Analysis Report

This report is structured as follows.

Contents

This analysis focused on the statistical comparison of several factors by the resident being present on surgery or not. When variables were continuous (age, BMI, etc.), Analysis of Variance (ANOVA) was employed. Chi-square analysis was executed whenever variables were categorical (Gender etc.). Both types of analysis were also disaggregated by surgery type: ATSA or RTSA. Tests were conducted to evaluate if there are significant relationships when looking at each surgery type only. The following sections present the results. 138 participants were included, of which 61 had Reverse Total Shoulder Arthroplasty and 77 had Anterior Total Shoulder Arthroplasty.

ANOVA Results

The analysis conducted sought to explore the influence of resident participation on various outcomes, including age, body mass index (BMI), operation time, and ASES Patient Satisfaction Score Change, within the context of two types of surgeries: Anterior Total Shoulder Arthroplasty (ATSA) and Reverse Total Shoulder Arthroplasty (RTSA). The table below shows results for both surgeries combined.

Variable	Resident Present	Mean	SEM	SD	F	p
Age	N	69.406	0.924	9.050	0.126	0.723
	Y	68.810	1.407	9.118		
	Total	69.225	0.770	9.042		
BMI	N	30.703	0.598	5.863	3.295	0.072
	Y	32.679	0.916	5.933		
	Total	31.304	0.505	5.933		
Operation Time	N	126.135	2.289	22.430	2.192	0.141
	Y	132.476	3.816	24.730		
	Total	128.065	1.979	23.248		
ASES Patient Satisfaction Score Change	N	31.500	3.413	33.445	1.635	0.203
	Y	23.760	4.781	30.987		
	Total	29.144	2.792	32.799		

The table below shows results disaggregated by surgery type.

Variable	Resident Present	ATSA	F	p	RTSA	F	p
Age	N	66.673			72.636		
	Y	67.000	0.022	0.883	71.471	0.251	0.618
	Total	66.779			72.311		
BMI	N	31.411			29.865		
	Y	31.595	0.018	0.893	34.272	6.305	0.015
	Total	31.471			31.093		
Operation Time	N	132.673			118.409		
	Y	133.360	0.024	0.876	131.176	2.712	0.105
	Total	132.896			121.967		
ASES Patient Satisfaction Score Change	N	29.969			33.309		
	Y	18.208	2.027	0.159	31.924	0.024	0.877
	Total	26.151			32.923		

For age, the ANOVA results did not reveal a statistically significant difference between cases with and without resident presence ($F(1, 138) = 0.126$, $p = .723$). This pattern persisted across both ATSA ($F(1, 77) = 0.022$, $p = .883$) and RTSA ($F(1, 61) = 0.251$, $p = .618$) surgeries, suggesting that the presence of a resident does not significantly affect the age distribution of patients undergoing either type of surgery.

Regarding BMI, the overall analysis indicated no significant difference related to resident participation ($F(1, 138) = 3.295$, $p = .072$). However, when disaggregated by surgery type, a significant effect was observed in the RTSA group ($F(1, 61) = 6.305$, $p = .015$), but not in the ATSA group ($F(1, 77) = 0.018$, $p = .893$). This finding suggests that resident presence may be associated with a higher BMI in patients undergoing RTSA but not ATSA.

Operation time analysis did not demonstrate a significant difference with resident involvement overall ($F(1, 138) = 2.192$, $p = .141$). When examining the types of surgery separately, neither ATSA ($F(1, 77) = 0.024$, $p = .876$) nor RTSA ($F(1, 61) = 2.712$, $p = .105$) showed significant differences, indicating that operation times are consistent regardless of resident participation in both surgical procedures.

Finally, the change in ASES Patient Satisfaction Score showed no significant overall difference with or without resident participation ($F(1, 138) = 1.635$, $p = .203$). This outcome was mirrored in the ATSA-specific analysis ($F(1, 77) = 2.027$, $p = .159$) and the RTSA-specific analysis ($F(1, 61) = 0.024$, $p = .877$), suggesting that resident involvement does not significantly impact patient satisfaction score changes in either surgical context.

In summary, this analysis provides evidence that the participation of a resident during shoulder arthroplasty procedures does not significantly affect the age or operation time of the patients, nor does it impact the change in ASES Patient Satisfaction Scores. However, a noteworthy exception was

found in BMI outcomes specifically within the RTSA group, where resident presence was associated with a higher BMI.

Chi-Square Results

The chi-square analysis aimed to assess the association between resident presence during surgery and various categorical variables, such as gender, type of shoulder arthroplasty (anatomic or reverse), patient arm operated on, diabetes status, tobacco use, history of previous cardiovascular events, incidence of periprosthetic joint infection within 6 weeks, postoperative blood transfusion, periprosthetic fracture within 6 weeks, and readmission within 30 days. The analysis further distinguished outcomes by surgery type, ATSA and RTSA.

The two tables below show the results of chi-square tests overall and disaggregated by surgery type.

