Original Article

Social and Demographic Factors Impact Shoulder Stabilization Surgery in Anterior Glenohumeral Instability

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Purpose: To assess independent predictors of surgery after an emergency department visit for shoulder instability, including patient-related and socioeconomic factors. **Methods:** Patients presenting to the emergency department were identified in the New York Statewide Planning and Research Cooperative System database from 2015 to 2018 by *International Classification of Diseases, Tenth Revision, Clinical Modification* diagnosis codes for anterior shoulder dislocation or subluxation. All shoulder stabilization procedures in the outpatient setting were identified using Current Procedural Terminology codes (23455, 23460, 23462, 23466, and 29806). A multivariable logistic regression was performed to assess the impact of patient factors on the likelihood of receiving surgery. The variables included in the analysis were age, sex, race, social deprivation, Charlson Comorbidity Index, recurrent dislocation, and primary insurance type. **Results:** In total, 16,721 patients with a shoulder instability diagnosis were included in the analysis and 1,028 (6.1%) went on to have surgery. Patients <18 years old (odds ratio [OR] 8.607, $P < .0001$), those with recurrent dislocations (OR 2.606, $P < .0001$), or worker's compensation relative to private insurance (OR 1.318, $P = .0492$) had increased odds of receiving surgery. Hispanic (OR 0.711, $P = .003$) and African American (OR 0.63, $P < .0001$) patients had decreased odds of surgery compared with White patients. Patients with Medicaid (OR 0.582, $P < .0001$) or self-pay (OR 0.352, $P < .0001$) insurance had decreased odds of undergoing surgery relative to privately insured patients. Patients with greater levels of social deprivation (OR 0.993, $P < .0001$) also were associated with decreased odds of surgery. **Conclusions:** Anterior glenohumeral instability and subsequent stabilization surgery is associated with disparities among patient race, primary insurance, and social deprivation. **Clinical Relevance:** Considering the relationship between differential care and health disparities, it is critical to define and increase physician awareness of these disparities to help ensure equitable care.

Glenohumeral instability is problematic in the general population, with an estimated 23.9 dislocations per 100,000 person-years presenting to the emergency department.[1] The true rate of shoulder instability is likely greater, given that subluxations are likely under-reported.[2,3] Acute, traumatic shoulder instability is most common among young, male patients who are highly active.[2-4] These patients also make up the population at greatest risk for recurrent instability,[2-7] where open or arthroscopic surgery often is indicated.[8] Early surgical stabilization is important in these patients, as operative management has been shown to reduce the risk of future instability episodes and further bony and soft-tissue injury.[9-11]

Only about 50% of patients are seen by an orthopaedist after visiting the emergency department for a shoulder dislocation, which may be due to a variety of reasons.[12] Without appropriate follow-up and assessment, these patients may be at risk for recurrent instability. Patients at risk for recurrent instability events may not be identified or treated operatively for several reasons. Factors such as socioeconomic disparities, including a patient's insurance, race and ethnicity,

income level, housing, and other social determinants of health, may be a barrier to accessing orthopaedic care for these patients.[13-16] Although it is well-known that social disparities exist in the realm of medical care, there is no current evidence examining how these factors may impact the ability to obtain timely follow up with an orthopaedist after a shoulder instability event[13-16] and thus a patient's opportunity to receive shoulder stabilization surgery.

The purpose of this study was to assess independent predictors of surgery after an emergency department visit for shoulder instability, including patient-related and socioeconomic factors. We hypothesized that patients who were younger, privately insured, and living in areas with greater social support would be more likely to undergo surgical stabilization.

Methods

Patients were identified in the New York Statewide Planning and Research Cooperative System (SPARCS) database from 2015 to 2018. SPARCS is a comprehensive all-payer database collecting outpatient (emergency department, ambulatory surgery, and hospital-based clinic visits) and all inpatient claims in New York. This includes *International Classification of Diseases* (ICD) diagnosis codes and ICD/Current Procedural Terminology (CPT) procedure codes associated with visits. Institutional review board approval was not required for this retrospective, database study.

