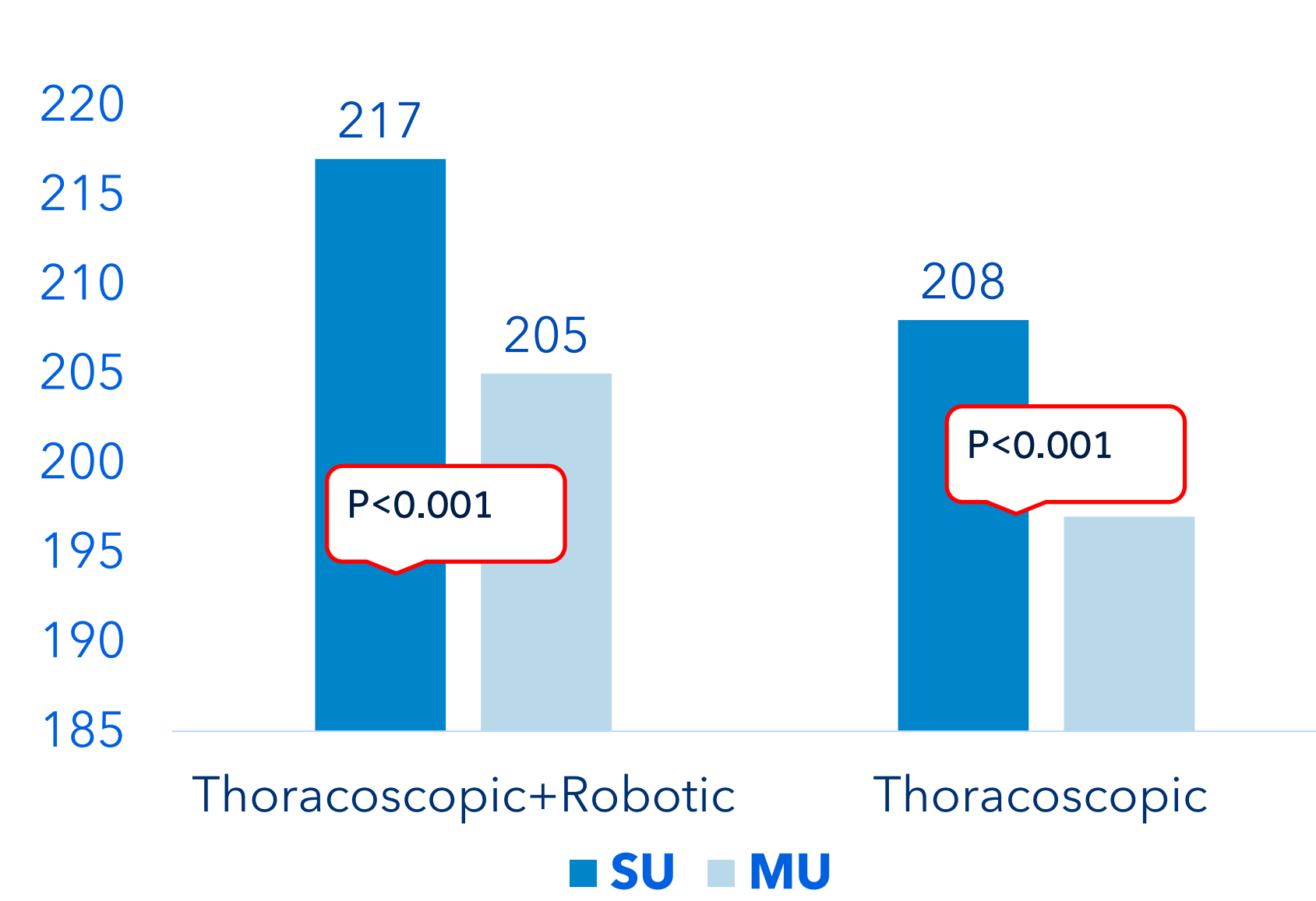


Figure 5: Length of stay (days) by SU and MU powered staplers

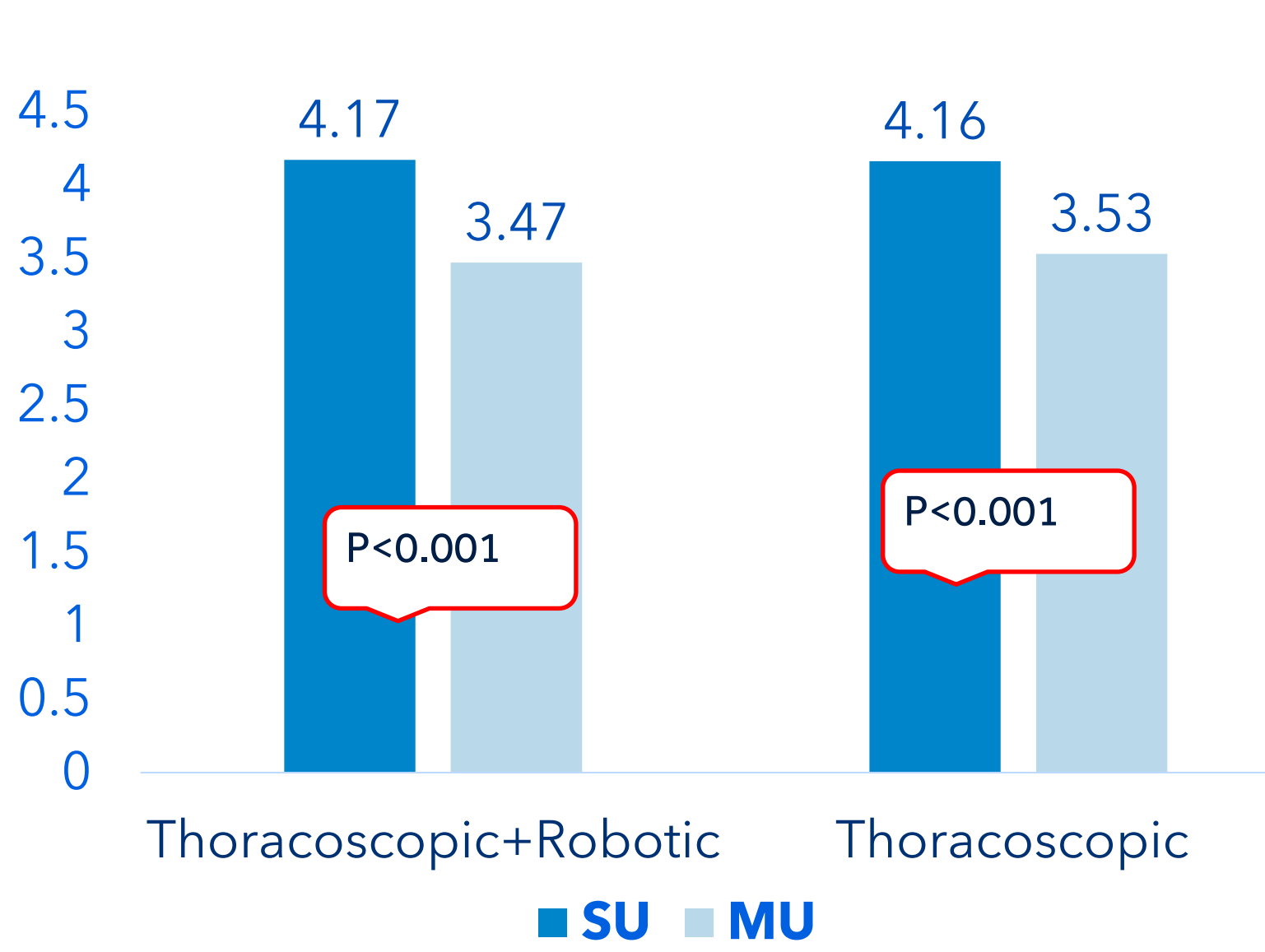


Table 3: Differences in resource utilization between SU and MU powered staplers

SU-MU Resources Use	Thoracoscopic + Robotic	p-value	Thoracoscopic	p-value
	Mean Difference (95% CI)		Mean Difference (95% CI)	
Operating room time (minutes)	12(6.6, 17.6)	<0.001	11(5, 17)	<0.001
Length of Stay (days)	0.7(0.5-0.9)	<0.001	0.6(0.4-0.9)	<0.001

See supplemental material for references
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