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Body Mass Index Class Is Independently Associated With Health-Related Quality of Life After Primary Total Hip Arthroplasty: An Institutional Registry-Based Study



Alexander S. McLawhorn, MD, MBA ^{a,*}, Michael E. Steinhaus, MD ^a,
Daniel L. Southren, MD ^b, Yuo-Yu Lee, MS ^c, Emily R. Dodwell, MD, MPH, FRCSC ^a,
Mark P. Figgie, MD, MBA ^a

^a Department of Orthopedic Surgery, Hospital for Special Surgery, New York, New York

^b Department of Surgery, University of Michigan, Ann Arbor, Michigan

^c Department of Epidemiology and Biostatistics, Hospital for Special Surgery, New York, New York

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ABSTRACT

Background: The purpose of this study was to compare the health-related quality of life (HRQoL) of patients across World Health Organization (WHO) body mass index (BMI) classes before and after total hip arthroplasty (THA).

Methods: Patients with end-stage hip osteoarthritis who received elective primary unilateral THA were identified through an institutional registry and categorized based on the World Health Organization BMI classification. Age, sex, laterality, year of surgery, and Charlson-Deyo comorbidity index were recorded. The primary outcome was the EQ-5D-3L index and visual analog scale (EQ-VAS) scores at 2 years postoperatively. Inferential statistics and regression analyses were performed to determine associations between BMI classes and HRQoL.

Results: EQ-5D-3L scores at baseline and at 2 years were statistically different across BMI classes, with higher EQ-VAS and index scores in patients with lower BMI. There was no difference observed for the 2-year change in EQ-VAS scores, but there was a statistically greater increase in index scores for more obese patients. In the regression analyses, there were statistically significant negative effect estimates for EQ-VAS and index scores associated with increasing BMI class.

Conclusion: BMI class is independently associated with lower HRQoL scores 2 years after primary THA. While absolute scores in obese patients were lower than in nonobese patients, obese patients enjoyed more positive changes in EQ-5D index scores after THA. These results may provide the most detailed information on how BMI influences HRQoL before and after THA, and they are relevant to future economic decision analyses on the topic.

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Work was performed at the Hospital for Special Surgery, New York, NY.

* Reprint requests: Alexander S. McLawhorn, MD, MBA, Division of Adult Reconstruction and Joint Replacement, Department of Orthopedic Surgery, Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021.

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Total hip arthroplasty (THA) has been widely accepted as a reliable and effective surgical intervention for treating osteoarthritis (OA) of the hip after failed conservative management [1]. Obesity is an independent and modifiable risk factor for both OA and also the subsequent need for THA [2–6]. While OA has been shown to negatively impact health-related quality of life (HRQoL), affecting sleep, mood, and functioning in social and recreational activities [7] and providing the basis for the benefit of THA, the associations between obesity and HRQoL before and after THA are not well characterized. Prior outcome studies have revealed mixed results in determining whether quality of life before and after THA differs by BMI class [2].

Accurate measurement of HRQoL is particularly important for determining the societal impact of both hip OA and also THA. As the healthcare environment becomes more cost-conscious, healthcare interventions will be forced to demonstrate their cost-effectiveness to society in order to allocate limited resources efficiently. By definition, the determination of cost-effectiveness requires consideration of both costs and also patient preference–based HRQoL [8,9]. One of the commonest standardized measures of generic HRQoL is the EuroQol-5D 3 level (EQ-5D-3L) instrument, which permits assessment and comparison of health state utilities regardless of patient conditions or disease treatments [9,10].

The purpose of this study was to describe how the HRQoL in patients with advanced hip OA before and after THA differs according to World Health Organization (WHO) BMI class, using the EQ-5D-3L instrument. This study asked the following questions: (1) How does increasing BMI impact HRQoL preoperatively and at 2 years postoperatively for patients undergoing THA? (2) How does increasing BMI affect changes in these scores following THA? and (3) What are the effects of other demographic variables (ie, age, sex, year of surgery, and comorbidity index) on HRQoL before and after THA?

