Social Determinants of Health Negatively Impact Patient Reported Outcomes in Shoulder Arthroplasty

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INTRODUCTION: Socioeconomic factors significantly impact a patient's ability to access health care resources and ultimately can alter a patient's outcome after surgery. Recent literature has begun to highlight the influential role Social Determinants of Health (SDOH) factor into outcomes after orthopaedic surgeries. However, the impact of SDOH on patient reported outcomes and postoperative resource utilization in shoulder arthroplasty (SA) patients have yet to be fully elucidated. The purpose of this study is to investigate the role of SDOH on Patient-Reported Outcomes Measurement Information System (PROMIS) Computer Adaptive Test (CAT) outcomes and postoperative resource utilization in SA patients.

METHODS: All patients who underwent SA by 3 fellowship-trained orthopedic surgeons in one health system between July 2017 and April 2020 were included. SDOH metrics, including Area Deprivation Index (ADI) and Median Household Income (MHI), were identified from the electronic medical records. PROMIS scores for Upper Extremity ("PROMIS UE"), Pain Interference ("PROMIS PI"), and Depression ("PROMIS D") were completed pre- and postoperatively with a mean follow-up of 16.3 months (496 days). Postoperative health care utilization (clinical visits, virtual encounters, imaging encounters and physical therapy visits) were recorded, as well. Independent two-group t-tests and Wilcoxon rank-sum tests were used to analyze mean differences between patient groups based on SDOH.

RESULTS:
One-hundred-and-twenty patients (49.2% male) who underwent either anatomic (28, 23.3%), reverse TSA (89, 74.2%), or hemiarthroplasty (3, 2.5%) were included, with a mean age of 69.8 ± 10.2 years, BMI of 30.1 ± 6.1 kg/m^2, ADI of 51.4 ± 26.5, and MHI quartile of $58,102 - $80,095. MHI quartiles and ADI quartiles were not significantly associated with postoperative PROMIS scores. Patients who were Black reported significantly lower PROMIS UE (31.3 ± 9.1 vs. 40.5 ± 8.3, p<0.001) and PI scores approaching significance (p=0.057) at 1 year compared to White patients. Females had significantly lower PROMIS UE scores at 6 months (34.8 ± 7.9 vs. 39.2 ± 7.5, p=0.01) and 1 year (35.9 ± 9.2 vs. 40.2 ± 9.3, p=0.04) as well as higher Depression scores (48.2 ± 9.3 vs. 42.8 ± 9.8, p=0.01) compared to Males. Patients in the lowest MHI Quartile attended significantly fewer postoperative office visits (3.0 ± 1.3 vs. 4.7 ± 1.9, p=0.03) and had less postoperative imaging (3.1 ± 1.8 versus 4.8 ± 1.8, p=0.046) compared to patients in the highest quartile. No significant associations were found between SDOH and postoperative virtual encounters. Black race (p<0.001) and lowest MHI quartile (p<0.001) were significantly associated with higher ADI. Black patients had a significantly higher representation in the lowest MHI quartile (90.0% vs 10.0%, p<0.001) and higher Area Deprivation Index (ADI) scores (67.4 vs 46.1, p<0.001) when compared to White patients.

DISCUSSION AND CONCLUSION: Socioeconomic determinants of health, such as Black race and Female sex were significantly associated with worse postoperative PROMIS scores at 1 year after surgery. Patients who were Black were more often represented in the lowest MHI and had higher ADI. The lowest MHI was found to have the fewest postoperative visits and less postoperative imaging in comparison to the highest MHI. Race and gender, regardless of location or income, was associated with worse outcomes after SA and fewer postoperative visits. These results highlight the need for further research to investigate the cause of disparities in outcomes and develop initiatives to provide equitable care for all patients undergoing shoulder arthroplasty.

Table 1. Patient Descriptive Social Determinants of Health Characteristics (N = 120)

Variable	Value
Age, mean ± SD (range), y	69.8 ± 10.2 (23.0-90.0)
BMI, mean ± SD (range), kg/m²	30.1 ± 6.4 (16.8-50.8)
MHI Q1 ($21k-46k)	10 (8.3)
MHI Q2 ($46k-58k)	24 (20.0)
MHI Q3 ($58k-80k)	32 (26.7)
MHI Q4 ($80-157k)	54 (45.0)
ADI, mean ± SD (range)	51.4 ± 26.5 (7.0-100.0)
ADI Q1 (76-100)	29 (24.2)
ADI Q2 (51-75)	25 (20.8)
ADI Q3 (26-50)	41 (34.2)
ADI Q4 (1-25)	24 (20.0)
Sex	
Male	59 (49.2)
Female	61 (50.8)
Race	
White	91 (75.8)
Black	26 (21.7)
Asian	1 (0.8)
Arab American	2 (1.7)
Ethnicity	
Hispanic or Latino	0 (0.0)
Non-Hispanic or Latino	120 (100.0)
Employment Status	
Employed	22 (18.3)
Unemployed	8 (6.7)
Retired	46 (38.3)
Unknown	44 (36.7)
Insurance Status	
Private/Commercial Health Insurance	50 (41.7)
Public Healthcare Coverage	67 (55.8)
None	1 (0.8)
Unknown	44 (36.7)
Marriage Status	
Single	12 (10.0)
Married	86 (71.7)
Divorced	10 (8.3)
Widowed	11 (9.2)
Unknown	2 (1.7)
Tobacco Use	
Current Smoker	8 (6.7)
Never Smoker	48 (40.0)
Former Smoker	61 (50.8)
Unknown	3 (2.5)

Values are expressed as n (%) unless otherwise indicated.
ADI, Area Deprivation Index; BMI, body mass index; MHI, median household income; SDOH, Social Determinants of Health; Q, Quartile.

