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Primary Hip

Variation in Demographics, Hospital, and Patient-Reported Outcomes Following Total Hip Arthroplasty According to Biological Sex



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ABSTRACT

Background: The effect of biological sex on the outcomes of total hip arthroplasty (THA) remains unclear. Accounting for biological sex in research is crucial for reproducibility and accuracy. Average combined data may mask sex-related variation and obscure clinically relevant differences in outcomes. The aim of this study is to investigate hospital and patient-reported outcome measures (PROMs) after THA by biological sex to elucidate differences and ultimately provide more equitable care.

Methods: We performed a retrospective review of patients undergoing primary THA at a single large academic center between January 2013 and August 2020. Demographics, operative variables, hospital outcomes, and PROMs were compared between men and women patients. The PROMs included preoperative, 6-weeks, 6-months, and 1-year Single Assessment Numeric Evaluation, Visual Analog Scale, Hip Disability and Osteoarthritis Outcome Score Joint Replacement, University of California, Los Angeles, and Patient-Reported Outcomes Measurement Information System mental and physical scores, as well as satisfaction scores.

Results: A total of 6,418 patients were included (55% women). Women were older ($P < .001$), had a lower body mass index ($P < .001$), and were more likely to have public insurance ($P < .001$). Fewer women were discharged to home or self-care ($P < .001$). Women had higher rates of cementation ($P < .001$) and fracture within 90 days ($P < .001$), and these associations remained significant with adjusted multivariable analyses. Women had significantly higher pain and lower functional scores preoperatively; post-operatively, most PROMs were equivalent.

Conclusions: Important differences were observed in several areas. Demographic parameters differed, and a variable effect of biological sex was observed on surgical and hospital outcomes. Women had an increased incidence of cemented femoral components (indicated for osteoporotic bone) and post-operative fractures. Women's PROMs demonstrated globally lower functional scores and higher pain preoperatively. Differences attributed to sex should continue to be investigated and accounted for in risk-stratification models. Future studies are needed to elucidate the underlying causes of observed biological sex differences and are essential for equitable arthroplasty care.

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Osteoarthritis (OA) affects 1 in 3 people over the age of 65 years [1], and its prevalence is higher in women [2,3]. Despite the greater incidence of end stage arthritis in women, studies have demonstrated lower utilization and willingness to undergo total joint arthroplasty (TJA) surgery in women compared to men, with reports asserting that women are 22% less likely to undergo TJA than their peers who are men [4–6]. It has also been shown that women experience worse symptoms and greater disability than men who have OA of similar radiographic severity [3,7], and tend to present later in the OA disease course [8], and at an older age and higher body mass index (BMI), both known risk factors for OA [8]. Some of these differences may relate to differing concerns prior to arthroplasty surgery [9]. Evaluating sex-specific data regarding the utilization and outcome of total hip arthroplasty (THA) is necessary to improve outcomes and equity for men and women who undergo TJA.

Accounting for biological sex in research is crucial for reproducibility and accuracy, yet an evaluation of orthopedic literature published in 2010 indicated that 70% of studies failed to report on sex-specific analysis [10]. This finding is supported by the National Research Council, which found sex-specific reporting in research to be globally inadequate [11,12]. Reporting average combined men and women data can mask sex-related variation and obscure clinically-relevant differences related to efficacy [12–14]. The evolving body of research investigating sex-related differences in arthroplasty outcomes reports highly variable findings depending on the research methodology, time interval, and outcomes assessed [15–18]. A better understanding of sex differences in THA will aid in preoperative counseling and optimization and allow for improvements in health equity [19].

Materials and Methods

Data Collection

A retrospective review was performed of patients undergoing primary THA at a single large academic center between January 1, 2013, and August 31, 2020. Institutional review board approval was obtained. Patients less than 18 years of age, who had a history of septic arthritis or were discharged to a psychiatric hospital, were excluded. All patients received surgery using the anterior-based muscle sparing approach [20] by one of 3 fellowship-trained arthroplasty surgeons. The primary outcomes of interest were evaluated by categories of biological sex for patients undergoing THA.

Demographic, operative, and hospital outcome data were obtained from the institutional electronic medical record (EMR), including sex (men or women, as recorded in the EMR), age, BMI, race or ethnicity, American Society of Anesthesiologists score, indication for surgery (degenerative joint disease, OA, osteonecrosis (ON), or fracture), and insurance type (public or private). The comorbidity data contributing to the Charlson Comorbidity Index (CCI) [21] and updated CCI [22] were collected, including myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, rheumatic disease, peptic ulcer disease, liver disease, diabetes, hemiplegia or paraplegia, renal disease, malignancy, metastatic solid tumor, and Human Immunodeficiency Virus. Operative variables collected included arthroplasty fixation (press fit or cemented), procedure duration, length of stay (LOS), need for transfusion, and occurrence of an intraoperative complication. Hospital-reported outcomes included discharge disposition as well as the occurrence of postoperative complications, emergency department visits within 30 days, and readmission within 90 days. The complications evaluated included myocardial infarction or pneumonia (within 7 days), surgical site complications, pulmonary

embolism, death (within 30 days), fracture, dislocation, mechanical complications, joint infection, or wound infection (within 90 days). Patient-reported outcomes collected included preoperative, 6-weeks, 6-months, and 1-year Single Assessment Numeric Evaluation (SANE), Visual Analog Scale (VAS), Hip Disability and Osteoarthritis Outcome Score Joint Replacement (HOOS JR), University of California, Los Angeles (UCLA), and Patient-Reported Outcomes Measurement Information System (PROMIS) mental and physical scores, all collected from an in-house database. The Center for Medicare and Medicaid Services substantial clinical benefit (SCB) threshold, utilizing improvement postoperatively on the HOOS JR score, was analyzed [23,24]. The satisfaction scores evaluating pain relief, functional improvement, procedure meeting expectations, and surgeon were collected for postoperative time points.

Data Analyses

To assess the relationship between sex and outcomes of interest, all demographic, patient-reported, and hospital-reported variables were analyzed with respect to sex. Pearson's *Chi*-squared tests were used for normally distributed categorical variables, and Wilcoxon rank sum tests or Fisher's exact tests were used for nonnormally distributed categorical variables and continuous variables. *Q*-values were reported in outcomes tables to correct for the False Discovery Rate for multiple testing.

Univariate regression models were created to analyze the relationship between patient- and hospital-reported outcomes and all covariates. Linear and logistic regression approaches were used according to the respective outcome (linear for continuous outcomes, logistic for binary outcomes). Final linear and logistic multivariable regression models were created using a combination of clinical expertise and purposeful selection ($P < .2$) with respect to each individual outcome. Any patients who had missing data were excluded from regression analyses. All analysis was performed using R version 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Demographics

From January 1, 2013, to August 31, 2020, 6,421 patients underwent primary THA. Patients were excluded if they had a preoperative diagnosis of septic arthritis or a discharge disposition from a psychiatric hospital. Subsequently, 6,418 patients met the inclusion criteria. Of this patient population, 3,532 were women (55%), and 2,886 were men. When both sexes were analyzed together, the average age of patients was 65 (± 10) years, with an average BMI of 29.3 (± 6). The average age for women was 66 (± 10) with a BMI of 28.8 (± 6.6). The average age for men was 64 (± 10) with a BMI of 29.9 (± 5.3). There was a significant difference in the distribution of BMI by sex ($P < .001$), with a greater proportion of women at a healthy (18.5 to 24.9) or underweight (< 18.5) BMI, compared to more men who were overweight (25 to 29.9) or obese (> 30) BMI. More women had public insurance (60%) when compared to men (51%). Preoperative diagnosis was overwhelmingly degenerative joint disease, or OA (97%) across sexes, with a higher incidence of fracture in women and ON in men. The American Society of Anesthesiologists score varied slightly between groups; CCI did not. Women (28%) had both hips replaced more often than men (24%). A total of 97.0% of patients were of White race, with 2.1% of patients declining or having an Unknown or Other race. All other racial demographics (American Indian or Alaska Native, Black or African American, Multi Racial, Native

Hawaiian, and Other Pacific Islanders), represented less than 1% of the study population. Less than 1% of the study population was Hispanic or Latino. [Table 1](#) summarizes the baseline and perioperative characteristics of the study cohort. [Supplemental Table 1](#) shows diagnoses contributing to the CCI; the prevalence of most comorbidities did not vary significantly by biological sex.