Patients and Methods

Study Design and Subjects

Through an institutional review board (IRB)-approved THA registry, all patients who underwent an elective primary unilateral THA between May 1, 2007, and December 31, 2009, were reviewed. All THA were performed at a single, high-volume, orthopedic specialty hospital. Patients were eligible for study inclusion if hip OA was the primary diagnosis, and they underwent primary unilateral THA, gave consent to participate in the registry, and had completed preoperative and 2-year follow-up surveys. Patients with secondary diagnoses of dysplasia, inflammatory arthritis, avascular necrosis, posttraumatic arthritis, fracture, or preoperative deformity were excluded. Patients who were converted from a partial hip replacement, hip resurfacing, or other prior hip surgery to a THA were excluded. Patients who underwent revision or contralateral THA before completing the 2-year follow-up survey, or reported having complications on their 6-month adverse event

survey were excluded. Complications collected on the 6-month adverse event survey included pulmonary embolism, deep vein thrombosis, infection around the joint, major bleeding, pneumonia, stroke, myocardial infarction, dislocation, fracture, and requirement for additional surgery on the hip that was replaced. Finally, patients for whom BMI data or EQ-5D responses were unavailable or incomplete were excluded. Patients included in the study predominantly received THA through a posterior approach and were allowed to be weight-bearing as tolerated with posterior hip precautions for 6 weeks postoperatively. Precautions were relaxed after 6 weeks. Implants were based on surgeon preference but predominantly included noncemented femoral and acetabular fixation. A total of 2733 patients met criteria for inclusion in this study (Fig. 1). Of note, at the time of enrollment for this cohort, surgical approach was not included as a registry variable. One registry surgeon may have used the direct anterior approach rather than the posterior approach, and his case volume accounted for 1.79% of the cases reported in this study. However, several studies have shown that surgical approach for THA is not relevant for 2-year postoperative outcomes [11–13]. Therefore, his patients were included in this analysis.

Data

Preoperative BMI was calculated using height and weight information extracted from the hospital electronic medical record at admission. Patients' self-reported heights and weights collected preoperatively were used in lieu of electronic BMI when the information in the electronic health record was missing or out of valid physiologic range ($<14 \text{ kg/m}^2$ or $>60 \text{ kg/m}^2$). Patients were divided into 6 categories based on the WHO's established BMI classification: Underweight ($<18.50 \text{ kg/m}^2$), normal weight ($18.50\text{--}24.99 \text{ kg/m}^2$), overweight ($25.00\text{--}29.99 \text{ kg/m}^2$), obese class I ($30.00\text{--}34.99 \text{ kg/m}^2$), obese class II ($35.00\text{--}39.99 \text{ kg/m}^2$), and obese class III ($\geq 40.00 \text{ kg/m}^2$). In addition to BMI, patient characteristics were collected at baseline, including age at the time of index THA procedure, sex, laterality, year of surgery, and Charlson-Deyo comorbidity index (CDI).

The primary outcome measure, EQ-5D-3L, was collected at baseline preoperatively and at 2-year follow-up and consisted of a self-assessment questionnaire (EQ-5D index) and a visual analog