Patients presenting to the emergency department were identified using the ICD-Tenth Revision (10)-Clinical Modification diagnostic codes. The initial cohort of patients was first identified by ICD-10 codes S43.001−S3.086 (shoulder dislocation or subluxation), S43.301−S43.306 (unspecified shoulder girdle dislocation), M24.311−M24.319 (pathologic shoulder dislocation), M24.411−M24.419 (recurrent shoulder dislocation), and M25.311−M25.319 (other shoulder instability). Patients with posterior shoulder dislocations or humeral fracture diagnosis codes were removed from the analysis to ensure a homogenous population of patients. Only a patient's first shoulder dislocation that was encountered in the emergency department was included and the first date of diagnosis for each patient was captured. Diagnoses after the start date of the study were omitted due to the ICD coding change. Diagnoses after September 2018 were omitted to allow a minimum of 3 months' follow-up for all patients included in the analysis. Owing to SPARCS deidentification policy, the date of service is listed as the first day of the month. Therefore, if surgery occurred in the same month as the diagnosis, the time to surgery would be noted as 0 months.[17]

All shoulder stabilization procedures in the outpatient setting were identified using CPT codes 23455 (open Bankart repair), 23460 (capsulorrhaphy with bone block), 23462 (Latarjet procedure), 23466 (capsulorrhaphy for multidirectional instability), and 29806 (arthroscopic Bankart repair). Using a unique identifier for each patient, the diagnosis data were linked to procedure data to determine which patients went on to have shoulder stabilization surgery after the initial diagnosis. Social Deprivation Index (SDI) was linked to each patient based upon their ZIP code.[18] This index provides a measure of the social determinants of health that may not be captured by health care administrative databases by converting the following categories to an index ranging from 1 to 100: percent living in poverty, percent with less than 12 years of education, percent single parent household, percent living in rented housing unit, percent living in overcrowded housing unit, percent of households without a car, and percent nonemployed adults younger than 65 years of age.[19] Greater SDI scores equate to increased social deprivation. SDI data used in the current study was based on 2015 statistics.[19]

Statistical Analysis

Patients were divided into cohorts based on whether they underwent surgery or did not undergo surgery. Patient demographics were compared between the surgery and no surgery cohorts using χ^2 analysis. Mann−Whitney U tests were used when appropriate when continuous data were found to be not normally distributed. A multivariable logistic regression was performed to assess the likelihood of receiving surgery after presenting to the emergency department with a shoulder instability event. The variables included in the analysis were patient age, sex, race, SDI, Charlson Comorbidity Index (CCI), primary insurance type, and recurrent instability. The CCI is the most highly used score to measure patient comorbidity and has been used previously in large healthcare databases.[20] An additional model was performed using the same predictor variables to assess if there were any disparities in those receiving arthroscopic stabilization (29806) versus all other procedures analyzed (23455, 23460, 23462, 23466). "Other" race is defined as all other races excluding White, Hispanic, Asian, and African American but includes multiracial patients. "Other" primary insurance is defined as all other insurance excluding Private, Medicare, Medicaid, Self-pay (i.e., uninsured), or Worker's Compensation. An example of "Other" insurance is Veteran Affairs. The CCI was calculated using the method described by Deyo et al.[21] and was extended to ICD-10 Clinical Modification. CCI was dichotomized to a score of 0 versus a score of ≥ 1. A $P \leq$ .05 was considered significant across all statistical analyses. All analyses were performed using SAS 9.4 (SAS Inc., Cary, NC).[22,23]

Table 1. Patient Demographics and Characteristics

	No Surgery n = 15,693	Surgery n = 1,028	P Value
Age, y, median, mean (SD)	36 (42.5, 21.9)	24 (28.3, 13.9)	<.0001
<18	1,285 (8.2)	259 (25.2)	<.0001
18-29	4,918 (31.3)	418 (40.7)	<.0001
30-39	2,250 (14.3)	170 (16.5)	0.0522
40-49	1,453 (9.3)	77 (7.5)	0.0567
>49	5,787 (36.9)	104 (10.1)	<.0001
Sex, n (%)			
Female	5,430 (34.6)	246 (23.9)	<.0001
Male	10,263 (65.4)	782 (76.1)	—
Race, n (%)			
White	8,401 (53.5)	642 (62.5)	<.0001
Hispanic	2,225 (14.2)	111 (10.8)	.0025
Asian	621 (4)	36 (3.5)	.4667
African American	2,829 (18)	138 (13.4)	.0002
Other	1,617 (10.3)	101 (9.8)	.6241
Primary insurance, n (%)			
Private	7,861 (50.1)	748 (72.8)	<.0001
Medicare	2,876 (18.3)	35 (3.4)	<.0001
Medicaid	2,272 (14.5)	123 (12)	.0259
Worker's compensation	710 (4.5)	65 (6.3)	.0079
Self-pay	1,874 (11.9)	49 (4.8)	<.0001
Other	100 (0.6)	8 (0.8)	.5846
Charlson score, n (%)			
0	14,106 (89.9)	976 (94.9)	<.0001
≥1	1,587 (10.1)	52 (5.1)	—
SDI, median (mean, SD)	62 (57.7, 32.4)	43 (48.3, 32.5)	<.0001

SD, standard deviation; SDI, Social Deprivation Index.

