Hip Arthroscopy Patients from Neighborhoods with Greater Socioeconomic Disadvantage Experience Worse Healthcare Accessibility and Inferior Long-Term Functional Outcomes: Minimum 8-Year Follow-up

Jonathan Lee, Stephen Gillinov, Bilal Sohail Siddiq, Kieran Dowley, Rohit Reddy Rachala[1], Nathan J Cherian, Jeffrey Mun, Srish Sritacharan Chenna[1], Scott David Martin
[1]Department of Orthopaedic Surgery, Massachusetts General Hospital, Boston, MA, USA

INTRODUCTION:
A growing area of interest in orthopaedic surgery is the relationship between social determinants of health (SDOH) and post-operative outcomes. Past population health investigations support that neighborhood-level disparities may portend average life expectancies that differ by 20 to 30 years in adjacent communities, leading health equity researchers to suggest that a patient's ZIP code may matter more than their genetic code. In efforts to better quantify a patient's health risk and optimize post-operative recovery, past literature has encouraged the use of the Area Deprivation Index (ADI), a validated tool that calculates neighborhood-level socioeconomic disadvantage. As such, the ADI may help identify neighborhoods that lack resources (e.g. medical services, recreational facilities, or grocery stores) that play a key role in improving overall health and post-operative recovery. This deeper understanding can inspire equitable clinical guidelines along with health policies that mitigate the disparities that disadvantaged patients face. The purpose of the present study was to investigate the effects of neighborhood-level socioeconomic disadvantage on healthcare accessibility and long-term functional outcomes for patients undergoing hip arthroscopy.
METHODS: This retrospective study queried patients with minimum 8-year follow-up who underwent hip arthroscopy for the treatment of symptomatic labral tears secondary to FAI. Included patients were ≥18 years old, underwent primary hip arthroscopy for symptomatic labral tears, had complete patient-reported outcome measures (PROMs) at minimum 8-year follow-up, and resided in the United States. The ADI scores of all included patients were normalized to a relative mean percentile of 50%, and the study population was stratified into quartiles: (Q1) 1-25th, (Q2) 26-50th, (Q3) 51-75th, and (Q4) 75-100th percentiles. Patients in Q1 and Q4 represented the ADI_{Low} (least disadvantaged) and ADI_{High} (most disadvantaged) cohorts, respectively. Patients in Q2 and Q3 were excluded from further analyses. The primary outcomes were the modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NAHS), Hip Outcome Score (HOS)–Activities of Daily Living (HOS-ADL), HOS–Sports Specific subscale (HOS-SSS), and 33-item International Hip Outcome Tool (iHOT-33). Secondary outcomes included long-term survivorship measured by conversion to total hip arthroplasty (THA), revision hip arthroscopy, pain levels, rates of achieving the patient acceptable symptom state (PASS) for PROMs, and patient satisfaction.
RESULTS: There was a total of 43 patients in both the ADI_{Low} and ADI_{High} cohorts. The only difference in baseline demographics between ADI cohorts was patient sex, with fewer females in the ADI_{Low} group (41.9% vs 67.4% female; P=0.017) (Table 1). ADI_{High} patients experienced significantly worse healthcare accessibility (Table 2). When comparing minimum 8-year post-operative PROM scores, ADI_{Low} patients reported significantly higher scores for all PROMs except for HOS-SSS (77.9±24.7 vs 72.6±28.9; P=0.371). Both cohorts underwent similarly low rates of revision hip arthroscopy rate (ADI_{High}: 3 [7.0%] vs. ADI_{Low}: 2 [3.7%]; P=0.645). Despite ADI_{High} having significantly worse PROMs, both cohorts converted to THA at a statistically similar rate (ADI_{High}: 5 [11.6%] vs. ADI_{Low}: 9 [20.9%]; P=0.243). By logistic regression, ADI_{High} patients had a significantly reduced odds of achieving PASS for mHHS (ADI_{High} vs. ADI_{Low}, OR: 0.09; 95% CI, 0.01-0.51; P=0.007) and HOS-ADL (ADI_{High} vs. ADI_{Low}, OR: 0.10; 95% CI, 0.01-0.66; P=0.018) (Table 4).
DISCUSSION AND CONCLUSION: In the present study, ADI_{High} patients were nearly 11.4 and 10.4 times less likely to achieve 10-year PASS for mHHS and HOS-ADL, respectively. A significantly greater proportion of ADI_{High} patients resided in rural communities, primary care HPSAs, MUA/Ps, and counties with a greater rural population. At a patient level, the ADI_{High} cohort had lower levels of insurance coverage, education, and household income. This investigation established that hip arthroscopy patients from neighborhoods with greater socioeconomic disadvantage experience worse healthcare accessibility and inferior long-term functional outcomes. While it is important that orthopaedic surgeons understand the consequential effects of SDOH on long-term musculoskeletal health, these findings have far greater implications. Orthopaedic surgeons nationwide must collaborate with patients, hospital systems, and local/state governments to reform healthcare policies that have contributed to these disparities.