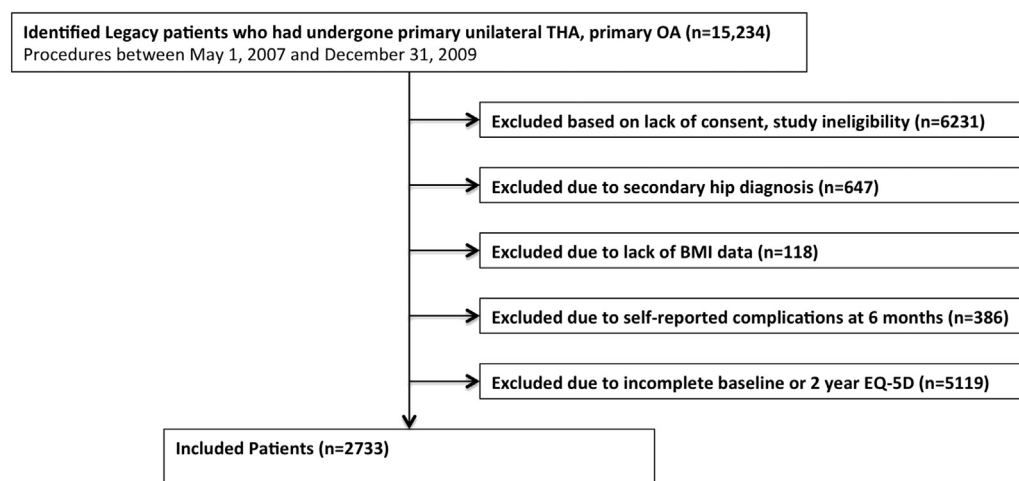


Fig. 1. Flowchart presenting the formation of the final included patient cohort—For a primary diagnosis of hip osteoarthritis (OA), 15,234 registry patients were identified who had undergone primary unilateral total hip arthroplasty (THA). Of those, patients were excluded because of lack of consent/ineligibility for study ($n = 6231$), secondary hip diagnosis ($n = 647$), lack of body mass index (BMI) data ($n = 118$), self-reported complications at 6-month adverse event survey ($n = 386$), and incomplete baseline and/or 2-year EQ-5D ($n = 5119$), leaving 2733 patients in the final study cohort.

scale (EQ-VAS). The questionnaire evaluates patients in 5 HRQoL dimensions, including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression [9,10,14]. Patients were asked to grade current level of function in each dimension into 1 of 3 degrees of disability. The combination generates 243 (3^5) possible response combinations, each of which can be transformed into a single score, the EQ-5D index [9]. The EQ-5D index represents the value, or utility, of a health state. For the US population, the index ranges from -0.624 to 1 , where 1 represents the best possible health state and 0 represents death. Scores less than 0 represent health states worse than death [9]. These scores are used for economic studies, such as cost-utility analyses [9]. The EQ-VAS records the patient's perception of current overall health status ranging from 0 (worst imaginable health state) to 100 (best imaginable health state).

Statistical Analysis

Descriptive statistics were used to illustrate BMI, patient characteristics, and HRQoL outcomes. Means and standard errors were calculated for continuous variables and frequency distributions for categorical variables. Inferential statistics (analysis of variance, Pearson's chi-square, and/or Fisher exact test, as appropriate) were used to assess statistical significance among study variables. Multiple variable linear regression analysis was performed to assess the association between BMI and EQ-5D index score and EQ-VAS at 2-year follow-up, controlling for preoperative age, sex, CDI, year of surgery, and length of stay, to control for confounding from any of these variables. All analyses were conducted using SAS for Windows 9.2 (SAS Institute Inc, Cary, NC). All tests were 2-sided, and a critical P value of .05 was set for all comparisons.

Results

The mean age of patients included in the study was 65.5 ± 0.2 years and mean CDI score was 0.36 ± 0.02 (Table 1). There were

significant differences in age, sex, and CDI across BMI classes. There were no differences in laterality or year of surgery. Patients classified as obese class II and III were younger than patients in other BMI classes who were largely similar to one another. More underweight patients were women compared to all other BMI classes, and normal weight patients were more commonly women than were patients in higher BMI classes. The mean CDI score for normal weight patients was lower than the means for patients in higher BMI classes, and the mean CDI for overweight patients was lower than the means for patients classified in obese class I–III, with class II and III patients exhibiting the highest comorbidity burden.

Both EQ-5D VAS and EQ-5D index scores at baseline and at 2 years postoperatively were significantly lower in patients with higher BMI class (Table 2). While patients in higher BMI classes reported lower scores on average, this group experienced a significantly greater increase in EQ-5D index than did their counterparts in lower BMI classes ($P = .022$). However, this relationship was not observed for the change in EQ-5D VAS from baseline to 2 years ($P = .430$).

Regression analyses were performed to determine the association of different variables with EQ-5D index and VAS scores (Table 3; Figs. 2 and 3). With regard to obesity, significant negative effect estimates were found for EQ-5D VAS starting with class I obesity, increasing in effect with greater BMI class, with class I, II, and III associated with effect estimates of -2.44 ± 0.73 , -4.93 ± 1.05 , and -6.36 ± 1.59 , respectively. Additionally, increasing comorbidity index score and increasing age were associated with significant negative effect estimates. Similarly, obesity was significantly associated with worse scores for the EQ-5D index, although it did not show the same linear relationship, with overweight, class I, class II, and class III obesity having effect estimates of -0.01 , -0.03 , -0.06 , and -0.04 , respectively. Comorbidity index 1–2 was associated with significantly lower EQ-5D index scores, and comorbidity index 3 was associated with a nonsignificant trend toward lower scores. Outcomes for both scales showed no

Table 1
Patient Characteristics by BMI Class.