Results

In total, 16,721 patients with a shoulder instability diagnosis were included in the analysis and 1,028 (6.1%) underwent surgical stabilization. The mean time to surgery after the initial diagnosis was 5.8 months, with a median of 3 months, and maximum of 36 months. Comparing demographic data between the surgical and nonsurgical groups we found that the nonoperative group was older and suffered greater social deprivation. The nonoperative group had increased incidence of female sex, Hispanic ethnicity, African American race, Medicare, Medicaid, or self-pay insurance status, and had CCI ≥1 (Table 1). In total, 83.7%

Table 2. Distribution of CPT Procedure Codes

Procedure Codes	Frequency	Percent
23455 − Open Bankart Repair	57	5.5
23460 − Capsulorraphy with Bone Block	5	0.5
23462 − Latarjet Procedure	93	9.1
23466 − Capsulorraphy for Multidirectional Instability	13	1.3
29806 − Arthroscopic Bankart Repair	860	83.7

CPT, Current Procedural Terminology.

Table 3. Multivariable Logistic Regression for the Likelihood of Receiving Shoulder Stabilization Surgery After Initial Diagnosis of Instability in the Emergency Department

	Rate of Surgery (6.1%)	Odds Ratio (95% CI)	P Value
Age			
<18*	16.8	8.607 (6.56-11.292)	<.0001
18-29*	7.8	3.911 (3.03-5.048)	<.0001
30-39*	7	3.807 (2.88-5.033)	<.0001
40-49*	5	2.498 (1.809-3.449)	<.0001
>49	1.8	—	—
Sex			
Male	7.1	—	—
Female†	4.3	0.982 (0.838-1.15)	.8221
Race			
White	7.1	—	—
Hispanic‡	4.8	0.711 (0.567-0.891)	.003
Asian‡	5.5	0.765 (0.535-1.095)	.1431
African American‡	4.7	0.63 (0.508-0.782)	<.0001
Other‡	5.9	0.829 (0.658-1.045)	.1121
Primary insurance			
Private	8.7	—	—
Medicare§	1.2	0.389 (0.263-0.576)	<.0001
Medicaid§	5.1	0.582 (0.475-0.714)	<.0001
Worker's compensation§	8.4	1.318 (1.001-1.736)	.0492
Self-pay§	2.6	0.352 (0.261-0.476)	<.0001
Other§	7.4	0.88 (0.42-1.844)	.7356
Instability status			
Primary instability	5	—	—
Recurrent instability‖	13	2.606 (2.248-3.022)	<.0001
Charlson Score			
CCI = 0	6.5	—	—
CCI ≥1¶	3.2	1.075 (0.795-1.454)	.6382
SDI	—	0.993 (0.991-0.996)	<.0001

CCI, Charlson Comorbidity Index; CI, confidence interval; SDI, Social Deprivation Index.

*Compared with >49.
†Compared with males.
‡Compared with White race.
§Ccompared with private insurance.
‖Compared with primary instability.
¶Compared with CCI = 0.

of procedures involved arthroscopic stabilization (CPT 29806) (Table 2).

Hispanic and African American patients had decreased odds of undergoing surgery relative to White patients. Patients with Medicare, Medicaid, or self-pay insurance status all had decreased odds of undergoing surgery relative to privately insured patients and a greater SDI was also associated with decreased odds of surgery (Table 3). African American patients had the greatest rate of experiencing a recurrent instability event before surgery at 18%, whereas White race had the lowest rate of preoperative recurrent instability at 12.8% (P < .0001) (Table 4).