Surgical Variables and Disposition

Many surgical variables differed significantly between sexes, including anesthesia time ($P < .001$), procedure duration ($P < .001$), room duration ($P < .001$), LOS (LOS) ($P < .001$), and estimated blood loss ($P < .001$). A smaller proportion of women (5.4%; 189 of 3,532) than men (6.7%; 194 of 2,886) had a procedure duration greater than 100 min ($P = .021$). However, a greater proportion of women (17%; 611 of 3,532) had a LOS greater than 48 h when compared to men (10%; 302 of 2,886) ($P < .001$). A total of 246 of 6,418 patients received a cemented femoral stem, which comprised 5% (177 of 3,532) of all women compared to 2.4% (69 of 2,886) of all men. Discharge disposition varied ($P < .001$); women were less often discharged to home/self-care (55 versus 66%) and more often discharged to home with services (36 versus 29%), a skilled nursing facility (8 versus 4%), or a rehabilitation center (1.4 versus 1.1%). [Table 2](#) summarizes surgical and dispositional outcomes by biological sex.

Postsurgical events were rare; only 83 (1.3%) of 6,418 total patients were affected by any complication. Peri-prosthetic fracture within 90 days was observed in 25 of 6,418 patients; 22 of these fractures (88%) occurred in women ($q = 0.016$). All 22 of these women who

experienced periprosthetic fractures had uncemented THA. A surgical site complication within 30 days occurred in 4 patients, all of whom were men. This difference by sex was no longer significant when corrected for multiple tests ($q = 0.4$). There were no statistically significant differences in ED visits within 30 days ($q > 0.9$), readmissions within 90 days ($q > 0.7$), complications ($q = 0.7$), or surgical admissions ($q = 0.5$) within 90 days [Table 3](#) summarizes hospital-reported postoperative outcomes by biological sex.

Patient-Reported Outcome Measures

Most patient-reported outcome measures (PROMs) remained similar between men and women from 6 weeks to 1 year postoperatively. Preoperatively, women experienced lower function, with UCLA current, UCLA desired, HOOS JR, PROMIS physical, PROMIS mental, and VAS scores showing statistically significant ($q < 0.001$) differences. Women reported greater preoperative pain on the VAS scale (5.8 (± 2.17) compared to 5.4 (± 2.23) in men). Additionally, women reported both a lower *current* UCLA score of 4.0 (± 1.59) compared to 4.7 (± 2.04) in men, and a lower *desired* UCLA score of 7.4 (± 1.76) compared to 8.1 (± 2.17) in men. Functional scores recovered amongst both sexes postoperatively, pain decreased over time, and satisfaction scores remained high. Few scores varied significantly ($q < 0.05$) across the monitored postoperative period. Statistically significant differences in functional PROMs indicated lower scoring among women apart from the 6-week SANE score. At 6 weeks, women experienced greater pain on the VAS scale, lower UCLA ($q = 0.11$), and higher SANE ($q = 0.045$) scores. At 6 months,

Table 1

Demographic Information. Baseline Characteristics of 6,418 Patients Undergoing Primary Total Hip Arthroplasty Stratified by Sex, as Categorized in the Electronic Medical Record.

Characteristic	Overall, N = 6,418 ^a	Women, N = 3,532 ^a	Men, N = 2,886 ^a	P Value ^b
Primary procedure (%)	6,348 (99)	3,500 (99)	2,848 (99)	.12
Laterality (right) (%)	3,426 (53)	1,947 (55)	1,479 (51)	.002
Both hips replaced (%)	1,670 (26)	976 (28)	694 (24)	.001
Age at discharge (years)	65 (10)	66 (10)	64 (10)	<.001
Weight (kg)	85 (20)	77 (18)	95 (18)	<.001
Height (m)	1.70 (0.10)	1.63 (0.07)	1.78 (0.07)	<.001
Mean BMI	29.3 (6.1)	28.8 (6.6)	29.9 (5.3)	<.001
BMI category (%)				<.001
Underweight	64 (1.0)	62 (1.8)	2 (<0.1)	
Healthy weight	1,531 (24)	1,078 (31)	453 (16)	
Overweight	2,268 (35)	1,108 (31)	1,160 (40)	
Obese	2,555 (40)	1,284 (36)	1,271 (44)	
Race (%)				.640
American Indian and Alaska Native	13 (0.20)	8 (0.23)	5 (0.17)	
Asian	14 (0.22)	6 (0.17)	8 (0.28)	
Black or African American	19 (0.30)	8 (0.23)	11 (0.38)	
Multiracial	10 (0.16)	7 (0.20)	3 (0.10)	
Native Hawaiian and Other Pacific Islander	2 (0.06)	0 (0)	2 (0.03)	
White or Caucasian	6,223 (97.0)	3,429 (97.1)	2,794 (96.9)	
Declined, Other, Unknown	137 (2.1)	73 (2.1)	64 (2.2)	
Ethnicity				.723
Hispanic	21 (0.33)	11 (0.31)	10 (0.35)	
Non-Hispanic	6,309 (98.3)	3,470 (98.2)	2,839 (98.4)	
Declined, Unknown	88 (1.4)	52 (1.5)	36 (1.2)	
Insurer category (%)				<.001
Government	3,559 (56)	2,104 (60)	1,455 (51)	
Private	2,796 (44)	1,400 (40)	1,396 (49)	
Preop diagnosis (%)				.009
DJD/OA	6,182 (97)	3,406 (97)	2,776 (97)	
ON	94 (1.5)	39 (1.1)	55 (1.9)	
Fracture	102 (1.6)	64 (1.8)	38 (1.3)	
ASA rating (%)	2.13 (0.53)	2.11 (0.51)	2.16 (0.55)	<.001
Charlson Comorbidity Index	0.65 (1.16)	0.65 (1.13)	0.65 (1.20)	.2

Bolded values are statistically significant with P -value $< .05$.

ASA, American Society of Anesthesiology; DJD/OA, degenerative joint disease/osteoarthritis; ON, osteonecrosis; Preop, preoperative.

^a n (%); Mean (standard deviation).

^b Pearson's *Chi*-squared test; Wilcoxon rank sum test.

Table 2
Surgical Variables and Disposition.

Characteristic	Overall, N = 6,418 ^a	Women, N = 3,532 ^a	Men, N = 2,886 ^a	P Value ^b
Anesthesia				
General (%)	6,223 (97)	3,421 (97)	2,802 (97)	.6
Anesthesia time (min)	109 (21)	107 (20)	111 (22)	<.001
Procedure duration (min)	66 (19)	64 (18)	68 (20)	<.001
Procedure duration >100 min (%)	383 (6.0)	189 (5.4)	194 (6.7)	.021
Room duration (min)	102 (21)	100 (20)	104 (22)	<.001
Length of stay (h)	34 (20)	35 (21)	32 (19)	<.001
Length of stay >48 h (%)	913 (14)	611 (17)	302 (10)	<.001
Discharge disposition (%)				<.001
Home or self-care	3,842 (60)	1,931 (55)	1,911 (66)	
Home health service	2,100 (33)	1,271 (36)	829 (29)	
Skilled nursing facility	395 (6.2)	281 (8.0)	114 (4.0)	
Rehab facility	81 (1.3)	49 (1.4)	32 (1.1)	
Cemented (Yes) (%)	246 (3.8)	177 (5.0)	69 (2.4)	<.001
Estimated blood loss (mL)	221 (78)	215 (7)	229 (81)	<.001
Unknown	1,567	901	666	
Blood transfusion (Yes) (%)	55 (0.9)	34 (1.0)	21 (0.7)	.3
Intraop complication (Yes) (%)	19 (0.3)	13 (0.4)	6 (0.2)	.2

Bolded values are statistically significant with P -value < .05.