Demographic Variable	Underweight (BMI < 18.5) N = 35	Normal Weight (18.5 ≤ BMI < 25) N = 865	Overweight (25 ≤ BMI < 30) N = 1044	Obese Class I (30 ≤ BMI < 35) N = 530	Obese Class II (35 ≤ BMI < 40) N = 186	Obese Class III (40 ≤ BMI) N = 73	P Value	All Patients N = 2733
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE		Mean ± SE
Age	66.49 ± 1.59	66.35 ± 0.36	66.01 ± 0.32	65.04 ± 0.40	61.90 ± 0.65	60.51 ± 1.08	<.0001	65.51 ± 0.19
Charlson-Deyo comorbidity index score	0.29 ± 0.09	0.24 ± 0.03	0.42 ± 0.04	0.36 ± 0.04	0.48 ± 0.06	0.56 ± 0.10	.0003	0.36 ± 0.02
BMI	17.65 ± 0.15	22.70 ± 0.06	27.34 ± 0.04	32.09 ± 0.06	36.97 ± 0.10	43.85 ± 0.38	<.0001	27.76 ± 0.10
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	P Values	N (%)
Gender							<.0001	
Male	2 (5.7)	253 (29.2)	585 (56.0)	286 (54.0)	90 (48.4)	35 (47.9)		1251 (45.8)
Female	33 (94.3)	612 (70.8)	459 (44.0)	244 (46.0)	96 (51.6)	38 (52.1)		1482 (54.2)
Laterality							.422	
Right	17 (48.6)	490 (56.6)	561 (53.7)	283 (53.4)	98 (52.7)	46 (63.0)		1495 (54.7)
Left	18 (51.4)	375 (43.4)	483 (46.3)	247 (46.6)	88 (47.3)	27 (37.0)		1238 (45.3)
Year of surgery							.5179	
2007	10 (28.6)	177 (20.5)	213 (20.4)	86 (16.2)	35 (18.8)	17 (23.3)		538 (19.7)
2008	11 (31.4)	335 (38.7)	408 (39.1)	231 (43.6)	76 (40.9)	30 (41.1)		1091 (39.9)
2009	14 (40.0)	353 (40.8)	423 (40.5)	213 (40.2)	75 (40.3)	26 (35.6)		1104 (40.4)
Charlson-Deyo comorbidity index score							<.0001	
0	26 (74.3)	727 (84.0)	823 (78.8)	400 (75.5)	119 (64.0)	45 (61.6)		2140 (78.3)
1–2	9 (25.7)	127 (14.7)	180 (17.2)	120 (22.6)	63 (33.9)	24 (32.9)		523 (19.1)
3+	0	11 (1.3)	41 (3.9)	10 (1.9)	4 (2.2)	4 (5.5)		70 (2.6)

SE, standard error; BMI, body mass index (kg/m^2).

Table 2
Mean EQ-5D Scores by BMI Class.

Outcome Score	Underweight (BMI < 18.5) N = 35 Mean ± SE	Normal Weight (18.5 ≤ BMI < 25) N = 865 Mean ± SE	Overweight (25 ≤ BMI < 30) N = 1044 Mean ± SE	Obese Class I (30 ≤ BMI < 35) N = 530 Mean ± SE	Obese Class II (35 ≤ BMI < 40) N = 186 Mean ± SE	Obese Class III (40 ≤ BMI) N = 73 Mean ± SE	P Value	All Patients N = 2733 Mean ± SE
EQ-5D VAS @ baseline	74.12 ± 3.31	76.62 ± 0.58	76.28 ± 0.50	71.97 ± 0.82	69.27 ± 1.35	67.79 ± 2.19	<.0001	74.84 ± 0.33
EQ-5D VAS @ 2-y follow-up	84.67 ± 2.01	84.93 ± 0.47	83.17 ± 0.42	80.88 ± 0.64	77.51 ± 1.19	76.03 ± 1.91	<.0001	82.73 ± 0.27
Δ EQ-5D VAS	9.11 ± 3.36	8.23 ± 0.59	6.94 ± 0.50	8.67 ± 0.80	8.34 ± 1.35	8.12 ± 2.02	.4291	7.83 ± 0.329
EQ-5D index score @ baseline	0.61 ± 0.04	0.66 ± 0.01	0.66 ± 0.01	0.62 ± 0.01	0.58 ± 0.01	0.54 ± 0.03	<.0001	0.64 ± 0.004
EQ-5D index score @ 2-y follow-up	0.89 ± 0.02	0.90 ± 0.004	0.89 ± 0.004	0.87 ± 0.01	0.84 ± 0.01	0.85 ± 0.02	<.0001	0.89 ± 0.003
Δ EQ-5D index score	0.28 ± 0.04	0.24 ± 0.01	0.23 ± 0.01	0.25 ± 0.01	0.25 ± 0.02	0.31 ± 0.02	.0216	0.24 ± 0.004