A second multivariable logistic regression model was performed with the same variables to assess whether there were any disparities in those receiving

Table 4. Preoperative Rate of Recurrent Instability by Race and Insurance Type

Procedure Codes	Rate of Recurrent Instability	Percent of Total
Race		
White	12.8	48.5
Asian	13.2	3.7
African American	18	22.5
Hispanic	15.5	15.2
Other	14.1	10.2
Primary insurance		
Private	14.9	53.7
Medicaid	19.5	19.7
Medicare	9.9	12.1
Workers compensation	8	2.6
Self-pay	14.3	11.5
Other	10.2	0.5

Table 5. Multivariable Logistic Regression for the Likelihood of Arthroscopic Versus Open Stabilization

	Odds Ratio (95% CI)	*P* Value
Age, y		
<18*	1.914 (0.923-3.966)	.0809
18-29*	1.009 (0.523-1.947)	.9789
30-39*	0.601 (0.302-1.198)	.148
40-49*	0.616 (0.274-1.382)	.2395
>49	—	—
Sex		
Males	—	—
Females†	1.64 (1.058-2.54)	.0269
Race		
White	—	—
Hispanic‡	0.748 (0.425-1.316)	.3143
Asian‡	6.718 (0.897-50.3)	.0637
African American‡	0.693 (0.404-1.192)	.185
Other‡	0.984 (0.536-1.806)	.9595
Primary insurance		
Private	—	—
Medicare§	0.469 (0.194-1.135)	.0931
Medicaid§	0.52 (0.323-0.839)	.0073
Worker's compensation§	2.769 (1.071-7.159)	.0355
Self-pay§	1.207 (0.539-2.702)	.6481
Other§	NA	NA
Dislocation status		
No repeat dislocation	—	—
Repeat dislocation‖	0.565 (0.395-0.808)	.0017
Charlson score		
CCI = 0	—	—
CCI ≥1¶	1.895 (0.786-4.572)	.1547
SDI	1.004 (0.998-1.01)	.2433

CCI, Charlson Comorbidity Index; CI, confidence interval; NA, not analyzable; SDI, Social Deprivation Index.
*Compared with >49.
†Compared with males.
‡Compared with White race.
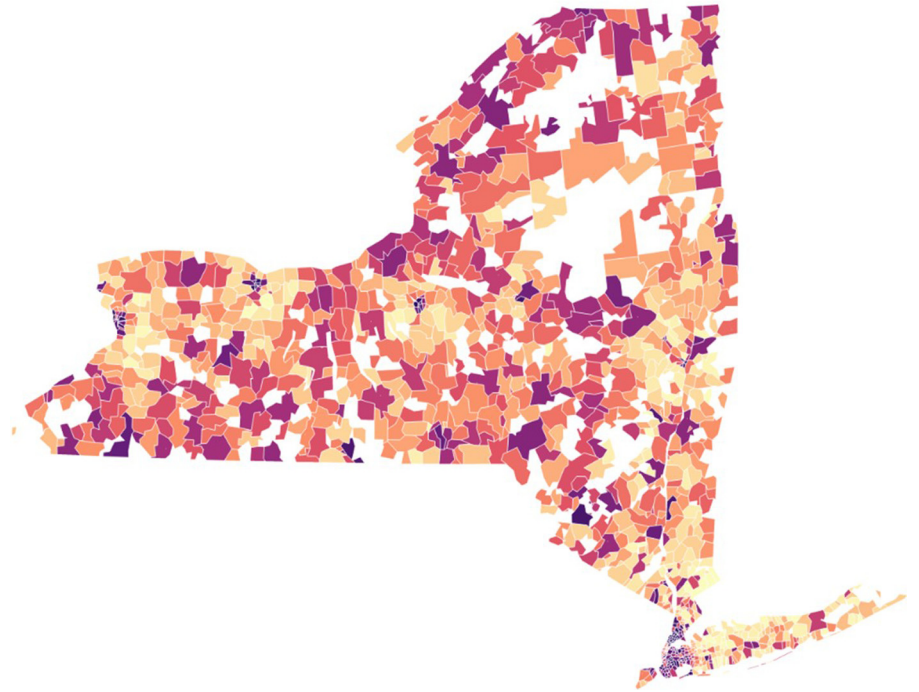§Compared with private insurance.
‖Compared with no repeat dislocation
¶Compared with CCI = 0.

arthroscopic stabilization (CPT 29806) versus all other procedures analyzed. Medicaid patients had lower odds of receiving arthroscopic surgery when compared with those with private insurance. Worker's compensation insurance status also was associated with greater odds of arthroscopic surgery compared to private insurance, as was female sex compared to male sex (Table 5).

Figure 1 illustrates how the SDI varies across New York Zip codes, with darker areas representing greater SDI. Figure 2 illustrates the rate of shoulder stabilization surgery by ZIP code. For example, western Long Island demonstrates greater SDI scores in Figure 1, with lower rates of shoulder stabilization surgery in Figure 2.