Intraop, intraoperative.

^a n (%); Mean (standard deviation).

^b Wilcoxon rank sum test; Pearson's χ^2 -squared test.

women experienced lower UCLA ($q = 0.045$) and HOOS JR ($q = 0.014$) scores. And at one year, the UCLA score remained lower among women ($q < 0.001$). It is unlikely these postoperative functional scores varied in a clinically meaningful way; while the percentage of patients meeting CMS SCB on the HOOS JR score was significantly different between men and women at 6 weeks ($P = .018$), by 1 year postoperatively there was no significant difference ($P = .9$). Overall, 75% (1,989 of 2,658) of patients met the HOOS JR SCB at 6 weeks postoperation and 90% (954 of 947) at 1 year. Satisfaction scores did not vary significantly across all time points. Table 4 summarizes PROMs by biological sex; Table 5 reports on SCB.

To investigate the finding that women had significantly lower UCLA functional scores and lower expectations for postoperative function (UCLA desired), these results were plotted over time. Women scored lower at all-time points, and at one year, the average

UCLA score was well below the preoperatively desired score (6.4 versus 7.7) (Figure 1). An investigation was undertaken to determine whether a variable percentage of women met their desired UCLA score or functional level (Table 6). There were no significant differences between the percentage of men and women reaching their desired UCLA score at any time point. At one year, only 33% of all patients met their desired UCLA score (Figure 2).

Multivariable Analyses

On multivariable analysis, when compared to men, women had higher odds for periprosthetic fracture within 90 days (OR [odds ratio] 5.23; 1.77 to 22.3) and discharge disposition other than home (OR 1.43; 1.27 to 1.60). Women were less likely than men to have

Table 3
Postoperative Variables.

Characteristic	Overall, N = 6,418 ^a	Women, N = 3,532 ^a	Men, N = 2,886 ^a	P Value ^b	q-Value ^c
Any postoperative event (%)	310 (4.8)	164 (4.6)	146 (5.1)	.4	0.7
Emergency department visit within 30 d (%)	122 (1.9)	68 (1.9)	54 (1.9)	.9	>0.9
Average days after surgery for emergency department visit	8 (4, 15)	7 (4, 13)	9 (4, 20)	.4	0.7
Readmission within 90 d (%)	192 (3.0)	100 (2.8)	92 (3.2)	.4	0.7
Average days after surgery for readmission	33 (13, 59)	23 (12, 60)	39 (19, 59)	.11	0.5
Surgical admission (%)	56 (67)	37 (74)	19 (58)	.12	0.5
Unplanned readmission (%)	192 (3.0)	100 (2.8)	92 (3.2)	.4	0.7
Any complication (%)	83 (1.3)	50 (1.4)	33 (1.1)	.3	0.7
Myocardial infarction within 7 d (%)	8 (0.1)	3 (<0.1)	5 (0.2)	.5	0.7
Pneumonia within 7 ds (%)	3 (<0.1)	2 (<0.1)	1 (<0.1)	>.9	>0.9
Pulmonary embolism within 30 d (%)	4 (<0.1)	3 (<0.1)	1 (<0.1)	.6	0.8
Death within 30 d (%)	2 (<0.1)	1 (<0.1)	1 (<0.1)	>.9	>0.9
Surgical site complication within 30 d (%)	4 (<0.1)	0 (0)	4 (0.1)	.041	0.4
Fracture within 90 d (%)	25 (0.4)	22 (0.6)	3 (0.1)	<.001	0.016
Dislocation within 90 d (%)	10 (0.2)	5 (0.1)	5 (0.2)	.8	>0.9
Mechanical complication within 90 d (%)	4 (<0.1)	4 (0.1)	0 (0)	.13	0.5
Joint infection within 90 d (%)	12 (0.2)	5 (0.1)	7 (0.2)	.4	0.7
Wound infection within 90 d (%)	11 (0.2)	5 (0.1)	6 (0.2)	.6	0.8

Bolded values are statistically significant with P -value < .05.

^a n (%); for data points involving days, mean (range).

^b Pearson's χ^2 -squared test; Wilcoxon rank sum test; Fisher's exact test.

^c False discovery rate correction for multiple testing.

Table 4
Patient Reported Outcome Measures.

Patient Reported Outcome Measure	Overall, N = 6,418 ^a	Women, N = 3,532 ^a	Men, N = 2,886 ^a	P Value ^b	q Value ^c
Mean preoperative					
VAS (N = 4,031)	5.6 (2.21)	5.8 (2.17)	5.4 (2.23)	<.001	<0.001
UCLA current (N = 4,428)	4.3 (1.84)	4.0 (1.59)	4.7 (2.04)	<.001	<0.001
UCLA desired (N = 4,428)	7.7 (1.99)	7.4 (1.76)	8.1 (2.17)	<.001	<0.001
HOOS, JR (N = 3,165)	41.0 (15.46)	40.0 (15.09)	42.2 (15.81)	<.001	<0.001
PROMIS physical (N = 3,951)	39.9 (5.26)	39.4 (5.09)	40.5 (5.40)	<.001	<0.001
PROMIS mental (N = 3,951)	50.4 (7.38)	49.9 (7.27)	51.0 (7.47)	<.001	<0.001
SANE (N = 3,630)	41.5 (21.29)	41.4 (21.11)	41.7 (21.51)	.9	>0.9
Mean 6 wks postoperative					
VAS (N = 3,626)	1.5 (1.68)	1.5 (1.75)	1.5 (1.60)	.030	0.11
UCLA (N = 3,633)	4.9 (1.41)	4.8 (1.30)	5.0 (1.53)	<.001	<0.001
HOOS, JR (N = 3,135)	76.5 (13.09)	76.7 (12.95)	76.3 (13.25)	.2	0.5
PROMIS physical (N = 3,579)	45.0 (5.48)	44.9 (5.34)	45.1 (5.66)	.2	0.5
PROMIS mental (N = 3,579)	51.6 (7.02)	51.3 (6.88)	51.8 (7.19)	.11	0.3
SANE (N = 3,355)	77.1 (17.98)	77.6 (18.21)	76.4 (17.69)	.010	0.045
Mean 6 wks satisfaction					
Pain relief (N = 3,032)	8.9 (1.74)	8.9 (1.77)	8.9 (1.70)	.3	0.6
Functional improvement (N = 3,009)	8.6 (1.69)	8.6 (1.69)	8.6 (1.69)	>.9	>0.9
Procedure met expectations (N = 3,009)	9.0 (1.66)	9.0 (1.70)	9.1 (1.62)	.6	0.8
Surgeon (N = 3,034)	9.8 (0.72)	9.8 (0.74)	9.8 (0.69)	.8	>0.9
Mean 6 mos postoperative					
VAS (N = 710)	0.9 (1.61)	1.0 (1.73)	0.9 (1.45)	.5	0.8
UCLA (N = 691)	6.1 (1.90)	6.0 (1.75)	6.4 (2.05)	.011	0.045
HOOS, JR (N = 421)	86.7 (15.25)	85.3 (14.92)	88.7 (15.50)	.003	0.014
PROMIS physical (N = 753)	46.9 (6.24)	46.5 (6.16)	47.4 (6.33)	.041	0.14
PROMIS mental (N = 753)	51.3 (6.93)	51.2 (6.73)	51.5 (7.21)	.8	>0.9
SANE (N = 624)	89.8 (15.27)	89.5 (15.15)	90.2 (15.43)	.3	0.6
Mean 6 mos satisfaction					
Pain relief (N = 380)	9.4 (1.33)	9.5 (1.19)	9.4 (1.50)	.7	0.9
Functional improvement (N = 378)	9.3 (1.42)	9.4 (1.19)	9.2 (1.69)	.7	0.9
Procedure met expectations (N = 377)	9.4 (1.47)	9.3 (1.50)	9.4 (1.43)	.4	0.6
Surgeon (N = 378)	9.9 (0.60)	9.9 (0.60)	9.9 (0.61)	.8	>0.9
Mean 1 y postoperative					
VAS (N = 1,859)	0.9 (1.64)	0.9 (1.74)	0.8 (1.51)	>.9	>0.9
UCLA (N = 1,819)	6.4 (1.89)	6.2 (1.83)	6.7 (1.93)	<.001	<0.001
HOOS, JR (N = 1,640)	88.0 (14.30)	87.2 (14.77)	88.9 (13.66)	.019	0.075
PROMIS physical (N = 2,230)	47.3 (6.27)	47.1 (6.43)	47.6 (6.06)	.091	0.3
PROMIS mental (N = 2,230)	52.0 (7.25)	51.8 (7.19)	52.1 (7.32)	.7	0.9
SANE (N = 1,693)	90.2 (15.47)	90.0 (15.50)	90.5 (15.45)	.8	>0.9
Mean 1 y satisfaction					
Pain relief (N = 1,277)	9.3 (1.28)	9.3 (1.32)	9.4 (1.25)	.2	0.4
Functional improvement (N = 1,288)	9.4 (1.36)	9.4 (1.43)	9.5 (1.27)	.6	0.9
Procedure met expectations (N = 1,286)	9.9 (0.63)	9.9 (0.63)	9.9 (0.63)	.3	0.6
Surgeon (N = 1,283)	9.4 (1.25)	9.5 (1.24)	9.4 (1.25)	.4	0.7

