Does Insurance Status Determine Treatment of Humeral Shaft Fractures?

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INTRODUCTION: Humeral shaft fractures have been historically managed non-operatively in a functional brace. However, recent studies suggest an increase in the rates of operative fixation. Disparities in surgical management based on insurance status have been demonstrated across a wide array of orthopaedic conditions. The purpose of this study was to identify the association between insurance status and the likelihood of operative fixation of humeral shaft fractures.

METHODS: A retrospective analysis of the National Readmissions Database 2016 – 2018 was performed on patients with isolated closed humeral shaft fractures using International Classification of Disease, Tenth Revision (ICD-10) diagnostic codes. Surgery was determined using ICD-10 procedural codes. A binary logistic regression analysis was used to examine demographic and other important variables, with a significance level of $p < 0.05$. Results were recorded as odds ratios (OR).

RESULTS: Using weighted data, a total of 28,358 patients with isolated closed humeral shaft fractures were identified. Of these patients, 12,750 (45%) underwent operative fixation. Patients with Medicare (OR, 0.35; 95% CI, 0.33 – 0.38; p<0.001), Medicaid (OR, 0.56; 95% CI, 0.51 – 0.62; p<0.001), and self-pay patients (OR, 0.75; 95% CI, 0.65 – 0.87; p<0.001) had a lower likelihood of undergoing operative fixation of humeral shaft fracture than those with private insurance. Additionally, older patients and female patients were less likely to undergo surgical treatment (OR, 0.89; 95% CI, 0.85 – 0.94; p<0.001). Although significant in the univariate analysis, patient income quartile was not found to be statistically significant in predicting the likelihood of surgery.

DISCUSSION AND CONCLUSION: Patients without private insurance or those with no insurance coverage are less likely to undergo operative fixation for humeral shaft fractures compared to those with private insurance, even after adjusting for social and demographic variables. Surgeons should be aware of these potential biases affecting management decisions.

Table I Breakdown of humeral shaft fracture admissions by year

	No Surgery	Surgery
2016	4911 (53.6)	4253 (46.4)
2017	5230 (55.2)	4246 (44.8)
2018	5468 (56.3)	4251 (43.7)

p=0.001

Table III Breakdown of population comorbidities for patients with humeral shaft fractures

	All years			
	No Surgery, n (%)	Surgery, n (%)	All cases, n (%)	P value
Hypertension	6,751 (43.3)	5,953 (46.9)	12,704 (44.8)	<0.001
Nicotine dependence				
Current	1,635 (10.5)	1,551 (12.2)	3,186 (11.2)	<0.001
History	2,732 (17.5)	2,090 (16.4)	4,822 (17.0)	0.013
Diabetes	2,474 (15.9)	1,953 (15.2)	4,407 (15.5)	0.111
Hypothyroidism	2,868 (18.4)	1,931 (15.1)	4,799 (16.9)	<0.001
Psychiatric diagnosis	3,462 (22.2)	2,809 (22.0)	6,271 (22.1)	0.763
Heart disease	3,119 (20.0)	1,640 (12.9)	4,759 (16.8)	<0.001
Obesity	1,016 (6.5)	1,278 (10.0)	2,294 (8.1)	<0.001
Morbid Obesity	896 (5.7)	1020 (8.0)	1,916 (6.8)	<0.001
COPD	2,227 (14.3)	1,303 (10.2)	3,530 (12.4)	<0.001
Osteoporosis	1,295 (8.3)	973 (7.6)	2268 (8.0)	0.040
CKD	2,350 (15.1)	1,105 (8.7)	3,455 (12.2)	<0.001
Anemia	2,254 (14.4)	1,222 (9.6)	3476 (12.3)	<0.001
Fibromyalgia	276 (1.8)	253 (2.0)	529 (1.9)	0.181
Anticoagulant therapy	1,536 (9.8)	759 (6.0)	2,295 (8.1)	<0.001

COPD, chronic obstructive pulmonary disease; CKD, chronic kidney disease

Table IV Binary logistic regression analysis of factors associated with humeral shaft fracture fixation

	All years	
Variable	OR (95% CI)	P value
Age (ranges)		
19-34	Reference	Reference
35-49	0.55 (0.48 – 0.63)	<0.001
50-64	0.35 (0.32 – 0.39)	<0.001
65-74	0.30 (0.27 – 0.33)	<0.001
≥ 75	0.17 (0.17 – 0.19)	<0.001
Sex		
Male	Reference	Reference
Female	0.89 (0.85 – 0.94)	<0.001
Income quartile by ZIP code, n (%)		
1	Reference	Reference
2	0.94 (0.89 – 1.004)	0.068
3	1.04 (0.97 – 1.11)	0.241
4	0.96 (0.89 – 1.03)	0.223
Payer, n (%)		
Private	Reference	Reference
Medicare	0.35 (0.33 – 0.38)	<0.001
Medicaid	0.56 (0.51 – 0.62)	<0.001
Self-pay	0.75 (0.65 – 0.87)	<0.001
No charge	0.71 (0.48 – 1.05)	0.085
Other	1.17 (1.02 – 1.35)	0.025