Discussion

The results of the current study demonstrate that minority patients, those who are uninsured, and those with greater degrees of social deprivation are less likely to receive operative intervention when presenting to the emergency department with an anterior glenohumeral instability event. In accordance with our hypothesis, younger patients and those from areas with less social deprivation had greater odds of receiving surgery following instability events. Patients with recurrent instability and worker's compensation insurance had increased odds of surgical intervention, whereas patients with public insurance or those of Hispanic ethnicity or African American race had decreased odds of receiving surgery following their instability event. Recognizing demographic differences in the surgical management of shoulder instability is important in improving high quality and equitable treatment in orthopaedic surgery.

This study demonstrated that the preoperative recurrent instability rate was greatest for African American patients (Table 4). Accordingly, the Multicenter Orthopaedic Outcomes Network (MOON) cohort found that a greater percentage of minority patients in the United States have recurrent shoulder instability events than White patients.[24,25] Our findings showed greater rates of recurrent instability events among minority patients, which may be due to disparities in follow-up and treatment of first-time shoulder dislocations. Ethnicity was also found to be related to undergoing surgical management in glenohumeral instability, as Hispanic patients had decreased odds of receiving surgery compared to White patients (Table 3). These disparate surgery rates have been documented for other upper extremity orthopaedic surgeries, such as total shoulder arthroplasty[26] and rotator cuff repair.[25] Previous research has shown that lack of access to insurance, as well as specific social factors that may be unique to minority patients, may contribute to disparate surgery rates.[27]

Differing views of surgery between different racial and ethnic groups may also contribute to disparate surgery rates. For example, Ang et al.[28] found that African American patients undergoing total joint arthroplasty perceived fewer benefits and greater risks

Fig 1. SDI by New York ZIP code. Darker-shaded areas represent greater social deprivation. (SDI, Social Deprivation Index.)

compared with White patients. Although we accounted for patient insurance and social deprivation index in our model, it is possible that factors such as language or cultural barriers may also play a role. The decision to undergo surgical intervention is not insignificant, and patient trust of the surgeon is of utmost importance.[29]
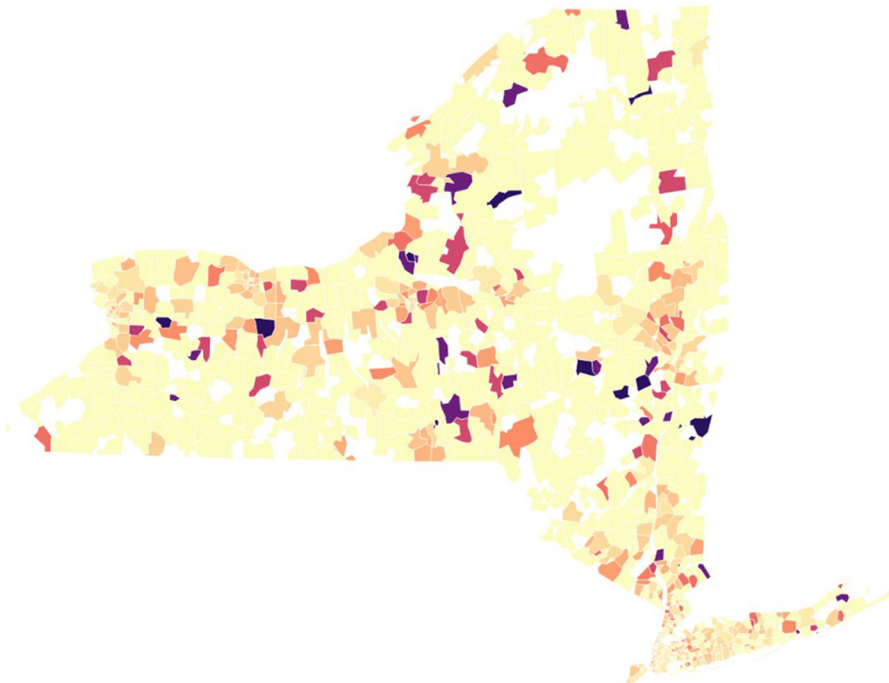

Fig 2. Rate of shoulder stabilization surgery after instability event by ZIP code. White ZIP codes had no shoulder dislocation cases during the study period. ZIP codes with a rate beyond 0.6 receive the darkest color.