Bolded values are statistically significant with P -value $< .05$.

VAS, visual analog score; HOOS, JR, hip disability and osteoarthritis outcome score, joint replacement; PROMIS, Patient-Reported Outcomes Measurement Information System; SANE, single assessment numeric evaluation; SD, standard deviation; UCLA, University of California Los Angeles.

^a n (%); Mean (SD).

^b Pearson's χ^2 test; Wilcoxon rank sum test; Fisher's exact test.

^c False discovery rate correction for multiple testing.

any postsurgical event (OR 0.77; 0.61 to 0.98) or readmission within 90 days (OR 0.73; 0.54 to 0.98) (Table 7).

Discussion

Compared with men, women undergoing primary THA at our institution were more often older, had a lower BMI, and were covered by government insurance. Both men and women

predominantly self-identified their race as White, reflective of the demographics of the state in which this study took place [25]. The CCI did not vary between sexes. OA was the primary preoperative diagnosis across sexes, with a higher percentage of fractures and a lower percentage of ON among women. Women were more likely to have both hips replaced, and to receive a cemented THA. Surgically, women had shorter anesthesia and procedure times, but longer LOS. Women were less likely to discharge home to self-care

Table 5
Effect Size Measures of Selected Patient-Reported Outcome Measures.

Met CMS SCB (HOOS, JR; +22 Points)	Overall	Women	Men	P Value
6 wks (N = 2,658)	1,989 (75%)	1,106 (77%)	883 (73%)	.018
1 y (N = 947)	854 (90%)	454 (90%)	400 (90%)	>.9

Bolded values are statistically significant with P -value $< .05$.

CMS, center for medicare and medicaid services; SCB, substantial clinical benefit; HOOS, JR, hip disability and osteoarthritis outcome score.

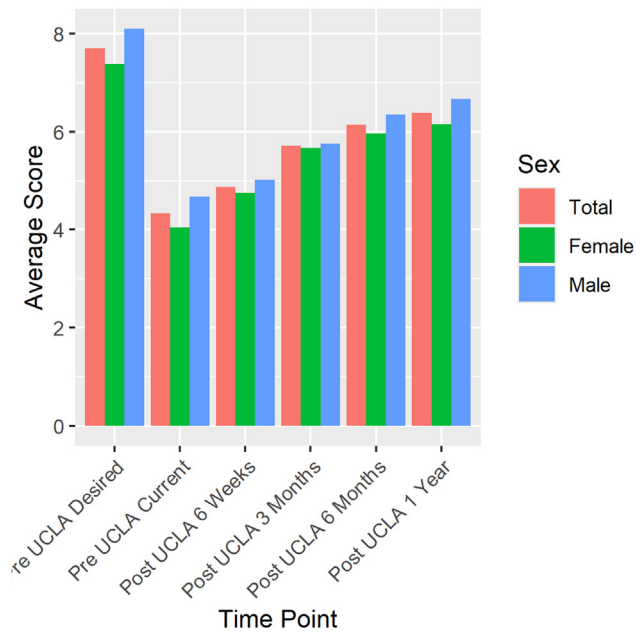


Fig. 1. Mean UCLA activity score by sex over time, preoperatively to 1 year postoperatively. UCLA, University of California Los Angeles.

and more likely to recover at a skilled nursing facility or rehabilitation facility “out of home” than “in home” compared to men. After controlling for all preoperative and perioperative differences, women were associated with greater odds of nonhome discharge and periprosthetic fracture within 90 days.

Demographics and Hospital Outcomes

Our finding of a lower BMI among women was dissimilar to prior studies reporting that women frequently have a higher BMI [16,18]. Additionally, our patient population (97%) was notably homogenous for Caucasian patients of European descent, a background recognized for higher rates of osteoporosis [26]. Osteoporosis is often a consideration for cementing the femoral stem in THA due to concerns about peri-prosthetic fracture [27,28]. We observed in our cohort that women were more likely to undergo cementation of the femoral component. This finding is consistent with current evidence supporting the use of cementation in elderly patients and those with osteoporotic bone [27–31]. Research indicates higher rates of peri-prosthetic fracture occur in women [30,32,33], but also endorses that fracture is less likely following cemented THA in older patients [29–31]. Of the 25 fractures within 90 days observed, 22 occurred in

women. Each of these patients had an uncemented stem, a finding in support of previous literature that found early periprosthetic fracture risk is higher in older women who have an uncemented THA [34]. The relationship of these factors to one another is complex and limited by the infrequent incidence of complications in this database.

PROMs

A strength of this study was the relative completeness of PROMs. Women reported lower functional status and higher pain preoperatively; the etiology underlying these differences is likely multifactorial. There is a higher prevalence of radiographic and symptomatic OA in women, which may be impacted by anatomic and genetic variables impacting disease course [35–38]. The effectiveness of treatment for OA, including analgesics, may vary by sex, pointing to additional biological variation [12,39]. Kushwaha et al. found that while both corticosteroid and hyaluronic acid injections were effective for treating OA of the knee in men, women responded only to hyaluronic acid [40]. Additionally, studies investigating health care access indicate that women who have OA are less likely to have discussed surgical treatment with a provider, been referred to an orthopedic surgeon, or been offered arthroplasty when compared with men who have identical clinical presentations [4–6,41–44]. Preoperative functional and pain variations between sexes are likely impacted by both differences in disease progression and delayed presentation related to access to care [8]. While statistically significant and congruent with previous findings in this area of study, it is noteworthy that these values likely do not reach minimal clinically important differences (MCIDs) between men and women [45,46]. The MCID is a well-known effect size metric defined as “the difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient’s management” [47,48]; essentially “the smallest change important to patients” [47–49]. Similarly, SCB is another effect size measure that represents the threshold value for a given PROM, indicating substantial improvement rather than minimal improvement (the MCID) [47,50,51].