OR, odds ratio; CI, confidence interval

Table II Demographics of patients admitted with humeral shaft fractures

	All years			
	No Surgery (N=15,608)	Surgery (N=12,750)	All cases (N=28,358)	P value
Age, year	71.96 (15.47)	68.82 (18.97)	67.85 (17.73)	<0.001
Length of stay, days	5.28 (5.22)	3.94 (4.32)	4.68 (4.56)	<0.001
Total charges, $	54,331.68 (90,545.31)	51,104.34 (42741.49)	62,985.62 (79,825.73)	<0.001
APR-DRG mortality risk score	2.19 (0.97)	1.56 (.79)	1.91 (0.93)	<0.001
APR-DRG disease severity score	2.44 (0.86)	2.19 (.53)	2.33 (0.74)	<0.001
Female, n (%)	10,744 (68.8)	8,449 (66.3)	19,193 (67.7)	<0.001
Disposition, n (%)				<0.001
Routine	4,575 (29.3)	6,562 (51.5)	11,137 (39.3)	
Short-Term Hospital	211 (1.4)	39 (0.3)	250 (0.9)	
Transfer to SNF, ICF, or another facility	7,639 (49.0)	3,824 (30.0)	11,463 (40.4)	
Home Health Care	2,427 (15.6)	2,179 (17.1)	4,626 (16.3)	
Against Medical Advice	178 (1.1)	42 (0.3)	220 (0.8)	
Died	569 (3.6)	75 (0.6)	644 (2.3)	
Discharge alive, destination unknown	2 (0.0)	0 (0.0)	2 (0.0)	
Payer, n (%)				<0.001
Medicare	11,855 (76.0)	7,274 (57.1)	19,129 (67.5)	
Medicaid	1,222 (7.8)	1,192 (9.4)	2,414 (8.5)	
Private insurance	1,709 (11.0)	2,959 (23.2)	4,668 (16.5)	
Self-pay	460 (2.4)	520 (4.1)	920 (3.2)	
No charge	46 (0.3)	57 (0.4)	103 (0.4)	
Other	358 (2.3)	727 (5.7)	1,085 (3.8)	
Patient Location, n (%)				0.008
"Central" counties of metro areas of >=1 million population	3,892 (25.0)	3,340 (26.2)	7,232 (25.6)	
"Fringe" counties of metro areas of >=1 million population	4,049 (26.1)	3,120 (24.5)	7,169 (25.4)	
Counties in metro areas of 250,000-999,999 population	3,428 (22.1)	2,868 (22.6)	6,296 (22.3)	
Counties in metro areas of 50,000-249,999 population	1,567 (10.1)	1,259 (9.9)	2,826 (10.0)	
Micropolitan counties	1,358 (8.7)	1,172 (9.2)	2,530 (9.0)	
Income quartile by ZIP code, n (%)				0.018
1	4,394 (28.3)	3,658 (28.8)	8,053 (28.7)	
2	4,535 (29.4)	3,364 (26.5)	8,079 (28.9)	
3	3,463 (23.0)	3,153 (25.1)	6,816 (24.3)	
4	2,821 (18.4)	2,244 (17.8)	5,075 (18.1)	
Bed size of hospital				<0.001
Small	2,906 (18.6)	1,795 (14.1)	4,701 (16.6)	
Medium	4,834 (30.9)	3,446 (26.7)	8,230 (29.0)	
Large	7,878 (50.3)	7,509 (59.2)	15,427 (54.4)	
Control/ownership of hospital, n (%)				<0.001
Government, nonfederal	1,569 (10.1)	1,526 (12.0)	3,095 (10.9)	
Private, non-profit	10,613 (68.0)	9,007 (71.8)	19,020 (69.2)	
Private, investor-owned	3,424 (22.0)	2,217 (17.4)	5,641 (19.9)	
Hospital urban-rural designation, n (%)				<0.001
Large metropolitan areas with at least 1 million residents	8,366 (53.6)	6,882 (54.0)	15,248 (53.8)	
Small metropolitan areas with less than 1 million residents	5,722 (36.7)	4,815 (37.7)	10,523 (37.2)	
Micropolitan areas	1,021 (6.5)	918 (7.2)	1,939 (6.8)	
Not metropolitan or micropolitan (non-urban residual)	499 (3.2)	150 (1.2)	649 (2.3)	
Teaching Status of Urban Hospital				<0.001
Metropolitan, non-teaching	4,120 (26.4)	3,176 (24.9)	7,296 (25.7)	
Metropolitan, teaching	9,869 (63.8)	8,507 (66.7)	18,476 (65.2)	
Non-metropolitan	1,520 (9.7)	1,067 (8.4)	2,587 (9.1)	

APR-DRG, All Patients Refined Diagnosis Related Groups; SNF, skilled nursing facility; ICF, intermediate care facility