The Consequences of Rurality on Body Mass Index and Surgical Outcomes in Patients Undergoing Total Joint Arthroplasty

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INTRODUCTION: Social determinants of health are an important contributing factor to outcomes for surgical patients. The prevalence of obesity, defined as a body mass index (BMI) of ≥30 kg/m2, has been increasing since the end of the 20th century in the United States. Obesity is heavily correlated with the risk of developing severe knee or hip osteoarthritis due to excessive and prolonged weight-bearing resulting in degeneration of hyaline cartilage in the joint. Rural populations are particularly vulnerable, with the prevalence of obesity being 6.2 times higher than for urban residents. Definitive treatment for severe osteoarthritis that has failed non-operative management is total joint arthroplasty (TJA). Our goal is to evaluate differences in demographics, body composition, and complication rates between rural and urban populations seeking primary total joint arthroplasty procedures. We hypothesized that rural patients receiving total hip and joint replacements have a higher average body mass index (BMI) and higher post-operative complication rates for periprosthetic joint infection and wound complications than urban patients.

METHODS: We performed a retrospective review of all patients who underwent TJA at the University of Iowa Hospitals and Clinics (UIHC) from 04/01/2014 to 04/01/2024. We analyzed their age, BMI, race, ethnicity, TJA procedure type and postoperative complications. Patients were designated as rural or urban by zip code, using the U.S. Census Bureau's definition of urbanity (area population density >5,000 or housing unit density >2,000). Only patients receiving primary total joint arthroplasty following a diagnosis of primary osteoarthritis were included in final analyses. Only the first qualifying procedure per patient within the study's time frame was included. Statistically significant differences between rural and urban patients were found using independent t-test and chi-square analysis. IRB approved conduction of the study.

RESULTS SECTION: We identified 5,093 total patients, with 3,425 patients living in urban areas, and 1,668 in rural areas. Preliminary statistical analysis demonstrated significant differences in BMI, sex, and race between groups. Women and non-white patients were more likely to come from urban zip codes. The average BMI of urban patients (32.4 kg/m2, SD= 6.8) was significantly lower than that of rural patients (33.5 kg/m2, SD=6.6), with a p-value <0.0001. Patients with a BMI of less than 30 kg/m2 seeking TJA were more likely to be from urban areas, while patients with a BMI from 30-40 kg/m2 were more likely to be from rural areas, with a p-value <0.0001. Post-operative complications did not vary significantly by geographic location. Patients receiving both hip and knee arthroplasty followed these trends.

DISCUSSION: Based on the literature review, this is the first comparative study of BMI and postoperative complication rates among rural and urban patients undergoing total joint arthroplasty in Iowa. Our findings confirm the national trend of higher obesity prevalence in rural populations. The overrepresentation of urban patients in lower BMI quintiles (BMI <30 kg/m2) indicates the capacity for this population to seek earlier care. Similarities in complication rates for both urban and rural patients indicate. that despite higher BMI in rural areas, modern perioperative care and optimization programs are capable of leveling risk between the groups. Further inquiry is necessary to determine whether complication rates differ between BMI groups or when patients are stratified by risk factors. Limitations of this study include implementing a single-center design, as well as the use of BMI as a metric for obesity.

SIGNIFICANCE/CLINICAL RELEVANCE: This work addresses a critical barrier to optimizing surgical outcomes by clarifying how rural-urban differences in obesity contribute to complications after TJA. By defining these disparities, our study emphasizes the need to increase patient awareness in rural areas regarding the morbidity of obesity related to osteoarthritis.

IMAGES AND TABLES:

Measure	Rural Residence		p-value
	No (n=3,425)	Yes (n=1,668)	
Age (years)	63.7(10.8)	63.4(10.1)	0.2307
Sex (n, % female)	1,954 (57.1%)	863 (51.7%)	0.0003
Race:			<0.0001
Declined	22 (0.64)	9 (0.54)	
White	3120 (91.09)	1624 (97.36)	
Native Hawaiian	2 (0.06)	2 (0.12)	
African American	181 (5.28)	6 (0.36)	
Hispanic	60 (1.75)	18 (1.08)	
Asian	27 (0.79)	1 (0.06)	
Multiracial	7 (0.20)	3 (0.18)	
American Indian	6 (0.18)	5 (0.30)	
Procedure:			0.5474
Hip Arthroplasty	1914 (55.9)	947 (56.8)	
Knee Arthroplasty	1511 (44.1)	721 (43.2)	

Measure	Rural Residence		p-value
	No (n=3,425)	Yes (n=1,668)	
BMI (kg/m^2)	32.4(6.8)	33.5(6.6)	<0.0001
BMI Group:			<0.0001
<18.5	14 (0.41%)	3 (0.18%)	
18.5 to < 25	447 (13.05%)	144 (8.63%)	
25 to < 30	950 (27.74%)	399 (23.9%)	
30 to < 40	1505 (43.94%)	841 (50.42%)	
GE 40	509 (14.86%)	281 (16.85%)	
Overweight (n, % >25)	2964 (86.5%)	1521 (91.2%)	<0.0001
Obese (n, % > 30)	2014 (58.8%)	1122 (67.3%)	<0.0001
Morbidly Obese (n, % >40)	509 (14.9%)	281 (16.9%)	0.0663
Superficial Complications	52 (1.5%)	26 (1.6%)	0.9120
PJI	42 (1.2%)	17 (1.0%)	0.5169