As the SCB associated with the HOOS JR score—an improvement of 22 points preoperatively to postoperatively indicating substantial improvement and successful intervention [23,24]—is set to be utilized for the upcoming CMS mandatory PROMs reporting, we elected to utilize this measure here. SCB varied at 6 weeks but not at 1 year postoperatively between men and women patients. The similarity in postoperative scoring by sex, as well as the nonsignificant differences in percentage of men and women patients reaching SCB by final follow-up at 1 year, suggests no clinically significant difference in postoperative PROMs and highlights the effectiveness of this surgery for improving patient functioning and

Table 6

Mean UCLA Score by Sex Over Time, Preoperatively to 1 y Postoperatively, and Percent of Patients Reaching Desired UCLA Score at Each Time Point.

Selected Measure of UCLA Score	Overall, N = 6,418 ^a	Female, N = 3,532 ^a	Male, N = 2,886 ^a
Preoperative UCLA current	4.3 (1.84)	4.0 (1.59)	4.7 (2.04)
Preoperative UCLA desired	7.7 (1.99)	7.4 (1.76)	8.1 (2.17)
6 wks UCLA	4.9 (1.41)	4.8 (1.30)	5.0 (1.53)
% of patients reaching desired UCLA score at 6 wk (N = 86)	12	12	11
3 mos UCLA	5.7 (1.79)	5.8 (1.84)	5.7 (1.74)
% of patients reaching desired UCLA score at 3 mo (N = 2,590)	28	29	27
6 mos UCLA	6.1 (1.90)	6.0 (1.75)	6.4 (2.05)
% of patients reaching desired UCLA score at 6 mo (N = 299)	33	28	40
1 y UCLA	6.4 (1.89)	6.2 (1.83)	6.7 (1.93)
% of patients reaching desired UCLA score at 1 y (N = 764)	33	31	36

UCLA, University of California Los Angeles.

^a n (%); Mean (standard deviation).

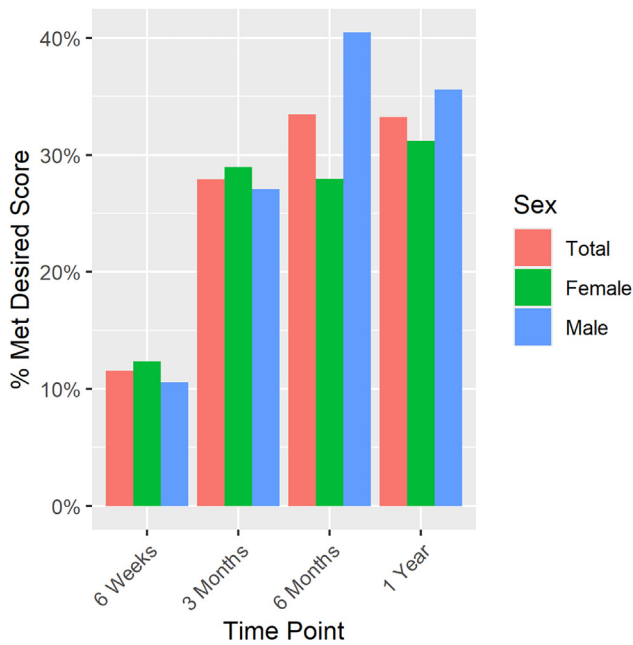


Fig. 2. Percent of patients reaching preoperative desired UCLA activity score by sex over time, 6 weeks to 1 year postoperatively. UCLA, University of California Los Angeles.

quality of life, as well as the associated high rates of satisfaction [52–56]. We remain interested in the observed trends that *multiple* preoperative scores were lower in women than men counterparts; the clinical significance of this clustering remains unclear, and further investigation is warranted.

Women in our study had lower functional expectations of THA, as evidenced by lower desired UCLA. Desired UCLA is, to our knowledge, a score unique to our study; however, several studies have sought to evaluate preoperative expectations in arthroplasty. Jain et al. found younger age and worse preoperative function predicted higher THA expectations [57] while Mancuso et al., found older age, men, and worse function were independently associated with higher THA expectations [58]. Differences in expectations may in part be due to different goals, as a recent study by Woolley et al. assessing the postoperative goals of TJA patients found that men highlighted themes of returning to an active lifestyle, sports participation, and exercise, while women focused on maintaining their current functional status and performing activities of daily living [35].

Postoperatively, most PROM differences were nonsignificant, with pain decreasing, function improving, and high rates of satisfaction among both sexes over the first year. UCLA scores remained significantly lower among women across all time points, yet it is likely that these values do not reach MCIDs in function, suggesting

no clinically significant difference in PROMs postoperatively [59]. Evaluation was undertaken to address whether a greater percentage of women patients reached their desired UCLA score given that they reported lower expectations (and potentially had more achievable functional goals) [35]; this line of inquiry did not reveal significant differences between men and women, and on average, only 33% of patients reached their preoperatively desired UCLA level at one year, despite average satisfaction scores of 9.9 of 10 in “procedure met expectations” and 9.4 of 10 in “functional improvement” at one year. Despite not reaching their preoperatively desired functional level, most patients, men and women, were highly satisfied with THA. Potential implications for patient counseling include sensitivity to patients desired goals and function outcomes, as well as reassurance that most patients of both sexes undergoing this procedure report high satisfaction regardless of their desired UCLA score (and if they actually reach it). Further research on the role of preoperative expectations on PROMs is needed to further develop the role of counseling in goal setting in presurgical optimization.

Patient Disposition

Lastly, in our study, women were associated with increased LOS and nonhome discharge. Similar results have been reported in previous arthroplasty and spine literature [18,60–63]. In the absence of variations in intraoperative and hospital complications (which we did not observe), these findings may be influenced by lower pain thresholds [64] and decreased upper body strength, which limits the use of gait aids safely and effectively [65]. Women may also engage in the caretaking role more often than men, and they may not have individuals available or able to assist them during recovery [66,67]. The finding that women were more likely to have public insurance is likely impacted by the older age of women in this study, and may underlie socioeconomic status accessibility issues with referral to home health care services and/or agency in disposition planning [66,68]. Work to improve access to TJA and the quality of life improvements it is associated with [52–56], is imperative for health care equity.

Potential Limitations Including Limited Racial Diversity

Several potential limitations are notable. While previous work has found that nonresponders have similar PROMs to responders in TJA [69], with patient-reported outcome surveys, there remains the potential for incomplete data and bias. Furthermore, the study population was racially and ethnically homogenous, limiting generalizability. Biological sex classification was limited to the men or women categories available in the EMR; gender was not addressed. Complications were infrequent, making it difficult to identify and statistically account for differences between groups. Data from only 3 surgeons at a single institution was included.

Table 7
Results of Multivariate Analyses for Outcomes Between Men and Women.

Characteristic	Odds Ratio (Male = Reference)	95% CI	P Value ²
Discharge disposition other than home	1.43	(1.27, 1.60)	<.001
Any postsurgical event	0.77	(0.61, 0.98)	.034
ED visit within 30 days	0.90	(0.62, 1.32)	.6
Readmission within 90 days	0.73	(0.54, 0.98)	.039
Any complication	1.00	(0.63, 1.61)	>.9
Fracture within 90 days	5.23	(1.77, 22.3)	.002

Odds ratios indicate the relative risk of each postsurgical event in female relative to male patients (male as reference = 1.0). Unadjusted odds ratios were determined from univariate logistic regression. Adjusted odds ratios were determined from a multivariable logistic regression that accounts for patient factors demonstrating significant differences between subgroups in Tables 1 through 3. For all analyses, significant values in bold and defined as $P < .05$.

