ELSEVIER

ARTHROPLASTY
TODAY

AAHKS
AMERICAN ASSOCIATION OF
HIP AND KNEE SURGEONS

Original Research

Racial Differences in Patient Satisfaction With the Hospital Experience Undergoing Primary Unilateral Hip and Knee Arthroplasty: A Retrospective Study

Orett C. Burke Jr., BS [a, *], J. Alex B. Gibbons, BA [b], Huong T. Do, MA [c], Emily Y. Lai, MS [c], Letitia Bradford, MD [d], Anne R. Bass, MD [b, e], Troy B. Amen, MD, MBA [f], Linda A. Russell, MD [b, e], Bella Mehta, MBBS, MS [b, e], Michael Parks, MD [f], Mark Figgie, MD [f], Susan Goodman, MD [b, e]

[a] Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ, USA
[b] Division of Rheumatology, Department of Medicine, Hospital for Special Surgery, New York, NY, USA
[c] Division of Research Administration, Hospital for Special Surgery, New York, NY, USA
[d] Department of Orthopedics, University of Nevada, Reno, Reno, NV, USA
[e] Division of Rheumatology, Department of Medicine, Weill Cornell Medicine, New York, NY, USA
[f] Department of Orthopedics, Hospital for Special Surgery, New York, NY, USA

ARTICLE INFO

ABSTRACT

Background: Press Ganey (PG) inpatient survey is widely used to track patient satisfaction with the hospital experience. Our aim was to use the PG survey to determine if there are racial differences in overall hospital experience and perception of nurses and surgeons following hip and knee arthroplasty.
Methods: We retrospectively analyzed Black and White patients from hip and knee arthroplasty registries from a single institution between July 2010 and February 2012. The overall assessment score for the hospital experience and perception of the nurse and surgeon questions from the PG inpatient survey were dichotomized as "not completely satisfied" or "completely satisfied". Multivariable logistic regression models were developed to determine the impact of race on the likelihood of being 'completely satisfied' in the hip and knee cohorts.
Results: There were 2517 hip and 2114 knee patients who underwent surgery and completed the PG survey, of whom 3.9% were Black and 96.0% were White. Black patients were less likely to be completely satisfied with their hospital experience compared to White patients in the hip (odds ratio 0.62, confidence interval 0.39-1.00, $P = .049$) and knee (odds ratio 0.52, confidence interval 0.33-0.82, $P = .005$) cohorts. Black patients were also less likely to be completely satisfied with multiple aspects of care they received from the nurse and surgeon in both cohorts.
Conclusions: We found that the PG Survey shows Black patients were less likely to be completely satisfied than White patients with the hospital experience, including their interactions with nurses and surgeons. More work is needed to understand this difference.
 Published by Elsevier Inc. on behalf of The American Association of Hip and Knee Surgeons. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

Hospitals commonly use the Press Ganey (PG) inpatient survey to track patient satisfaction with the hospital experience [1]. In fact, the Centers for Medicare and Medicaid Services rely on PG survey data for hospital comparison, reimbursement, and recommendation [1-3]. Modifiable factors such as respect, communication, the responsiveness of hospital staff, control of pain, or the hospital environment are known to influence a patient's overall rating when using the PG survey [4]. Furthermore, the patient's perception of the orthopaedists and nurses may outweigh the perception of pain control in the overall surgical experience, with nurses having the most influence [5]. However, the association between patient race (Black and White) and satisfaction with the hospital experience, including the perception of the nurses and surgeons using the PG

* Corresponding author. Rutgers Robert Wood Johnson Medical School, 675 Hoes Lane West, Piscataway, NJ 08854, USA.
E-mail address: ocb4@rwjms.rutgers.edu

survey following total hip arthroplasty (THA) and total knee arthroplasty (TKA), is not well understood. Racial disparities in utilization and outcomes of THA and TKA have persisted over decades [6-9], and patients perceptions of their hospital care may play a role.

Our primary objectives were to: 1) evaluate whether there are racial differences in satisfaction with the overall hospital experience; and 2) determine if race impacted the perception of the care patients received from nurses and surgeons. This would potentially provide insight into how these factors contribute to the racial disparity in arthroplasty utilization and outcomes. We hypothesized that Black patients would be less likely to be completely satisfied with both their overall hospital experience and nurse and surgeon, as reported in the PG survey.