Table 1: Baseline Demographics

	$ADI_{≤66}$ (n=43)	$ADI_{≥86}$ (n=43)	P-value
Area Deprivation Index (ADI)	4.0 ± 2.1	37.7 ± 12.1	**<0.001**
Length of follow-up, years	10.9 ± 2.4	11.3 ± 2.6	0.470
Age, y	39.9 ± 12.5	36.0 ± 10.6	0.123
BMI, kg/m^2	25.1 ± 3.5	26.1 ± 3.9	0.214
Sex, n (%)			**0.017**
Male	25 (58.1%)	14 (32.6%)	
Female	18 (41.9%)	29 (67.4%)	
Labral treatment, n (%)			0.514
Repair	20 (46.5%)	17 (39.5%)	
Debridement	23 (53.5%)	26 (60.5%)	
Chondral treatment, n (%)			0.366
Microfracture	5 (11.6%)	8 (18.6%)	
None	38 (88.4%)	35 (81.4%)	
LCEa, degrees	35.9 ± 7.0	35.2 ± 6.0	0.633
Alpha angle, degrees	57.8 ± 17.9	53.9 ± 18.8	0.336
Tönnis Grade, n (%)			0.802
0	32 (74.4%)	33 (76.7%)	
1	11 (25.6%)	10 (23.3%)	
Laterality, n (%)			0.829
Left	20 (53.5%)	19 (44.2%)	
Right	23 (46.5%)	24 (55.8%)	

*Data are reported as mean ± standard deviation or No. of patients (%). Boldface denotes statistical significance (P<0.05).
Abbreviations: ADI, Area Deprivation Index; BMI, body mass index; LCEa, lateral center-edge angle.

Table 2: Healthcare Accessibility and Socioeconomic Demographics

	$ADI_{≤66}$ (n=43)	$ADI_{≥86}$ (n=43)	P-value
Area Deprivation Index (ADI)	4.0 ± 2.1	37.7 ± 12.1	**<0.001**
Rural-Urban Commuting Area (RUCA), n (%)			**0.023**
Metropolitan area: core	42 (97.7%)	32 (74.4%)	
Metropolitan area: high commuting	0 (0%)	3 (7.0%)	
Micropolitan	0 (0%)	4 (9.3%)	
Small town	1 (2.3%)	1 (2.3%)	
Rural area	0 (0%)	3 (7.0%)	
Rural, n (%)			**0.026**
Yes	1 (2.3%)	7 (16.3%)	
No	42 (96.7%)	36 (83.7%)	
Primary Care Health Professional Shortage Area (HPSA), n (%)			**0.024**
Yes	2 (4.6%)	9 (20.9%)	
No	41 (95.4%)	34 (79.1%)	
Medically Underserved Area/Population (MUA/P), n (%)			**0.019**
Yes	3 (7.0%)	11 (25.6%)	
No	40 (93.0%)	32 (74.4%)	
County-level Rurality, %	3.8 ± 4.0	22.2 ± 22.5	**<0.001**
Insurance, n (%)			**0.035**
Private	35 (81.4%)	24 (55.8%)	
Medicare, Medicaid, or MassHealth	3 (7.0%)	9 (20.9%)	
Unknown/Prefer not to Answer	5 (11.6%)	10 (23.3%)	
Education, n (%)			**0.002**
≥ Graduate degree	27 (62.8%)	10 (23.3%)	
College degree	12 (27.9%)	19 (44.2%)	
High School diploma	4 (9.3%)	12 (27.9%)	
Unknown/Prefer not to Answer	0 (0%)	2 (4.7%)	
Family Income, n (%)			**0.002**
≥ $250,000	12 (27.9%)	0 (0%)	
$150,000 – $249,999	7 (16.3%)	5 (11.6%)	
$100,000 – $149,999	10 (23.3%)	9 (20.9%)	
$50,000 – $99,999	6 (13.9%)	12 (27.9%)	
< $50,000	8 (18.6%)	14 (32.6%)	
Unknown/Prefer not to Answer	0 (0%)	3 (7.0%)	