SE, standard error; BMI, body mass index (kg/m²); VAS, visual analog scale.

significant associations by sex or the year in which THA surgery was performed.

Discussion

Obesity is a major risk factor for hip OA and the subsequent need for THA. Obesity has been associated with poor outcomes after THA [2–6]. The Workgroup of the American Association of Hip and Knee Surgeons Evidence Based Committee recently concluded that fewer studies have focused on outcomes for obese patients undergoing THA than TKA, and the relationship between BMI and THA outcomes is not clear [2]. Furthermore, the Workgroup emphasized that most studies have analyzed obesity only as a dichotomous variable of obese (BMI > 30 kg/m²) and nonobese (BMI ≤ 30 kg/m²) [2]. The purpose of this study was to describe how the HRQoL in patients with advanced hip OA before and after THA differs according to WHO BMI class using the EQ-5D-3L instrument. The results showed that for patients undergoing elective primary unilateral THA, higher BMI is independently associated with lower HRQoL at 2-year follow-up. Nevertheless, although patients in higher BMI classes reported lower scores, these more obese

patients experienced greater increases in EQ-5D index scores, demonstrating a greater absolute gain from THA than their counterparts with lower BMI.

This study has several limitations. First, results from a single institutional registry study may have limited external validity, as they reflect the experience of only one hospital. However, the registry is made up of patients of various backgrounds and insurance statuses and treated by many different surgeons. Second, using BMI as a measure of obesity has been criticized as inaccurate in certain patients, particularly those who are heavily muscled, and this can be considered a weakness of this and other such studies. BMI was used as a surrogate for obesity because of the simplicity of the calculation, utilization by the WHO, and the fact that it has been adopted in the literature as the primary measure of obesity [5]. Third, the distribution of patients in our study is skewed, with clustering into normal weight (31.7%), overweight (28.3%), and class I obesity (19.4%) groups, with far fewer patients in the underweight (1.3%), class II (6.8%), and class III (2.7%) categories. Yet, our cohort is reflective of the general US population of middle-aged and older adults, which according to a recent population study by Stenholm et al [15] has a BMI distribution of underweight, normal weight, overweight, obesity class I, II, and III of 0.6%, 27.0%, 38.8%, 21.6%, 8.0%, and 4.0%, respectively. Despite unequal number of patients in each group studied, we believe that the relationships provided here between obesity and utilities are valid. Fourth, some BMI calculations were based upon self-reported values for height and weight, and BMI was analyzed from a single time point. The intraclass correlation coefficients between measured and self-reported height and weight have been reported from the registry [16]. They are 0.92 and 0.98, respectively, for patients who underwent THA, indicating high agreement between measured and self-reported values. Furthermore, the same study showed that the majority of THA patients (73%) maintained their weight after THA [16]. Fifth, our exclusion criteria may further limit the generalizability of our results. In including only those patients with a diagnosis of primary OA, undergoing primary THA, and without complications within 6 months or contralateral THA/revision within 2 years postoperatively, we attempted to isolate our analysis to reflect the independent impact of obesity on HRQoL in the case of successful THA. This limits the generalizability of our findings for all-comers, as excluding these cases could bias our results in favor of obese patients, who have been shown to experience greater complication rates (eg, periprosthetic infection) [2,17,18]. However, in order to minimize confounding and isolate the influence of BMI alone, we elected to exclude patients with complications. Additionally, 2-year follow-up in the registry for patients with

Table 3
BMI Class and Adjusted 2-Year EQ-5D VAS and EQ-5D Index Scores.