Material and methods

Patient cohort

This was a retrospective analysis of PG survey data from patients identified using a single institutional hip and knee arthroplasty registry. We included patients whose race was recorded as Black or White, who resided in New York, New Jersey, or Connecticut, and who underwent a primary unilateral hip or knee arthroplasty at a high-volume tertiary care hospital from July 2010 to February 2012. The patients in this arthroplasty registry that met this inclusion criterion were linked to their PG response data, and any patient without a survey was excluded. As the PG overall assessment score requires all questions to be completed to generate a valid score, patients who did not complete all 3 questions were also excluded from the analysis (Fig. 1).

Clinical and administrative data from the hospital record, such as demographics, International Classification of Diseases, Ninth Revision diagnosis and procedure codes, payor, length of stay, discharge disposition, and intra- and post-operative complications, were collected as part of the registries. The median length of stay (LOS) for the knee and hip cohort was 5 days. American Society of Anesthesiologists (ASA) status was also captured at baseline. ASA status is a ranking that quantifies surgical risk on the basis of overall health on a scale of 1 to 6, with a score of 1 indicating a healthy patient and a score of 6 indicating an organ donor [10]. Medical

comorbidities were assessed by calculating a Charlson comorbidity index [11]. Socioeconomic status (SES) was assessed by using primary payor.

Data from the arthroplasty registries were linked to patients' postoperative PG survey responses. The PG survey was mailed to approximately 75% of patients who underwent hip and knee arthroplasty within 7 days after hospital discharge. This survey uses a 5-point Likert scale for each question, asking about patient satisfaction with the overall hospital experience, nurse, and surgeon. Three questions from the overall assessment section of the PG survey: "how well staff worked together to care for you," "likelihood of your recommending this hospital to others," and "overall rating of care given at hospital" (Fig. 2) were used to generate an overall assessment score for each patient. Each response was converted into percentages as follows: 1 (very poor) - 0%; 2 (poor) - 25%; 3 (fair) - 50%; 4 (good) - 75%; 5 (very good) - 100% and the score was calculated as the mean of their responses to these three questions. This variable was converted into a binary variable where a maximum overall score (100%) is designated as "completely satisfied" and all other possible scores are designated as "not completely satisfied," which is in line with the current hospital practice of score reporting [4]. In addition to the overall score, we dichotomized and studied other individual patient satisfaction questions focused on the perception of nurses and surgeons captured in the survey, such as (1) their courtesy, (2) promptness of response to the call button, (3) attitude toward requests, (4) attention to personal needs, (5) ability to keep them informed, (6) assessment of skill level, (7) time spent with the patient, and (8) concern for questions/worries (Fig. 2).

Statistical analysis

Demographics and clinical characteristics of the hip and knee arthroplasty cohorts were summarized as frequency (percentage) for categorical variables. Univariate analyses comparing characteristics between patients whose overall assessment score indicated they were "completely satisfied" were performed using Fisher's exact test and chi-square test, as appropriate. Multivariable logistic regression was performed to obtain adjusted odds ratios (OR) for factors associated with being "completely satisfied" for the overall satisfaction score as well as individual questions related to patients'
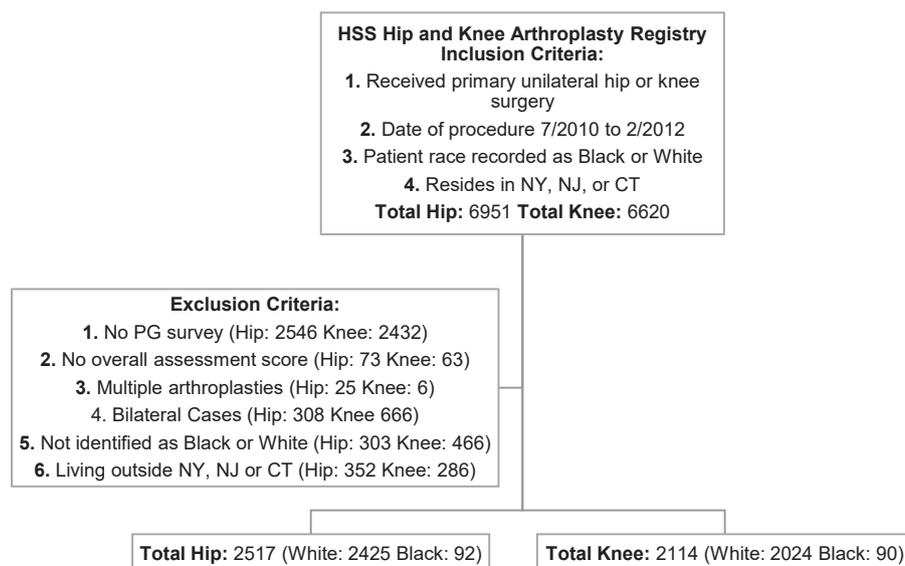