*Data are reported as mean ± standard deviation or No. of patients (%). Boldface denotes statistical significance (P<0.05).
Abbreviations: ADI, Area Deprivation Index.

Table 3: PROMs and Rate of Conversion to THA

	$ADI_{≤66}$ (n=43)	$ADI_{≥86}$ (n=43)	P-value
PROMs			
mHHS	90.1 ± 13.9	79.3 ± 14.6	**0.008**
NAHS	87.5 ± 15.3	80.7 ± 14.9	**0.043**
HOS-ADL	91.6 ± 11.8	84.7 ± 14.8	**0.020**
HOS-SSS	77.9 ± 24.7	72.6 ± 28.9	0.371
iHOT-33	78.2 ± 24.2	66.8 ± 26.0	**0.041**
Revision Hip Arthroscopy			
Revision Hip Arthroscopy, n (%)	2 (4.7%)	3 (7.0%)	0.645
Time to Revision, years	5.5 ± 3.6	7.0 ± 5.4	0.759
Age at Revision, years	40.0 ± 12.5	36.1 ± 10.6	0.126
Conversion to THA			
Conversion to THA, n (%)	9 (20.9%)	5 (11.6%)	0.243
Time to THA, years	4.1 ± 5.3	8.5 ± 4.2	0.137
Age at conversion to THA, years	55.8 ± 7.2	57.6 ± 6.9	0.655

*Data are reported as mean ± standard deviation or No. of patients (%). Boldface denotes statistical significance (P<0.05).
Abbreviations: ADI, Area Deprivation Index; mHHS, modified Harris Hip Score; NAHS, Nonarthritic Hip Score; LEFS, Lower Extremity Functional Scale; HOS-ADL, Hip Outcome Score-Activities of Daily Living; HOS-SSS, Hip Outcome Score-Sports Specific Subscale; iHOT-33, 33-item International Hip Outcome Tool; THA, total hip arthroplasty.

Table 4: Multivariate Logistic Regression of PASS Achievement

	mHHS		HOS-ADL		HOS-SSS	
	Odds Ratio (95% CI)	P-value	Odds Ratio (95% CI)	P-value	Odds Ratio (95% CI)	P-value
$ADI_{≥86}$ (vs. $ADI_{≤66}$)	**0.09 (0.01-0.51)**	**0.007**	**0.10 (0.01-0.66)**	**0.018**	0.37 (0.07-1.81)	0.217
Female Sex (vs. Male)	1.75 (0.30-7.65)	0.471	0.15 (0.02-1.18)	0.072	0.37 (0.07-2.00)	0.245
Age, per 1-year increase	1.00 (0.93-1.08)	0.910	**0.88 (0.05-0.98)**	**0.015**	0.92 (0.85-1.00)	0.052
Tönnis grade, per 1-unit increase	1.72 (0.31-9.44)	0.528	0.23 (0.03-1.62)	0.138	0.60 (0.11-3.17)	0.550
Repair (vs. Debridement)	8.54 (0.10-2.82)	0.461	0.53 (0.07-3.72)	0.519	0.54 (0.09-3.23)	0.501

*Boldface denotes statistical significance (P<0.05). Abbreviations: PASS, Patient Acceptable Symptom State; ADI, Area Deprivation Index; mHHS, modified Harris Hip Score; HOS-ADL, Hip Outcome Score-Activities of Daily Living; HOS-SSS, Hip Outcome Score-Sports Specific Subscale