Bolded values are statistically significant with P -value $< .05$.

ED, emergency department; CI, confidence interval.

The heterogeneity of race is a significant limitation in the generalizability of our study. Notably, 74.5% of THA procedures in the United States are performed on non-Hispanic White patients, indicating under-representation and utilization by non-White patients [70]. This variation is likely based on inequity in access, systemic racism, and lower socioeconomic status and health care accessibility that are associated with marginalization, limiting access to this function-restoring procedure [70]. Specifically, Black race and Hispanic/Latino ethnicity have been associated with underutilization of TJA, higher postoperative complications and readmission rates, and poorer PROMs [70–74]. Previous studies have shown women and Black patients to have worse function than men and White patients, who have a lower Harris Hip Score [74,75]. Minority status and racial identity have also been shown to be associated with longer LOS, with Black patients more likely to develop surgical or medical complications, Hispanic or Latino patients more likely to develop surgical complications, and American Indians or Alaska Natives more likely to undergo reoperations [70]. Our study was underpowered to detect any of these differences.

Notable health care disparities exist based on race and are an important variable to report on and study in order to identify and address health care disparities within arthroplasty and medicine as a whole. With the majority of patients undergoing THA within the United States identifying as White, our findings remain relevant to a large patient population. The observed differences in sex may be exacerbated by examining racial differences, given the role of intersectionality (the convergence of race, sex, and other social identities creating unique forms of oppression) in marginalization [76,77] and should continue to be studied to prioritize improving health equity in arthroplasty care.

Conclusions

Overall, our findings appear to be variably consistent with previous reports of sex-based differences in THA. Congruent findings [16–18] include that women presenting for THA were of an older age. While progression of OA is multifactorial, this observation aligns with the understanding that women tend to present later in the disease course [8], and is supported by the preoperative PROMs data collected, indicating lower functioning and higher pain, consistent with more severe disease. Women are associated with higher odds of periprosthetic fracture and nonhome discharge. Equivalent CCI between men and women indicates this variation is unlikely due to differences in baseline health status alone. Differences attributed to biological sex should continue to be investigated and accounted for in risk-stratification models. Future studies are needed to elucidate the underlying causes of observed differences and are essential to providing equitable arthroplasty care.

CRediT authorship contribution statement

Catherine M. Call: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Andrew D. Lachance:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Thomas M. Zink:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Henry Stoddard:** Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Conceptualization. **George M. Babikian:** Writing – review & editing, Project administration, Methodology, Data curation, Conceptualization. **Adam J. Rana:** Writing – review & editing, Project administration, Data curation, Conceptualization. **Brian J. McGrory:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project

administration, Methodology, Investigation, Data curation, Conceptualization.

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References

- [1] Bombardier C, Mosher D, Hawker G. The impact of arthritis in Canada: today and over the next 30 years. Arthritis Alliance of Canada; 2016.
- [2] Hawker GA. Osteoarthritis is a serious disease. Clin Exp Rheumatol 2019;37(Suppl 120):3–6.
- [3] Global Burden of Disease Study 2013 Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2015;386:743–800.
- [4] Hawker GA, Wright JG, Coyte PC, Williams JI, Harvey B, Glazier R, et al. Differences between men and women in the rate of use of hip and knee arthroplasty. N Engl J Med 2000;342:1016–22.
- [5] Borkhoff CM, Hawker GA, Kreder HJ, Glazier RH, Mahomed NN, Wright JG. The effect of patients' sex on physicians' recommendations for total knee arthroplasty. CMAJ 2008;178:681–7.
- [6] Jüni P, Low N, Reichenbach S, Villiger P, Williams S, Dieppe P. Gender inequity in the provision of care for hip disease: population-based cross-sectional study. Osteoarthritis Cartilage 2010;18:640–5.
- [7] Srikanth VK, Fryer JL, Zhai G, Winzenberg TM, Hosmer D, Jones G. A meta-analysis of sex differences prevalence, incidence and severity of osteoarthritis. Osteoarthritis Cartilage 2005;13:769–81.
- [8] Parsley BS, Bertolusso R, Harrington M, Brekke A, Noble PC. Influence of gender on age of treatment with TKA and functional outcome. Clin Orthop Relat Res 2010;468:1759–64.
- [9] Trousdale RT, McGrory BJ, Berry DJ, Becker MW, Harmsen WS. Patients' concerns prior to undergoing total hip and total knee arthroplasty. Mayo Clin Proc 1999;74:978–82.
- [10] Hettrich CM, Hammoud S, LaMont LE, Arendt EA, Hannafin JA. Sex-specific analysis of data in high-impact orthopaedic journals: how are we doing? Clin Orthop Relat Res 2015;473:3700–4.
- [11] Wizeman TM. Sex-specific reporting of scientific research: a workshop summary. Washington, DC: National Academies Press; 2012.
- [12] Choong AL, Shadbolt C, Dowsey MM, Choong PF. Sex-based differences in the outcomes of total hip and knee arthroplasty: a narrative review. ANZ J Surg 2021;91:553–7.
- [13] Novicoff WM, Saleh KJ. Examining sex and gender disparities in total joint arthroplasty. Clin Orthop Relat Res 2011;469:1824–8.
- [14] Bischof AY, Steinbeck V, Kuklinski D, Marques CJ, Bohlen K, Westphal KC, et al. What is the association between gender and self-perceived health status when controlling for disease-specific conditions? A retrospective data analysis of pre- and post-operative EQ-5D-5L differences in total hip and knee arthroplasty. BMC Musculoskelet Disord 2023;24:914.
- [15] Kennedy DM, Hanna SE, Stratford PW, Wessel J, Gollish JD. Preoperative function and gender predict pattern of functional recovery after hip and knee arthroplasty. J Arthroplasty 2006;21:559–66.
- [16] Basques BA, Bell JA, Fillingham YA, Khan JM, Della Valle CJ. Gender differences for hip and knee arthroplasty: complications and healthcare utilization. J Arthroplasty 2019;34:1593–1597.e1.
- [17] Basques BA, Bell JA, Sershon RA, Della Valle CJ. The influence of patient gender on morbidity following total hip or total knee arthroplasty. J Arthroplasty 2018;33:345–9.
- [18] Robinson J, Shin JI, Dowdell JE, Moucha CS, Chen DD. Impact of gender on 30-day complications after primary total joint arthroplasty. J Arthroplasty 2017;32:2370–4.
- [19] Tucker KK, Mont MA. Working Toward Health Equity and diversity in our field of Hip and Knee Arthroplasty. J Arthroplasty 2023;38:2202–3. <https://doi.org/10.1016/j.arth.2023.09.017>.
- [20] Rana AJ, Sturgeon CM, McGrory BJ, Frazier MV, Babikian GM. The able anterior-based muscle-sparing approach: a safe and effective option for total hip arthroplasty. Arthroplast Today 2022;16:264–269.e1.
- [21] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chron Dis 1987;40:373–83.
- [22] Quan H, Li B, Couris CM, et al. Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. Am J Epidemiol 2011;173:676–82.
- [23] Plate JF, Deen JT, Deans CF, Pour AE, Yates AJ, Sterling RS. Implementation of the new medicare-mandated patient-reported outcomes after joint