Parameter	EQ-5D VAS			EQ-5D Index Score		
	Estimate	Standard Error	P Value	Estimate	Standard Error	P Value
Intercept	61.39	3.08	<.0001	0.86	0.03	<.0001
BMI class						
Underweight ^a	−0.12	2.36	.9592	0.00	0.02	.8211
Overweight ^a	−1.15	0.60	.0573	−0.01	0.01	.0294
Class I ^a	−2.44	0.73	.0008	−0.03	0.01	<.0001
Class II ^a	−4.93	1.05	<.0001	−0.06	0.01	<.0001
Class III ^a	−6.36	1.59	<.0001	−0.04	0.02	.0095
Age at surgery	−0.26	0.08	.0017	−0.002	0.001	.0068
Gender	0.69	0.52	.1816	−0.02	0.01	<.0001
Year of surgery						
2008 vs 2007	−1.26	0.67	.0618	−0.01	0.01	.1976
2009 vs 2007	−0.83	0.67	.2151	0.00	0.01	.9953
CDI						
1–2 vs 0	−2.17	0.64	.0007	−0.01	0.01	.0302
3+ vs 0	−6.51	1.65	<.0001	−0.02	0.02	.1879
Baseline VAS score or index score	0.35	0.01	<.0001	0.17	0.01	<.0001

BMI, body mass index (kg/m²); VAS, visual analog scale; CDI, Charlson-Deyo comorbidity index.

^a Compared to normal weight.

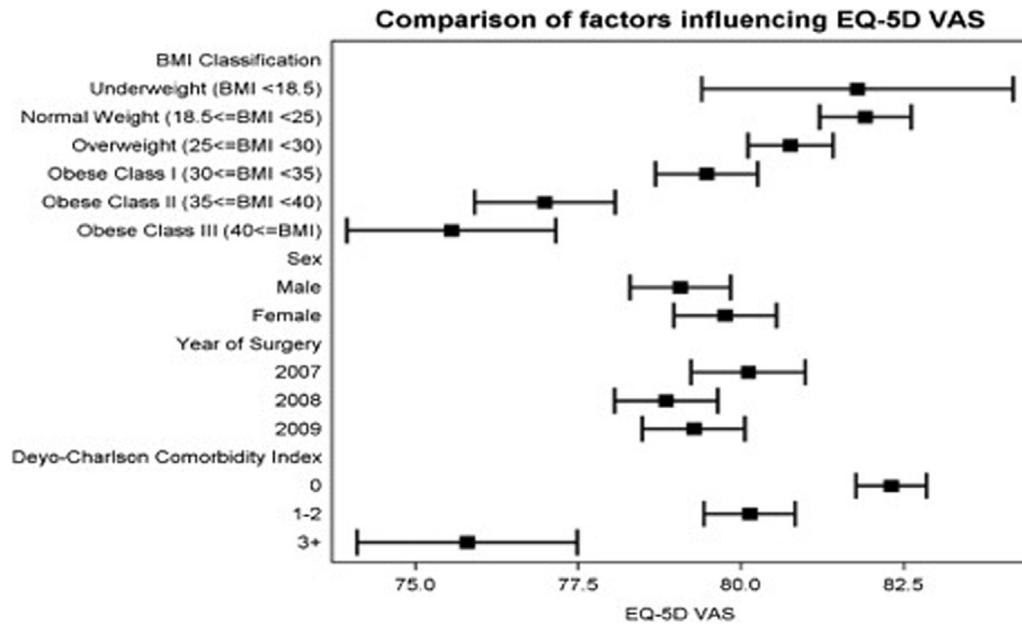


Fig. 2. Regression analysis of association of various factors with EQ-5D VAS at 2 years—Significant negative effect estimates were found, with increasing effect with greater BMI class and Charlson-Deyo comorbidity index. Estimates were not influenced by sex or year of surgery. VAS, visual analog scale.

complications is less consistent than for patients without complications. Furthermore, the frequency of each complication was small, which made statistical adjustment for their occurrence problematic. Finally, while the EQ-5D is commonly used to assess patient HRQoL in the total joint literature, recent reports have demonstrated that the EQ-5D-3L has exhibited ceiling effects in many chronic conditions [19–22]. These limitations are attributed to the questionnaire having only 3 possible responses for each dimension, losing granularity in patients with severe debilitation. In the future, use of the newly developed EQ-5D-5L, which

addresses these limitations by broadening the range of responses to 5 possible levels, could address this limitation [20,23].