Table 2. PROMIS Scores Stratified by Race

	Race	N	Mean	Std. Dev.	95% Confidence Interval for Mean Lower Bound	Upper Bound	Min	Max	P-Value
Preop PROMIS-UE	White	91	29.86	6.45	28.51	31.20	14.70	49.60	
	Black	26	26.71	4.70	24.81	28.61	14.70	36.10	
	Asian	1	18.50	-	-	-	18.50	18.50	
	Arab American	2	24.30	13.15	-93.86	142.46	15.00	33.60	
	Total	120	28.99	6.37	27.84	30.14	14.70	49.60	.03*
Preop PROMIS-PI	White	91	62.49	5.33	61.38	63.60	47.00	77.80	
	Black	26	66.40	3.75	64.88	67.92	60.00	74.00	
	Asian	1	74.10	-	-	-	74.10	74.10	
	Arab American	2	65.60	1.97	47.81	83.38	64.20	67.00	
	Total	120	63.49	5.30	62.53	64.44	47.00	77.80	.001*
Preop PROMIS-D	White	91	48.23	8.68	46.42	50.04	34.00	67.50	
	Black	26	50.09	8.13	46.81	53.38	34.20	65.70	
	Asian	1	71.40	-	-	-	71.40	71.40	
	Arab American	2	39.85	8.27	-34.48	114.18	34.00	45.70	
	Total	120	48.69	8.81	47.09	50.28	34.00	71.40	.021*
6 months PROMIS-UE	White	80	37.38	7.02	35.82	38.94	20.30	51.90	
	Black	17	34.61	10.40	29.26	39.96	15.00	51.20	
	Asian	1	27.10	-	-	-	27.10	27.10	
	Arab American	2	38.25	22.98	-168.22	244.72	22.00	54.50	
	Total	100	36.93	7.95	35.35	38.50	15.00	54.50	.631
6 Months PROMIS-PI	White	80	53.73	8.79	51.77	55.69	38.70	70.50	
	Black	17	57.33	10.95	51.70	62.96	38.70	72.00	
	Asian	1	38.70	-	-	-	38.70	38.70	
	Arab American	2	52.35	19.30	-121.08	225.78	38.70	66.00	
	Total	100	54.16	9.44	52.29	56.04	38.70	72.00	.184
6 Months PROMIS-D	White	80	44.09	8.61	42.17	46.01	34.00	62.20	
	Black	17	44.91	8.49	40.55	49.28	34.20	56.10	
	Asian	1	38.90	-	-	-	38.90	38.90	
	Arab American	2	34.10	.14	32.82	35.37	34.00	34.20	
	Total	100	43.98	8.56	42.28	45.68	34.00	62.20	.361
1 Year PROMIS-UE	White	63	40.50	8.30	38.41	42.59	26.00	61.00	
	Black	19	31.30	9.04	26.93	35.66	15.00	46.50	
	Asian	0							
	Arab American	1	22.00	-	-	-	22.00	22.00	
	Total	83	38.17	9.40	36.12	40.22	15.00	61.00	<.001*
1 Year PROMIS-PI	White	63	50.28	9.71	47.84	52.73	38.70	72.10	
	Black	19	56.09	11.77	50.42	61.76	38.70	72.00	.057

PROMIS, Patient-Reported Outcomes Measurement Information System; UE, upper extremity; PI, pain interference; D, depression. * indicates statistical significance

Table 3. PROMIS Scores Stratified by Gender

	Sex	N	Mean	Std. Dev	P-Value
Preop PROMIS-UE	male	59	31.27	6.62	<.001*
	female	61	26.78	5.28	
Preop PROMIS-PI	male	59	62.01	5.02	.002*
	female	61	64.91	5.21	
Preop PROMIS-D	male	59	47.94	7.55	.362
	female	61	49.41	9.89	
6 months PROMIS-UE	male	48	39.21	7.45	.005*
	female	52	34.81	7.88	
6 Months PROMIS-PI	male	48	53.45	8.56	.472
	female	52	54.82	10.23	
6 Months PROMIS-D	male	48	42.47	8.40	.091
	female	52	45.37	8.55	
1 Year PROMIS-UE	male	44	40.18	9.25	.038*
	female	39	35.90	9.15	
1 Year PROMIS-PI	male	44	50.04	10.15	.111
	female	39	53.71	10.56	
1 Year PROMIS-D	male	44	42.80	9.82	.013*
	female	38	48.19	9.33	

PROMIS, Patient-Reported Outcomes Measurement Information System; UE, upper extremity; PI, pain interference; D, depression; Std dev, standard deviation. * indicates statistical significance