This has been documented as an issue in a previous study where provider cultural sensitivity was an important factor in adherence to physician recommendations among Hispanic patients.[30] Further research into any variable decision-making between racial or ethnic groups remains an interesting area to investigate and would be useful to further delineate these relationships.

In addition to the aforementioned disparities found in the current study, patients with Medicaid or those who are self-pay also had decreased odds of undergoing shoulder stabilization surgery compared to those with private insurance (Table 3). Patients who are uninsured (i.e., self-pay) may have difficulty obtaining orthopaedic follow-up care and thus stabilization surgery after presenting to the emergency department with shoulder instability. This was found to be the case for patients with flexor tendon lacerations in a study performed by Draeger et. al,[31] and also in a pediatric orthopaedic population using a Medicaid program designed to enhance access to care for the underserved.[32] Furthermore, a review of pediatric and adolescent recurrent shoulder instability showed that privately insured patients were evaluated 5 times faster than publicly insured patients.[33] Interestingly, patients with Medicaid insurance had increased odds of undergoing an open or bony procedure in our study compared with privately insured patients (Table 5). This may be due to greater glenoid bone loss from recurrent instability events (Table 4), requiring bony transfer to adequately address the instability, although we were unable to determine the degree of bone loss from our data source. Moreover, worker's compensation and private insurance are understood to reimburse surgical fees at greater rates than public insurance, which may be a surgeon-related contributing factor to whether or not surgical intervention is pursued.

Our investigation also demonstrated that greater social deprivation was associated with decreased odds of undergoing surgical stabilization (Table 3). Based on our results, for every 10-point increase in SDI, there is a 7% decrease in the chance of undergoing surgical stabilization. Patients living in areas of greater social deprivation may face barriers to accessing orthopaedic care such as lack of transportation, inability to miss work for an appointment, or lack of social support at home. These patients may also be lost to follow-up because of poor patient education. Different patients have different values and a thorough discussion of these factors should occur between the patient and the orthopaedic surgeon.[34] Between 50% and 74% of patients follow up with orthopaedic surgeons after being evaluated in the emergency department.[35] This suggests patients lack understanding of the importance of follow up care.[5,34,36]

There are several potential avenues through which the disparities identified in this study may be addressed. There must be better identification of patients at risk of recurrent instability in the emergency department to ensure that the patients at greatest risk receive appropriate treatment. While those who are young and active are at risk for recurrent shoulder instability, the presence of bony Bankart and Hill—Sachs lesions are also risk factors for recurrent instability.[36] Importantly, these patients need to be educated on their high recurrence risk and need for orthopaedic subspecialty follow-up. While we were unable to track orthopaedic follow-up clinic visits, our results show that treatment beyond an initial evaluation has disparate rates among race and insurance status. This could be addressed via physician education as the widespread implementation of evidence-based implicit bias training among providers has been shown to mitigate treatment disparities.[37] In terms of socioeconomic disparities related to health insurance and health care access, the Affordable Care Act worked to improve access through its emphasis on integrated medical care and increased access to insurance.[34] However, there are still coverage gaps due to state-by-state implementation of the Affordable Care Act. Addressing access to care requires policy reform to potentially mitigate racial, ethnic, and socioeconomic disparities.

Limitations

Our study is not without limitations. Given the retrospective nature of this large database study, our results rely on the accuracy of medical coding as well as the accuracy of diagnosis in the emergency department. In addition, we were not able to control for more detailed demographic factors that are potential social determinants of health (i.e., cultural or language barriers etc.) Due to the limitations of the database, we could not account for injury specific factors such as pain level, degree of bone loss, or severity of symptoms as well as patient factors such as athletic or occupational demands which would be expected to influence surgical decision-making. The social deprivation index is also an approximate measure based on a patient's ZIP code, and there may be wide differences in living situations between individuals living in the same ZIP code. Also, the SDI data are from 2015, and thus may not fully capture the current social deprivation represented by our population. Our study only considered patients who are residents of New York, so the results cannot be generalized to other populations. Furthermore, there were a small number of patients overall captured in the surgical group, which may lead to selection bias. Coding issues with respect to laterality may also lead to unexpected inclusion of contralateral extremities, limiting the validity of the data to some degree. We were also unable to control for the timing of follow-up after the initial emergency department presentation.

Conclusions

Anterior glenohumeral instability and subsequent stabilization surgery is associated with disparities among patient race, primary insurance, and social deprivation.

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