The patients in our cohort demonstrated lower utility scores with increasing BMI class. At baseline, the differences in EQ-5D VAS and index scores between normal weight and class III individuals were 8.8 and 0.12, respectively; at 2 years postoperatively, these differences were 8.9 and 0.05, respectively. Regression analysis showed that these differences persisted even after controlling for other important covariables, providing further evidence for the negative relationship between obesity and HRQoL. Although obese

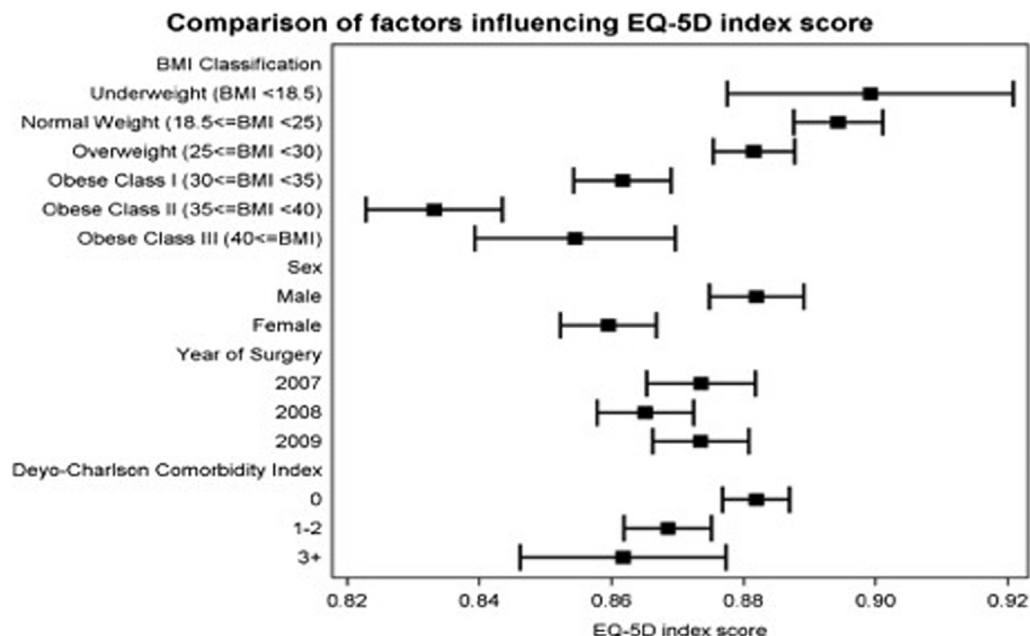


Fig. 3. Regression analysis of association of various factors with EQ-5D index at 2 years—Significant negative effect estimates were found for the following BMI classes: overweight, class I, II, and III obesity. Charlson-Deyo comorbidity index 1–2 was associated with significant reduction in EQ-5D index, whereas comorbidity index 3 showed a nonsignificant trend toward lower scores. Estimates were not influenced by sex or year of surgery.

patients tended to have lower utility scores, they experienced greater increases in EQ-5D index score, with class III patients gaining an average of 0.31 points compared with 0.24 gained by normal weight individuals over 2 years.

To our knowledge, this study represents the largest cohort of patients reporting health state utility outcomes by BMI class for both OA and THA. In the setting of increasingly limited resources, these findings are important, demonstrating the value of THA across BMI classes. Others have similarly shown the HRQoL benefit of primary THA. Laupacis et al and Katz et al [24,25] used the time trade-off technique, noting substantial increases in utility for THA from preoperatively to postoperatively. More recently, Bozic et al [26] used preference-based utility measures to assess the impact of primary THA, demonstrating its high utility. Finally, Rasanen et al [27] employed a 15-dimension HRQoL instrument and demonstrated significant increases in utility for primary THA at 1 year postoperatively, with associated cost per quality-adjusted life-year of € 6710. Others have reported favorable costs per quality-adjusted life-year, as compared to other interventions, for THA [28]. Although different instruments have been used across the literature, these studies uniformly report improvements in utility from THA. Increased use of preference-based, as opposed to disease-specific, utility instruments will be critical in the future, as they allow for comparisons of interventions across different pathologies and disciplines, facilitating optimal allocation of resources at the broadest level [26].