- arthroplasty performance measure. *J Arthroplasty* 2024;39:1136–9. <https://doi.org/10.1016/j.arth.2024.01.038>.
- [24] Lyman S, Lee YY, McLawhorn AS, Islam W, MacLean CH. What are the minimal and substantial improvements in the hoos and koos and jr versions after total joint replacement? *Clin Orthop Relat Res* 2018;476:2432–41. <https://doi.org/10.1097/corr.0000000000000456>.
 - [25] United States Census Bureau QuickFacts Maine. USA.gov. <https://www.census.gov/quickfacts/fact/table/ME.US/INC910218>. [Accessed 16 May 2024].
 - [26] Melton LJ, Chrischilles EA, Cooper C, Lane AW, Riggs BL. Perspective how many women have osteoporosis? *J Bone Miner Res* 1992;7:1005–10.
 - [27] Yang C, Han X, Wang J, Yuan Z, Wang T, Zhao M, et al. Cemented versus uncemented femoral component total hip arthroplasty in elderly patients with primary osteoporosis: retrospective analysis with 5-year follow-up. *J Int Med Res* 2019;47:1610–9.
 - [28] Mears SC. Management of severe osteoporosis in primary total hip arthroplasty. *Curr Transl Geriatr Exp Gerontol Rep* 2013;2:99–104. <https://doi.org/10.1007/s13670-013-0044-7>.
 - [29] Tanzer M, Graves SE, Peng A, Shimmin AJ. Is cemented or cementless femoral stem fixation more durable in patients older than 75 years of age? A comparison of the best-performing stems. *Clin Orthop Relat Res* 2018;476:1428.
 - [30] Berend ME, Smith A, Meding JB, Ritter MA, Lynch T, Davis K. Long-term outcome and risk factors of proximal femoral fracture in uncemented and cemented total hip arthroplasty in 2551 hips. *J Arthroplasty* 2006;21:53–9.
 - [31] Edelstein AI, Hume EL, Pezzin LE, McGinley EL, Dillingham TR. The impact of femoral component cementation on fracture and mortality risk in elective total hip arthroplasty: analysis from a national medicare sample. *J Bone Joint Surg Am* 2022;104:523.
 - [32] Singh JA, Jensen MR, Harmsen SW, Lewallen DG. Are gender, comorbidity, and obesity risk factors for postoperative periprosthetic fractures after primary total hip arthroplasty? *J Arthroplasty* 2013;28:126–131.e2.
 - [33] Berend KR, Mirza AJ, Morris MJ, Lombardi AV. Risk of periprosthetic fractures with direct anterior primary total hip arthroplasty. *J Arthroplasty* 2016;31:2295–8.
 - [34] Hopman SR, de Windt TS, van Erp JHJ, Bekkers JEJ, de Gast A. Uncemented total hip arthroplasty: increased risk of early periprosthetic fracture requiring revision surgery in elderly females. *J Orthop* 2021;25:40–4. <https://doi.org/10.1016/j.jor.2021.03.025>.
 - [35] Woolley KA, Chi H, Allahabadi S, Fluet A, Roach C, Ward DT, et al. Sex-based differences in the utilization of shoulder, hip, and knee arthroplasty. *JAAOS Glob Res Rev* 2023;7:e23.
 - [36] Zhang Y, Jordan JM. Epidemiology of osteoarthritis. *Clin Geriatr Med* 2010;26:355–69.
 - [37] Kaprio J, Kujala UM, Peltonen L, Koskenvuo M. Genetic liability to osteoarthritis may be greater in women than men. *BMJ* 1996;313:232.
 - [38] Contartese D, Tschon M, De Mattei M, Fini M. Sex specific determinants in osteoarthritis: a systematic review of preclinical studies. *Int J Mol Sci* 2020;21:3696.
 - [39] Craft RM. Sex differences in opioid analgesia: “from mouse to man”. *Clin J Pain* 2003;19:175–86.
 - [40] Kushwaha NS, Chauhan P, Verma A, Kaushal RK, Patel MK, Kumar S. Comparative efficacy of intra-articular hyaluronic acid and corticosteroid injections in the management of knee osteoarthritis. *Int J Res Orthop* 2023;10/26:1187–91. <https://doi.org/10.18203/issn.2455-4510.IntJResOrthop20233262>.
 - [41] Mota REM, Tarricone R, Ciani O, Bridges JF, Drummond M. Determinants of demand for total hip and knee arthroplasty: a systematic literature review. *BMC Health Serv Res* 2012;12:1–18.
 - [42] Huynh C, Puyraimond-Zemmour D, Maillefert J-F, Conaghan PG, Davis AM, Gunther KP, et al. Factors associated with the orthopaedic surgeon's decision to recommend total joint replacement in hip and knee osteoarthritis: an international cross-sectional study of 1905 patients. *Osteoarthritis Cartilage* 2018;26:1311–8.
 - [43] Fraenkel L, Suter L, Weis L, Hawker GA. Variability in recommendations for total knee arthroplasty among rheumatologists and orthopedic surgeons. *J Rheumatol* 2014;41:47–52.
 - [44] Borkhoff CM, Hawker GA, Kreder HJ, Glazier RH, Mahomed NN, Wright JG. Influence of patients' gender on informed decision making regarding total knee arthroplasty. *Arthritis Care Res* 2013;65:1281–90.
 - [45] Maltenfort M, Diaz-Ledezma C. Statistics in brief: minimum clinically important difference—availability of reliable estimates. *Clin Orthop Relat Res* 2017;475:933–46. <https://doi.org/10.1007/s11999-016-5204-6>.
 - [46] Leopold SS, Porcher R. Editorial: the minimum clinically important difference—the least we can do. *Clin Orthop Relat Res* 2017;475:929–32. <https://doi.org/10.1007/s11999-017-5253-5>.
 - [47] Tanghe KK, Beiene ZA, McLawhorn AS, MacLean CH, Gausden EB. Metrics of clinically important changes in total hip arthroplasty: a systematic review. *J Arthroplasty* 2023;38:383–8. <https://doi.org/10.1016/j.arth.2022.09.007>.
 - [48] Jaeschke R, Singer J, Guyatt GH. Measurement of health status: ascertaining the minimal clinically important difference. *Contr Clin Trials* 1989;10:407–15. [https://doi.org/10.1016/0197-2456\(89\)90005-6](https://doi.org/10.1016/0197-2456(89)90005-6).
 - [49] Stratford PW, Binkley JM, Riddle DL, Guyatt GH. Sensitivity to change of the roland-morris back pain questionnaire: Part 1. *Phys Ther* 1998;78:1186–96. <https://doi.org/10.1093/ptj/78.11.1186>.
 - [50] Su F, Allahabadi S, Bongbong DN, Feeley BT, Lansdown DA. Minimal clinically important difference, substantial clinical benefit, and patient acceptable symptom state of outcome measures relating to shoulder pathology and surgery: a systematic review. *Curr Rev Musculoskelet Med* 2021;14:27–46.
 - [51] Cvetanovich GL, Gowd AK, Liu JN, Nwachukwu BU, Cabarcas BC, Cole BJ, et al. Establishing clinically significant outcome after arthroscopic rotator cuff repair. *J Shoulder Elbow Surg* 2019;28:939–48.
 - [52] Laupacis A, Bourne R, Rorabeck C, Feeny D, Wong C, Tugwell P, et al. The effect of elective total hip replacement on health-related quality of life. *J Bone Joint Surg Am* 1993;75:1619–26.
 - [53] Hawker G, Wright J, Coyte P, Paul J, Dittus R, Croxford R, et al. Health-related quality of life after knee replacement. Results of the knee replacement patient outcomes research team study. *J Bone Joint Surg Am* 1998;80:163–73.
 - [54] Ethgen O, Bruyère O, Richy F, Dardennes C, Reginster J-Y. Health-related quality of life in total hip and total knee arthroplasty: a qualitative and systematic review of the literature. *J Bone Joint Surg Am* 2004;86:963–74.
 - [55] Jones CA, Beaupre LA, Johnston D, Suarez-Almazor ME. Total joint arthroplasties: current concepts of patient outcomes after surgery. *Rheum Dis Clin N Am* 2007;33:71–86.
 - [56] Mariconda M, Galasso O, Costa GG, Recano P, Cerbasi S. Quality of life and functionality after total hip arthroplasty: a long-term follow-up study. *BMC Musculoskelet Disord* 2011;12:1–10.
 - [57] Jain D, Bendich I, Nguyen L-CL, Nguyen LL, Lewis CG, Huddleston JL, et al. Do patient expectations influence patient-reported outcomes and satisfaction in total hip arthroplasty? A prospective, multicenter study. *J Arthroplasty* 2017;32:3322–7.
 - [58] Mancuso CA, Sculco TP, Salvati EA. Patients with poor preoperative functional status have high expectations of total hip arthroplasty. *J Arthroplasty* 2003;18:872–8.
 - [59] Hung M, Bounsanga J, Voss MW, Saltzman CL. Establishing minimum clinically important difference values for the patient-reported outcomes measurement information system physical function, hip disability and osteoarthritis outcome score for joint reconstruction, and knee injury and osteoarthritis outcome score for joint reconstruction in orthopaedics. *World J Orthoped* 2018;9:41.
 - [60] Vincent HK, Alfano AP, Lee L, Vincent KR. Sex and age effects on outcomes of total hip arthroplasty after inpatient rehabilitation. *Arch Phys Med Rehabil* 2006;87:461–7.
 - [61] Passias PG, Poorman GW, Bortz CA, Qureshi R, Diebo BG, Paul JC, et al. Predictors of adverse discharge disposition in adult spinal deformity and associated costs. *Spine J* 2018;18:1845–52.
 - [62] Aldebeyan S, Aoude A, Fortin M, Nooh A, Jarzem P, Ouellet J, et al. Predictors of discharge destination after lumbar spine fusion surgery. *Spine* 2016;41:1535–41.
 - [63] Whitlock KG, Pionov HI, Shah SH, Wang OJ, Gonzalez MH. Gender role in total knee arthroplasty: a retrospective analysis of perioperative outcomes in US patients. *J Arthroplasty* 2016;31:2736–40.
 - [64] Lundblad H, Kreicbergs A, Jansson K-A. Prediction of persistent pain after total knee replacement for osteoarthritis. *J Bone Joint Surg Br* 2008;90:166–71.
 - [65] Lemmer JT, Martel GF, Hurlbut DE, Hurley BF. Age and sex differentially affect regional changes in one repetition maximum strength. *J Strength Condit Res* 2007;21:731–7.
 - [66] Pohl JM, Collins C, Given CW. Beyond patient dependency. *Home Health Care Serv Q* 1996;15:33–47. https://doi.org/10.1300/J027v15n04_03.
 - [67] Glazer NY. The home as workshop: women as amateur nurses and medical care providers. *Gend Soc* 1990;4:479–99. <https://doi.org/10.1177/089124390004004004>.
 - [68] Goodridge D, Hawranik P, Duncan V, Turner H. Socioeconomic disparities in home health care service access and utilization: a scoping review. *Int J Nurs Stud* 2012;49:1310–9.
 - [69] Ross L, O'Rourke S, Toland G, Harris Y, MacDonald DJ, Clement ND, et al. Non-response to hip and knee arthroplasty patient-reported outcome questionnaires. *Bone Joint* 2022;104:B:8.
 - [70] Ezomo OT, Sun D, Gronbeck C, Harrington MA, Malawi MJ. Where do we stand today on racial and ethnic health disparities? An analysis of primary total hip arthroplasty from a 2011–2017 national database. *Arthroplast Today* 2020;6:872–6.
 - [71] Lavernia CJ, Villa JM. Does race affect outcomes in total joint arthroplasty? *Clin Orthop Relat Res* 2015;473:3535–41.
 - [72] Pierce TP, Elmallah RK, Lavernia CJ, Chen AF, Harwin SF, Thomas CM, et al. Racial disparities in lower extremity arthroplasty outcomes and use. *Orthopedics* 2015;38:e1139–46.
 - [73] Stone AH, MacDonald JH, Joshi MS, King PJ. Differences in perioperative outcomes and complications between african American and white patients after total joint arthroplasty. *J Arthroplasty* 2019;34:656–62. <https://doi.org/10.1016/j.arth.2018.12.032>.
 - [74] Johnson MA, Sloan M, Lopez VS, Andah G, Sheth N, Nelson C. Racial disparities in peri-operative complications following primary total hip arthroplasty. *J Orthop* 2020;21:155–60. <https://doi.org/10.1016/j.jor.2020.03.037>.
 - [75] Bove AM, Porter J, Sayeed A, Klatt B. Race and gender disparities in physical function before and after total hip arthroplasty: a retrospective analysis. *Osteoarthritis Cartilage* 2018;26:S270. <https://doi.org/10.1016/j.joca.2018.02.549>.
 - [76] Wilson Y, White A, Jefferson A, Danis M. Intersectionality in clinical medicine: the need for a conceptual framework. *Am J Bioeth* 2019;19:8–19. <https://doi.org/10.1080/15265161.2018.1557275>.
 - [77] Ho IK, Sheldon TA, Botelho E. Medical mistrust among women with intersecting marginalized identities: a scoping review. *Ethn Health* 2022;27:1733–51. <https://doi.org/10.1080/13557858.2021.1990220>.

