Elevated Area of Deprivation Index Scores Associated with Increased 90 Day Emergency Department and Hospital Readmissions Following Primary Total Knee Arthroplasty

Benjamin T. Johnson BS[1], Rana Ahmad BS[1], Apurva S. Choubey M.D.[2], Brett Drake BS[2], Mark Gonzalez M.D. P.h.D.[2]
[1]University of Illinois College of Medicine at Chicago, Chicago, IL, [2]University of Illinois Hospital, Department of Orthopaedics
Email of Presenting Author: bjohn52@uic.edu
Disclosures: Benjamin T. Johnson (N), Rana Ahmad (N), Apurva S. Choubey (N), Brett Drake (N), Mark Gonzalez (N)

INTRODUCTION: It is well documented that patients undergoing total knee arthroplasty (TKA) are negatively affected by a multitude of socioeconomic factors including lower income, being medicaid beneficiaries, and living in lower income neighborhoods.[1,2] The area deprivation index (ADI) tool created by the University of Wisconsin-Madison ranks neighborhoods by socioeconomic disadvantage in a region of interest.[3] The calculation of ADI includes factors for the theoretical domains of income, education, employment, and housing quality with higher levels of ADI being associated with higher levels of deprivation. While numerous studies have examined the relationship between socioeconomic status and outcomes of primary TKA, few have utilized state level ADI as a proxy for socioeconomic disadvantage in this patient population. Therefore, the purpose of this study is to understand if patients with higher ADI scores undergoing TKA have differences in demographic and perioperative factors.

METHODS: Patients who were >1 year post-op from a primary TKA procedure between December 2020 and August 2022 were retrospectively recruited for this study from an urban, academic tertiary medical center. Prisoners, individuals <18 years of age, traumatic injuries, infection, and revision surgeries were excluded from the study. Medical charts were reviewed for patient address, demographics, medical comorbidities, procedure information, and subsequent hospital visits. Patients were grouped according to their state level ADI with 1-3 being low, 4-6 being moderate, and 7-10 being high. The study cohorts were compared using Pearson's Chi-squared test and Fischer's exact test. The Kruskal-Wallis H Test was used to evaluate non-parametric, continuous values. This study is IRB-approved by the institution of study.

RESULTS SECTION: A total of 215 patients fit the inclusion criteria for this study. Patients with higher ADIs were more likely to be female (p=0.009), Black/African American (p<0.001), have Medicaid as their primary insurance (p=0.041), be younger at the time of surgery (p=0.038), have cardiovascular disease (p=0.029), and be diagnosed with anxiety or depression (p=0.022) (**Table 1**). Additionally, patients with higher ADIs were more likely to present to the emergency department (ED) (p=0.006) and be readmitted to the hospital within 90 days following TKA (p=0.0014) (**Table 2**).

DISCUSSION: In patients undergoing TKA, higher levels of ADI are associated with increased rates of cardiovascular disease, higher rates of anxiety or depression, increased 90-day ED visits, and 90-day hospital readmissions. One study from Alvarez *et al* found that national level ADI was not a predictor of ED visits following TKA, however, a different study from found Khlopas *et al* ED visits to be substantially higher in individuals at the highest percentile of ADI.[4,5] The validity of social vulnerability indices and their ability to predict future hospital visits following TKA should be further investigated. Limitations of this study include the use of a single center with a skewed distribution of higher ADI scoring patients and the use of a state instead of national level measure of deprivation.

SIGNIFICANCE/CLINICAL RELEVANCE: Higher values of state-level ADI are associated with increased 90-day post-operative emergency department visits and 90-day hospital readmission rates following TKA and should be considered in operative planning.

REFERENCES:
1: Barrack RL, Ruh EL, Chen J, et al. Impact of socioeconomic factors on outcome of total knee arthroplasty. *Clin Orthop Relat Res*. 2014;472(1):86-97. 2: Alvarez, P.M., McKeon, J.F., Spitzer, A.I. *et al.* Socioeconomic factors affecting outcomes in total knee and hip arthroplasty: a systematic review on healthcare disparities. *Arthroplasty* 4, 36 (2022). 3: Kind AJH, Buckingham W. Making Neighborhood Disadvantage Metrics Accessible: The Neighborhood Atlas. *New England Journal of Medicine*, 2018. 378: 2456-2458. DOI: 10.1056/NEJMp1802313. University of Wisconsin School of Medicine Public Health. 2021 Area Deprivation Index. 4: Shaw JH, Wesemann LD, Ayoola AS, Les CM, Charters MA, North WT. Comparison of Area Deprivation Index, Socioeconomic Parameters, and Preoperative Demographics With Postoperative Emergency Department Visits After Total Knee Arthroplasty. *J Arthroplasty*. 2021;36(8):2788-2794. 5: Khlopas A, Grits D, Sax OC, et al. Neighborhood Socioeconomic Disadvantages Associated With Prolonged Lengths of Stay, Nonhome Discharges, and 90-Day Readmissions After Total Knee Arthroplasty. *J Arthroplasty*. 2022;37(6S):S37-S43.e1.