Figure 1. Schematic description of the patient selection process.

Question Domain	Questions
Overall Assessment	How well staff worked together to care for you
	Likelihood of your recommending this hospital to others
	Overall rating of care given at hospital
Nurses	
	Friendliness/courtesy of the nurses
	Promptness in responding to the call button
	Nurses attitude toward your requests
	Amount of attention paid to your special or personal needs
	How well the nurses kept you informed
	Skill of the nurses
Surgeon	
	Time surgeon spent with you
	Surgeon's concern for your questions and worries
	How well the surgeon kept you informed
	Friendliness/courtesy of surgeon
	Skill of surgeon

Note: Responses were converted into percentages as follows using the Likert Scale: 1 (very poor) - 0%, 2 (poor) - 25%, 3 (fair) - 50%, 4 (good) - 75%, 5 (very good) - 100%.

Figure 2. Press Ganey survey questions analyzed in this study using the Likert scale.

experiences with their nurse or surgeon. Factors included in all regression analyses were patient age in years (<65, 65-74, and ≥75), sex, race, ASA status (1, 2, and 3-4), primary payor (Medicare, Medicaid, commercial, and other), extended LOS (LOS ≥ 5 days), and discharge disposition (home, rehabilitation, skilled nursing facility [SNF], and other).

We assessed potential nonresponse bias by comparing patient demographics between the study cohorts and those who were excluded due to not completing the PG survey (Supplemental Tables A and B). All analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC, USA). P-values <.05 were considered significant. This study was reviewed and approved by our institutional review board (IRB # 2020-2564).

Results

Overall assessment score

There were 2517 hip and 2114 knee patients who completed the overall assessment section of the PG survey. Overall, 3.9% were Black, and 96.0% of the patients were White. Over 90% of the included cases were total joint arthroplasty, but the hip and knee cohorts also included some partial arthroplasty cases. Demographics for each cohort are shown in Table 1.

The multivariable regression models showed that Black patients were less likely to be completely satisfied than White patients in the hip and knee cohorts (OR 0.62; 95% confidence interval [CI] 0.39-1.00; P = .049 and OR 0.52; CI 0.33-0.82; P = .005, respectively). Patients aged 75 and older were also less likely to be completely satisfied than patients aged 65 to 74 years in both cohorts (hip OR 0.69; CI 0.52-0.90; P = .007; and knee OR 0.71; CI 0.55-0.92; P = .010). Longer LOS also reduced the likelihood of being completely satisfied (hip OR 0.76; CI 0.61-0.94; P = .012; and knee OR 0.66; CI 0.54-0.82; P = .000). Patient sex, ASA status, primary payor, and discharge status were not associated with the likelihood of being completely satisfied in either cohort (Table 2).

Patient perception of the nurse and surgeon

Black patients were less likely to be completely satisfied than White patients in the knee cohort (Fig. 3). Specifically, with the nurses' courtesy (OR 0.58; CI 0.36-0.93; P = .023), attitude toward requests (OR 0.49; CI 0.31-0.76; P = .001), attention to personal needs (OR 0.52; CI 0.33-0.80; P = .003); and ability to keep them informed (OR 0.51; CI 0.33-0.80; P = .003). In the hip cohort, Black patients were less likely to be completely satisfied than White patients with the surgeon's skill (OR 0.34; CI 0.20-0.59; P= <.001); Complete results of the analysis for hip patients are provided in Supplemental Tables C-E.