Appendix

Supplementary Table 1

Charlson Comorbidity Index.

Characteristic	Overall, N = 6,418 ^a	Women, N = 3,532 ^a	Men, N = 2,886 ^a	P Value ²
Charlson Comorbidity Index	0.65 (1.16)	0.65 (1.13)	0.65 (1.20)	.2
Updated Charlson Comorbidity Index	0.46 (0.97)	0.47 (0.94)	0.46 (1.00)	.061
Myocardial infarction (%)	251 (4.1)	138 (4.1)	113 (4.1)	>.9
Congestive heart failure (%)	260 (4.2)	136 (4.0)	124 (4.5)	.3
Peripheral vascular disease (%)	145 (2.4)	74 (2.2)	71 (2.6)	.3
Cerebrovascular disease (%)	84 (1.4)	46 (1.4)	38 (1.4)	>.9
Dementia (%)	93 (1.5)	61 (1.8)	32 (1.2)	.042
Chronic pulmonary disease (%)	976 (16)	549 (16)	427 (16)	.5
Rheumatic disease (%)	193 (3.1)	105 (3.1)	88 (3.2)	.8
Peptic ulcer disease (%)	16 (0.3)	8 (0.2)	8 (0.3)	.7
Mild liver disease (%)	102 (1.7)	53 (1.6)	49 (1.8)	.5
Moderate/severe liver disease (%)	0 (0)	0 (0)	0 (0)	
Diabetes without complications (%)	657 (11)	360 (11)	297 (11)	.8
Diabetes with complications (%)	174 (2.8)	100 (2.9)	74 (2.7)	.5
Hemiplegia or paraplegia (%)	21 (0.3)	11 (0.3)	10 (0.4)	.8
Renal disease moderate/severe (%)	318 (5.2)	176 (5.2)	142 (5.2)	>.9
Any malignancy (%)	71 (1.2)	44 (1.3)	27 (1.0)	.2
Metastatic solid tumor (%)	16 (0.3)	7 (0.2)	9 (0.3)	.4
AIDS/HIV (%)	2 (<0.1)	2 (<0.1)	0 (0)	.5

Bolded values are statistically significant with *P*-value < .05.

AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency virus.

^a n (%); Mean (standard deviation).