State ADI Decile	1-3, N = 39[1]	4-6, N = 103[1]	7-10, N = 83[1]	p-value[2]
Sex				0.009
Male	22 (56%)	30 (29%)	27 (33%)	
Female	17 (44%)	73 (71%)	55 (67%)	
Age at Surgery	32.5 ± 5.6	32.9 ± 4.7	33.1 ± 5.1	0.841
BMI	65.1 ± 10.9	65.3 ± 8.7	62.6 ± 8.1	0.038
Race/Ethnicity				<0.001
White/Caucasian	10 (26%)	9 (8.7%)	5 (6.1%)	
Black/African American	13 (33%)	50 (49%)	54 (66%)	
Hispanic/Latinx	12 (31%)	40 (39%)	21 (26%)	
Asian	4 (10%)	1 (1.0%)	0 (0%)	
Other	0 (0%)	3 (2.9%)	2 (2.4%)	
Insurance type				0.041
Medicare	17 (44%)	53 (51%)	33 (42%)	
Medicaid	8 (21%)	31 (30%)	35 (44%)	
Private/Commercial	11 (28%)	13 (13%)	10 (13%)	
Workers Comp	2 (5.1%)	5 (4.9%)	1 (1.3%)	
Other	1 (2.6%)	1 (1.0%)	0 (0%)	
Cardiovascular Disease	3 (7.7%)	15 (15%)	13 (16%)	**0.029**
Chronic Obstructive Pulmonary Disease	0 (0%)	6 (5.9%)	7 (8.4%)	0.179
Diabetes Mellitus	10 (26%)	36 (35%)	39 (47%)	0.055
History of Anxiety or Depression	2 (5.1%)	27 (26%)	18 (22%)	**0.022**
Smoking Status				0.704
Active	3 (7.7%)	15 (15%)	13 (16%)	
Former	14 (36%)	34 (33%)	23 (28%)	
Never	22 (56%)	54 (52%)	47 (57%)	

[1] n (%) Mean ± SD
[2] Pearson's Chi-Squared Test; Fisher's Exact Test; Kruskal-Wallis Rank Sum Test

Table 1: Demographic factors of TKA patients grouped by ADI.

State ADI Decile	1-3, N = 39[1]	4-6, N = 103[1]	7-10, N = 83[1]	p-value[2]
Reason for Surgery				0.121
Osteoarthritis	37 (95%)	102 (99%)	80 (%)	
Rheumatoid Arthritis	2 (5.1%)	0 (0%)	1 (1.2%)	
Other	0 (0%)	1 (1.0%)	2 (2.4%)	
Laterality				0.365
Left	21 (54%)	49 (48%)	43 (52%)	
Right	17 (4%)	54 (52%)	40 (48%)	
Bilateral	1 (2.6%)	0 (0%)	0 (0%)	
Surgery Cancelled / Postponed	1 (2.6%)	9 (8.7%)	10 (12%)	0.221
Patient Readmitted Within 90 Days	0 (0%)	18 (17%)	16 (19%)	**0.014**
ED Visit Within 90 Days	4 (10%)	34 (33%)	32 (39%)	**0.006**
Additional / Revision Surgery <1 Year	1 (2.6%)	7 (6.8%)	9 (11%)	0.275
Discharge Disposition				0.099
Home With Home Care	11 (28%)	42 (41%)	30 (36%)	
Home Without Home Care	19 (49%)	39 (38%)	45 (54%)	
Institutional Rehab Facility	1 (2.6%)	4 (3.9%)	1 (1.2%)	
Skilled Nursing Facility	8 (21%)	18 (17%)	6 (7.2%)	
Other	0 (0%)	0 (0%)	1 (1.2%)	

[1] n (%) Mean ± SD
[2] Pearson's Chi-Squared Test; Fisher's Exact Test; Kruskal-Wallis Rank Sum Test

Table 2: Perioperative information of TKA patients grouped by ADI