While many studies have demonstrated the utility benefit of THA overall, few have focused on the association between HRQoL vis-à-vis obesity and THA. Existing studies are limited by few numbers of obese patients in their cohorts and lack of longer-term follow-up. In a study of 191 THAs categorized into groups of BMI <30, 30–34, and ≥ 35 , Michalka et al [29] report no significant difference between groups in Oxford hip score or SF-12 health survey, although the BMI ≥ 35 group was quite small ($n = 21$). Similarly, Andrew et al found no difference in Oxford hip score while McLaughlin et al reported no difference in Harris hip score (HHS), although these studies likewise included few patients with high BMI (18 of 1417 with BMI > 40, and 26 of 188 with BMI ≥ 35 , respectively) [30,31]. Kessler et al [32] administered the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index and noted no significant difference by BMI, although obese patients were defined as BMI ≥ 30 and only included 3 months of follow-up data. More recently, Foster et al [33] analyzed 435 THA patients from an institutional registry. They stratified patients based on BMI class and found that all BMI classes enjoyed a significant increase in EQ-5D and EQ-VAS scores, except for EQ-VAS in patients with BMI > 40. Comparisons were not made across BMI classes. In contrast to our results, they could not find an association between BMI class and these outcomes, likely because of their sample size [33].

Others have found differences in outcomes following THA for obese patients. Stickles et al [34], for example, reported significantly lower preoperative WOMAC scores with increasing BMI class, although they found no difference in WOMAC gains at 1 year among the groups. They also studied the SF-36, noting significantly worse physical component scores at 1 year but no change in improvements postoperatively. Others have reported similar results, with lower absolute outcomes overall, but improvements for obese patients undergoing THA [35,36]. Similarly, Moran et al [37] noted significantly worse HHS at 6 and 18 months for obese patients undergoing THA, although BMI was not found to be a significant predictor of SF-36 scores. Additionally, multiple regression analysis demonstrated that preoperative HHS was by far the most influential variable in explaining the variation in HHS at 6 and 18 months, compared to other examined factors (BMI, length of stay, comorbidity, and drop in hemoglobin) [37].

In the present study, while significantly lower absolute HRQoL outcomes were found at baseline and at 2 years postoperatively, obese patients experienced similar or even greater improvements in utility compared to their less obese counterparts. This finding is consistent with the analysis presented in Moran et al [37], demonstrating the overwhelming impact of preoperative health and functional status compared to other factors, including BMI, on postoperative outcomes. These results are not surprising, given that obesity tends to be associated with multiple comorbidities, including diabetes, coronary artery disease, hyperlipidemia, hypertension, and obstructive sleep apnea [2]. In the present study cohort, obese patients had significantly greater CDI scores than nonobese patients, and the regression analysis demonstrated that patients with CDIs > 0 experience lower HRQoL.

It is important to reiterate that only patients without post-operative complications were included in our cohort, and the study results are simply associations that cannot directly inform clinical practice guidelines. While weight loss may improve absolute baseline and postoperative HRQoL in OA of obese patients [38,39], this finding is not universal. For example, Inacio et al [40] found that patients who lost weight and kept it off following THA had a 3.77 times greater likelihood of deep surgical site infections. Furthermore, many orthopedic surgeons empirically believe that obesity negatively impacts the chance of long-term favorable outcome [41]. Future studies are needed to clarify whether access to THA should be restricted based on preoperative BMI.

Conclusion

WHO BMI class is independently associated with lower HRQoL scores 2 years after primary unilateral THA for end-stage hip OA. In this study population that excluded patients having complications and secondary surgeries, obese patients enjoyed more positive changes in EQ-5D index scores after THA compared to nonobese patients, but the absolute scores in obese patients were lower than those for nonobese patients. Because obesity is a potentially modifiable factor, weight loss before THA may be a consideration to improve outcomes following THA. The results presented here may provide the most detailed information on how obesity influences HRQoL in patients with end-stage hip OA, and after THA. The results are relevant to future economic decision analysis studies on this topic.

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