Variables	Level	Resident Absent (%)	Resident Present (%)	Total (%)	X^2	p
Gender	Female	48.958	42.857	47.101	0.226	0.635
	Male	51.042	57.143	52.899		
anatomic or reverse total shoulder arthroplasty	ATSA	54.167	59.524	55.797	0.157	0.692
	RTSA	45.833	40.476	44.203		
Patient Arm	l	45.833	47.619	46.377	0.000	0.994
	r	54.167	52.381	53.623		
Diabetes	n	76.042	71.429	74.638	0.130	0.718
	y	23.958	28.571	25.362		
Tobacco Use	n	86.458	92.857	88.406	0.626	0.429
	y	13.542	7.143	11.594		
Previous Cardiovascular Event	n	90.625	92.857	91.304	0.010	0.920
	y	9.375	7.143	8.696		
Periprosthetic Joint infection within 6 weeks	n	98.958	100.000	99.275	0.000	1.000
	y	1.042	0.000	0.725		
Postoperative blood transfusion	n	98.958	100.000	99.275	0.000	1.000
	y	1.042	0.000	0.725		
Periprosthetic fracture within 6 weeks	n	100.000	97.619	99.275	0.182	0.670
	y	0.000	2.381	0.725		
Readmission within 30 days	n	96.809	97.561	97.037	0.000	1.000
	y	3.191	2.439	2.963		

Variable	Level	ATSA				RTSA			
		Resident Absent (%)	Resident Present (%)	X^2	p	Resident Absent (%)	Resident Present (%)	X^2	p
Gender	Female	50.000	32.000	1.548	0.213	47.727	58.824	0.242	0.623
	Male	50.000	68.000			52.273	41.176		
Patient Arm	l	53.846	56.000	0.000	1.000	36.364	35.294	0.000	1.000
	r	46.154	44.000			63.636	64.706		
Diabetes	n	76.923	64.000	0.845	0.358	75.000	82.353	0.074	0.785
	y	23.077	36.000			25.000	17.647		
Tobacco Use	n	88.462	92.000	0.006	0.938	84.091	94.118	0.381	0.537
	y	11.538	8.000			15.909	5.882		
Previous Cardiovascular Event	n	94.231	96.000	0.000	1.000	86.364	88.235	0.000	1.000
	y	5.769	4.000			13.636	11.765		
Postoperative blood transfusion	n					97.727	100.000	0.000	1.000
	y					2.273	0.000		
Periprosthetic Joint infection within 6 weeks	n	98.077	100.000	0.000	1.000	100.000	94.118	0.248	0.619
	y	1.923	0.000			0.000	5.882		
Readmission within 30 days	n	98.000	100.000	0.000	1.000	95.455	94.118	0.000	1.000
	y	2.000	0.000			4.545	5.882		

Across all examined variables, the chi-square tests indicated no statistically significant associations with resident presence during surgery. For gender, the analysis did not reveal a significant difference in distribution between surgeries performed with or without a resident present (χ^2 (1, N = 138) = 0.226, p = .635). Similarly, when the data were disaggregated by surgery type, no significant difference was found in gender distribution by resident presence for ATSA (χ^2 (1, N = 77) = 1.548, p = .213) or RTSA (χ^2 (1, N = 61) = 0.242, p = .623).

This pattern of nonsignificant findings extended across other variables. For diabetes, no significant association with resident involvement was detected (χ^2 (1, N = 138) = 0.130, p = .718), consistent in separate analyses for ATSA (χ^2 (1, N = 77) = 0.845, p = .358) and RTSA (χ^2 (1, N = 61) = 0.074, p = .785). Other variables, including tobacco use, prior cardiovascular events, and postoperative complications such as periprosthetic joint infection and blood transfusion, similarly showed no significant differences related to the presence of residents, in both the overall analysis and when examined by surgery type.

Notably, the incidence of periprosthetic fracture within 6 weeks and readmission within 30 days also did not reveal any significant association with resident presence, underscoring the consistent lack of significant associations across multiple variables. This absence of significant findings suggests that resident participation in shoulder arthroplasty procedures, whether ATSA or RTSA, does not significantly influence the categorical outcomes investigated in this study.

Conclusion

In conclusion, this comprehensive analysis evaluated the impact of resident presence on various outcomes related to shoulder arthroplasty procedures, encompassing both Anterior Total Shoulder Arthroplasty (ATSA) and Reverse Total Shoulder Arthroplasty (RTSA) among 138 participants. Through the application of Analysis of Variance (ANOVA) for continuous variables such as age, BMI, operation time, and ASES Patient Satisfaction Score Change, alongside Chi-square analysis for categorical variables, the study meticulously assessed potential differences attributable to surgical education. The findings from both analytical approaches revealed a consistent pattern: the presence of a resident during surgery did not significantly affect the majority of evaluated outcomes. Specifically, no statistically significant differences were observed in patient age distribution, operation times, or changes in ASES Patient Satisfaction Scores, irrespective of resident involvement. A notable exception was identified in the BMI of patients undergoing RTSA, where a significant association suggested a potential impact of resident participation. However, the chi-square results indicated no significant associations between resident presence and categorical variables such as gender, diabetes status, tobacco use, and other postoperative complications across both types of

shoulder arthroplasty. Collectively, these results underscore the neutral impact of resident involvement on the clinical and procedural aspects of shoulder arthroplasty, with implications for surgical education and patient care outcomes.