

Area Deprivation Index is a Predictor of Readmission and Increased Medical Complications and Emergency Department Utilization After Surgery for Femoral Neck Fractures

David Dallas-Orr, Noah Lyndall, Robert Ramiro G Hernandez, Abby Hankins, Safdar Nasim Khan, Gillian Soles, Sean T Campbell, John Patrick Meehan, Zachary Lum

INTRODUCTION: It is well documented that socioeconomic status (SES) has an impact on surgical outcomes; however, its influence on femoral neck fracture (FNF) postoperative management has not been well established on a national level. The Area Deprivation Index (ADI) assigns socioeconomic disadvantage rankings to neighborhoods by implementing variables such as income, education, and housing quality. Our study utilized a national claims database to assess postoperative complications following FNF surgery across ADI stratified cohorts. compared to patients in low-deprivation (LD) communities (ADI 1-90). We hypothesized that patients from high-deprivation (HD) communities, as compared to low-deprivation (LD) communities, were more likely to have a postoperative complication across each of the surgical fixation methods for FNF.

METHODS:

An insurance claims database was used to evaluate complications following surgical treatment of FNFs during the years from 2010 to 2023. Three different surgical groups were independently evaluated [Screw Fixation (SF): cannulated screw fixation or sliding hip screw; hemiarthroplasty (HA); total hip arthroplasty (THA)].

The Area Deprivation Index scores for zip codes nationwide were used to stratify patients into 2 cohorts (HD and LD) for each surgical treatment group. The HD cohorts consisted of patients in high distress communities with an ADI of 91-100. The LD comparator cohorts consisted of patients from lower distress communities with an ADI of 1-90. For each surgical group, the HD and LD cohorts were matched by age, sex, Elixhauser Comorbidity Index, tobacco use, illicit drug use, and presence of a mental health diagnosis.

RESULTS:

This study evaluated a total of 1,157,638 patients that were treated during the years from 2010 to 2023. The surgical cohort sizes for SF, HA for FNF, and THA for FNF were 732,039 patients, 289,867 patients, and 135,732 patients, respectively. Overall, patients residing in HD areas experience significantly higher rates of postoperative complications following FNF surgery compared to those from LD areas. In all three surgical cohorts, the risk of hospital readmission and postoperative emergency department (ED) visits was significantly higher for HD patients (Table 1). For SF, patients in the HD cohort were 13% more likely to be readmitted within 90 days (OR 1.13; $p < 0.0001$). Similar results were found for the risk of readmission in patients treated with either HA or THA.

Additionally, the SF HD cohort was more likely to visit the ED and have a surgical site infection (SSI) within 90 days as compared to the SF LD cohort (ED: OR 1.14; $p < 0.0001$) (SSI: OR 1.10; $p = 0.0114$). Similarly, HD patients treated with HA were more likely to visit the ED or have an SSI (ED: OR 1.08; $p < 0.0001$) (SSI: OR 1.11; $p = 0.0485$). Although HD patients treated with THA did have a higher risk of visiting the ED, they did not have an increased risk of SSI as compared to the respective LD cohort (ED: OR 1.10; $p < 0.0001$) (SSI: OR 0.86; $p = 0.1173$). Lastly, the risk of transfusion or urinary tract infection was significantly higher for the HD cohorts of each surgical treatment group (Table 1).

DISCUSSION AND CONCLUSION: Utilizing a matched cohort design in the setting of femoral neck fractures, this study summarizes the differences in 90-day postoperative complication risks between patients of HD communities as compared to patients of LD communities. Significant results were found for each FNF surgery type evaluated. The significant increase in postoperative complications such as 90-day readmission, postoperative ED visits, and SSIs reinforces the importance of incorporating risk calculation tools such as ADI into perioperative plans and care. These findings suggest that more work can be done to improve outcomes for vulnerable populations, which may include improving discharge planning, increasing access to postoperative care, and providing community support in highly deprived areas. Future research should explore the utility of integrating ADI-informed risk assessments into the clinical care of orthopaedic patients.

Table 1: Risk of 90-day complications following surgical treatment of femoral neck fractures for patients in high distress communities

Complication	SF		HA for FNF		THA for FNF	
	Odds Ratio (95% CI)	P-value	Odds Ratio (95% CI)	P-value	Odds Ratio (95% CI)	P-value
Patients	732,039		289,867		135,732	
Readmission	1.13 (1.10, 1.15)	<0.0001*	1.09 (1.05, 1.13)	<0.0001*	1.09 (1.05, 1.13)	<0.0001*
Emergency Department Visit	1.14 (1.11, 1.16)	<0.0001*	1.08 (1.05, 1.12)	<0.0001*	1.10 (1.05, 1.15)	<0.0001*
Surgical Site Infection	1.10 (1.02, 1.18)	0.0114*	1.11 (1.00, 1.23)	0.0485*	0.86 (0.72, 1.03)	0.1173
Transfusion	1.21 (1.22, 1.29)	<0.0001*	1.31 (1.25, 1.38)	<0.0001*	1.23 (1.13, 1.34)	<0.0001*
Deep Vein Thrombosis	1.00 (0.95, 1.05)	0.9008	0.95 (0.88, 1.02)	0.1775	1.02 (0.90, 1.16)	0.7753
Pulmonary Embolism	0.96 (0.89, 1.05)	0.3990	0.92 (0.81, 1.05)	0.256	1.11 (0.82, 1.49)	0.5500
Myocardial Infarction	1.13 (1.06, 1.20)	<0.0001*	1.14 (1.04, 1.24)	0.0034*	1.05 (0.92, 1.21)	0.4679
Pneumonia	1.09 (1.06, 1.13)	<0.0001*	1.07 (1.03, 1.11)	0.0010*	1.04 (0.97, 1.12)	0.2984
Respiratory Failure	1.05 (1.02, 1.09)	<0.0001*	1.05 (1.01, 1.10)	0.0179*	1.04 (0.97, 1.11)	0.3124
Cerebrovascular Accident	1.02 (0.98, 1.07)	0.2767	1.02 (0.96, 1.08)	0.5325	1.05 (0.96, 1.16)	0.2958
Acute Kidney Injury	1.03 (1.00, 1.06)	0.0504	1.05 (1.00, 1.09)	0.0343*	0.99 (0.92, 1.05)	0.6603
Urinary Tract Infection	1.08 (1.06, 1.10)	<0.0001*	1.10 (1.06, 1.13)	<0.0001*	1.07 (1.02, 1.13)	0.0065*

Note: * P-value of 0.05 was used to determine statistical significance.
Abbreviations: FNF = Femoral Neck Fracture; HA = Hemiarthroplasty; SF = Screw Fixation; THA = Total Hip Arthroplasty