Socioeconomic Status Using the Area Deprivation Index is Associated with Increased Medical Complications and Emergency Department Utilization After Total Hip Arthroplasty: Consideration of the Disadvantaged Patient

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INTRODUCTION: Socioeconomic status (SES) has been demonstrated to be an important prognostic factor among patients undergoing surgery including total joint arthroplasty. Measures of socioeconomic disadvantage may enable improved targeting of measures to prevent and recognize potential increased healthcare utilization in these disadvantaged patients. The Area Deprivation Index (ADI) is a weighted index comprised of 17 census-based markers of material deprivation and poverty. The purpose of this study was to utilize a large nationwide administrative claims database to determine whether patients with high ADI (greater disadvantage) undergoing THA is associated with differences in: 1) 90-day medical complications; 2) 90-day emergency department (ED) utilization; and 3) 90-day readmission rates.

METHODS: A retrospective query of all primary THA patients was performed using a large private insurance database from January 1st, 2010 to October 31st, 2020. Cohorts of interest were queried using Current Procedural Terminology (CPT) codes and International Classification of Disease, Ninth/Tenth Revision (ICD-9), ICD-10 codes. ADI is reported on a scale of 0-100 with higher numbers associated with greater disadvantage. Percentile was documented for each zip code for all states. The study group consisted of patients undergoing primary THA in zip codes associated with high ADI (90%+) as established by previously published studies. The comparison cohort consisted of THA patients who underwent surgery in zip codes not defined by the study group (ADI 0-89%). Patients with high ADI were 1:1 propensity score matched to controls by age, gender, and Elixhauser Comorbidity Index (ECI). This yielded 138,670 patients in total, evenly matched between the two cohorts. Primary endpoints of the study were to compare 90-day medical complications, 90-day ED utilization, and 90-day readmission rates. Multivariable logistic regression models were used to calculate the odds-ratios (OR) and 95% confidence intervals (95%CI) of ADI on medical complications, ED utilization, and readmission rates. Due to the ease of finding statistical significance with large database studies, a Bonferroni correction was performed to reduce the probability of a type I error. Thus, a p-value less than 0.01 was considered to be statistically significant.

RESULTS: High ADI patients incurred significantly higher rates and odds of developing any medical complications (13.0 vs. 11.91%; OR: 1.09, 95%CI: 1.05 – 1.13, p<0.0001), including acute kidney injuries (1.83 vs 1.52%; OR: 1.20, 95%CI: 1.11 - 1.31, p<0.0001), urinary tract infections (4.19% vs. 3.77%; OR: 1.11, 95%CI: 1.05 - 1.18, p=0.0001), myocardial infarctions (0.35% vs. 0.24%; OR: 1.45, 95%CI: 1.18 - 1.76, p=0.0003), and surgical site infections (0.94% vs. 0.76%; OR: 1.23, 95%CI: 1.10 - 1.38, p=0.0004). Despite no significant difference in 90-day readmissions in the more deprived cohort (5.44 vs 5.69%: OR: 0.95, 95%CI: 0.91 – 0.99, p=0.034), high ADI patients had significantly higher rates and odds of ED visits within 90 days (3.94 vs. 3.67%; OR: 1.08, 95%CI: 1.02 - 1.14, p=0.008).

DISCUSSION AND CONCLUSION:

Socioeconomically disadvantaged patients have increased rates and odds of all 90 day medical complications. ED utilization was higher in socioeconomically disadvantaged patients despite no significant differences in readmission rates within 90 days of surgery. Measures of neighborhood disadvantage, including the ADI, could potentially be used to inform healthcare policy and improve post-discharge care.

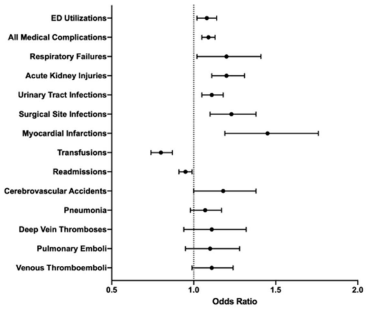

Figure 1. Forest plot of postoperative outcomes of high ADI patients versus controls. High ADI cohorts were those above the 90th percentile. The reference cohort was anyone from an ADI of 0-89%. High ADI patients had greater odds of all 90-day medical complications, ED utilizations, acute kidney injuries, urinary tract infections, surgical site infections, and myocardial infarctions. Patients from high ADIs had lower odds of transfusions. Readmissions were similar between groups.

	High ADI (>90%)		Controls		
DEMOGRAPHICS	n	%	n	%	*p*-value[b]
Age (Years)					
15-19	109	0.16	109	0.16	0.99
20-24	94	0.14	94	0.14	
25-29	171	0.25	171	0.25	
30-34	267	0.39	267	0.39	
35-39	510	0.74	510	0.74	
40-44	1167	1.68	1167	1.68	
45-49	2687	3.88	2687	3.88	
50-54	5576	8.04	5576	8.04	
55-59	8902	12.84	8902	12.84	
60-64	11116	16.03	11116	16.03	
65-69	11297	16.29	11297	16.29	
70-74	15068	21.73	15068	21.73	
75-79	10391	14.99	10391	14.99	
80+	1980	2.86	1980	2.86	
Sex					
Female	38981	56.22	38981	56.22	0.99
Male	30354	43.78	30354	43.78	
Comorbidity Burden					
ECI					
0	7356	10.61	7356	10.61	0.99
1	10068	14.52	10068	14.52	
2	11094	16.00	11094	16.00	
3	10162	14.66	10162	14.66	
4	8291	11.96	8291	11.96	
5	6402	9.23	6402	9.23	
6	4658	6.72	4658	6.72	
7	3442	4.96	3442	4.96	
8	2415	3.48	2415	3.48	
9	1767	2.55	1767	2.55	
10	1212	1.75	1212	1.75	
11	841	1.21	841	1.21	
12	569	0.82	569	0.82	
13	412	0.59	412	0.59	
14	253	0.36	253	0.36	
15+	393	0.57	393	0.57	

Table 1. Demographics of Primary Total Hip Arthroplasty Patients from High Area Deprivation Index Regions Compared to Controls. ECI = Elixhauser Comorbidity Index; * = <11 Patients; N/A = Not Applicable; [b] = Assessed by Pearson's χ^2

	High ADI (%)	Control (%)	OR	95% CI	*p*-value
Urinary Tract Infections	4.19	3.77	1.11	1.05-1.18	**0.0001**
Acute Kidney Injuries	1.83	1.52	1.20	1.11-1.31	**<0.0001**
Pneumoniae	1.43	1.33	1.07	0.98-1.17	0.143
Myocardial Infarctions	0.35	0.24	1.45	1.18-1.76	**0.0003**
Transfusions	1.51	1.87	0.80	0.74-0.87	**<0.0001**
Surgical Site Infections	0.94	0.76	1.23	1.10-1.38	**0.0004**
Venous Thromboemboli	0.89	0.80	1.11	0.99-1.24	0.081
Pulmonary Emboli	0.52	0.47	1.10	0.95-1.28	0.203
Deep Venous Thrombosis	0.41	0.37	1.11	0.94-1.32	0.223
Cerebrovascular Accidents	0.47	0.40	1.18	1.00-1.38	0.048
Respiratory Failures	0.46	0.38	1.20	1.02-1.41	0.028
Total Complications	13.0	11.91	1.09	1.05-1.13	**<0.0001**

Table 2. Comparison of Incidence and Odds of Ninety-Day Medical Complications of Patients from High Area Deprivation Index Regions Compared to Controls.

OR = Odds-Ratio; 95% CI = 95% Confidence Interval