

Evaluating Associations Between Neighborhood Disadvantage and Hip Fracture Surgery Outcomes

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INTRODUCTION: Hip fractures in the geriatric population pose a significant public health challenge due to high risks of morbidity and mortality, with outcomes influenced by clinical and psychological factors but also by socioeconomic status (SES).^{1,2} The Area Deprivation Index (ADI) serves as a practical composite measure of SES, reflecting variables such as education, income, occupation, and social class, and prior research suggests that greater socioeconomic deprivation is linked to worse postoperative outcomes.³ This study primarily aimed to determine whether ADI is independently associated with one-year mortality after hip fracture surgery, with secondary objectives evaluating its relationship to 30-day mortality and in-hospital complications.

METHODS: Institutional review board approval was attained. This retrospective cohort study was conducted at two urban Level 1 trauma centers in the United States. Patients aged 70 years and older who sustained a hip fracture and received treatment between January 2016 and September 2024 were included, while those without a US zip code or with pathological, periprosthetic, or conservatively managed fractures were excluded. Patients were stratified by Area Deprivation Index (ADI), with the upper 15th percentile (indicating higher socioeconomic disadvantage) compared to the lower 85%, which served as the reference group. The primary outcome was one-year mortality, while secondary outcomes included 30-day mortality and in-hospital complications. Associations between ADI and these outcomes were evaluated using multivariable logistic regression.

RESULTS: A total of 3,019 patients were included (median age 84 years, 69% female) with a median Area Deprivation Index of 16 (IQR 8–21), characteristics in Figure 1. One-year mortality was 25%, 30-hospital mortality was 4.9%, and 39% patients sustained one or more in-hospital complication. After adjusting for age, sex, ethnicity, and Charlson Comorbidity Index, patients in the upper 15 percentile of Area Deprivation had similar odds of one-year mortality compared to those in the lower 85% (OR: 1.04, 95% CI 0.81–1.33, p=0.758). Further, no significant associations were observed for 30-day mortality (OR: 1.02, 95% CI 0.63-1.67, p=0.923) and or in-hospital complications (OR: 0.93, 95% CI 0.75-1.16, p=0.543) (Figures 2-3).

DISCUSSION: This study found no significant association between the Area Deprivation Index (ADI) and one-year mortality, 30-day mortality, or in-hospital complications following hip fracture surgery in geriatric patients, which contrasts with prior literature linking socioeconomic status (SES) to worse outcomes.⁴ Several factors may explain this, including the relatively advantaged study population with a narrow range of ADI values, potential non-linear relationships between SES and outcomes, and the limitations of using an area-level measure like the ADI, which may not capture individual SES differences. Additionally, many in-hospital complications were influenced more by perioperative management than by pre-hospital social context, further limiting the impact of ADI on outcomes in this cohort. These findings suggest that, within more affluent populations, the ADI may have limited predictive value, underscoring the need for future research using more socioeconomically diverse samples, individual SES measurements, and prospective data collection to better understand the influence of social determinants on hip fracture outcomes. Clinically, this highlights the importance of focusing on patient-specific factors rather than relying solely on neighborhood-level SES indicators for risk assessment and management. Several limitations should be considered. The sample's relatively advantaged demographics do not reflect the broader US population, and the limited socioeconomic variation within the cohort may have reduced the ability of the ADI to capture meaningful differences. Additionally, the retrospective study design could have led to underreporting of complications, and residual confounding from unmeasured social determinants remains possible. Therefore, these findings are not definitive, and future research should use more socioeconomically diverse and larger samples, collect individual-level SES data, and employ prospective study designs to better assess how social determinants impact hip fracture outcomes.

SIGNIFICANCE/CLINICAL RELEVANCE: This study found no independent association between Area Deprivation Index and mortality or complications after hip fracture surgery, suggesting that socioeconomic effects may be less pronounced in such cohorts or overshadowed by the injury's physical burden. These findings are not definitive and emphasize the need for further research to clarify the effects of social determinants on outcomes in hip fracture patients.

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Baseline	Total, n = 3019	Deprived patients, n = 451	Reference cohort, n = 2568	p-value
Age in years, median (IQR)	84 (78-90)	82 (76-88)	84 (78-90)	0.001
Female sex, n (%)	2088 (69.2)	299 (66.3)	1789 (69.7)	0.001
Race, n (%)				0.266
American Indian / Alaska Native	4 (0.1)	1 (0.2)	3 (0.1)	
Asian	78 (2.6)	7 (1.6)	71 (2.8)	
Native Hawaiian / Pacific Islander	1 (0.0)	-	1 (0.0)	
White	2208 (69.7)	400 (88.7)	2208 (69.9)	
Black	83 (2.7)	12 (2.7)	71 (2.8)	
ADI, median (IQR)	16 (8-21)	35 (20-44)	12 (7-18)	<0.001
Postoperative in-hospital, n (%)				<0.001
Home	3279 (85.4)	413 (91.6)	2166 (84.3)	
Skilled nursing facility	107 (3.3)	11 (2.4)	96 (3.7)	
Long-term facility	325 (10.8)	26 (5.8)	299 (11.6)	
Walk-in aid, n (%)				0.138
None	1265 (41.9)	225 (49.9)	1040 (40.5)	
Cane	481 (15.9)	54 (12.0)	427 (16.6)	
Walker	1043 (34.5)	136 (30.2)	907 (35.3)	
Wheelchair	122 (4.1)	15 (3.3)	108 (4.2)	
CCI, median (IQR)	5 (4-7)	4 (4-6)	5 (4-7)	<0.001

Figure 1. Baseline Characteristics of Study Sample

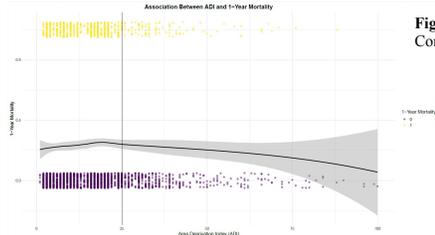


Figure 2. Multivariate Analysis for Postoperative Complications and Mortality by ADI Groups

Outcomes	Adjusted OR	95% CI	p-value
One-year mortality, n (%)	1.05	0.82-1.34	0.685
30-day mortality, n (%)	1.02	0.63-1.67	0.923
≥1 more complication(s), n (%)	0.93	0.75-1.16	0.543

Figure 3. Locally Weighted Scatterplot Smoothing (LOESS) Curve for ADI and One-Year Mortality