Discussion

In this study, we found racial differences in overall satisfaction with the hospital experience following hip and knee arthroplasty. Black patients were less likely to be completely satisfied with their overall hospital experience compared to White patients. However, patient sex, ASA status, and primary payor were not associated with satisfaction in either cohort. Regarding the patient's perception of the nurses, Black patients in the knee cohort were less likely to be completely satisfied when asked about their nurse's courtesy, attitude toward requests, attention to personal needs, and ability to keep them informed. Black patients in the hip cohort were less likely to be completely satisfied with their surgeon's skills.

Although the findings from this study are likely multifaceted and multifactorial, they may partially stem from potential provider bias or lack of physician-patient racial concordance. Prior studies have examined provider racial implicit bias. Dy et al. and Oliver et al. both discovered that there was no association between orthopaedic surgeons, internal medicine, and family medicine physicians' TKA recommendations and patients race while using an investigator-developed questionnaire and Implicit Association Test (IAT) [12,13], which served as a validated tool to measure implicit and explicit bias [14]. In addition, Cohen-Levy et al. found no association between regional IAT scores and arthroplasty utilization rates. However, the differences in arthroplasty utilization were greater in regions with a higher proportion of Black residents [15]. Although there is no association between IAT and TKA recommendations, physicians viewed White patients as more medically cooperative and endorsed higher feelings of warmth toward them over Black patients [13]. These findings all point to the possibility that a physician's unconscious bias may impact their perception of Black patients and inform their interactions with them. Furthermore, a prior research survey conducted in 2018 by the Harvard T.H. Chan School of Public Health revealed that 32% of Black Americans had experienced racial discrimination when going to a doctor or health clinic [16]. Regarding a lack of physician-patient racial

Table 1
Patient characteristics by joint and race.

Patient characteristics	Hip				Knee			
	Black		White		Black		White	
	N	%	N	%	N	%	N	%
Sex								
Female	56	60.9	1308	53.9	67	74.4	1214	60.0
Age group								
0-64								
65-74	21	22.8	755	31.1	32	35.6	796	39.3
75+	12	13.0	475	19.6	5	5.6	501	24.8
ASA status[a]								
1	7	7.6	187	7.7	4	4.4	47	2.3
2	67	72.8	1867	77.0	67	74.4	1580	78.1
3 or 4	18	19.6	371	15.3	19	21.1	397	19.6
Charlson comorbidity index								
0	70	76.1	1896	78.2	48	53.3	1456	71.9
1	17	18.5	420	17.3	34	37.8	431	21.3
2+	5	5.4	109	4.5	8	8.9	137	6.8
Payor								
Commercial	5	5.4	76	3.1	5	5.6	76	3.8
Medicare	40	43.5	1155	47.6	41	45.6	1250	61.8
Other	45	48.9	1188	49.0	43	47.8	698	34.5
Medicaid	2	2.2	6	0.2	1	1.1	0	0
LOS ≥ 5[b]								
Yes	32	34.8	718	29.6	48	53.3	1054	52.1
Discharge disposition								
Home	49	53.3	1733	71.5	38	42.2	920	45.5
Rehab	35	38.0	553	22.8	43	47.8	906	44.8
SNF[c]	7	7.6	129	5.3	7	7.8	184	9.1
Other	1	1.1	10	0.4	2	2.2	14	0.7
Complications								
Yes	1	1.1	15	0.6	1	1.1	14	0.7

[a] ASA, American Society of Anesthesiologist (ASA) physical status classification.
[b] LOS ≥ 5 is length of stay at least 5 days.
[c] SNF is skilled nursing facility.

concordance, Takeshita et al. found that Black patients who were treated by White or Asian surgeons were less likely to rate them favorably compared to those who saw Black surgeons [17]. This highlights the need for a more diverse workforce since about 2% of orthopaedic surgeons are Black [18]. Although prior studies focused on physician-patient racial concordance, it would be interesting if this principle also applies to the nursing staff.

Our findings contribute to the paucity of research investigating associations between patient race and satisfaction with the hospital experience, including the perception of the nurses and surgeons

Table 2
Hip and knee cohort logistic regression results: likelihood of being completely satisfied.

Variable	Level	OR	Hip cohort			Adjusted OR[a]	Knee cohort	
			95% Confidence interval	P-value			95% Confidence interval	P-value
Age group	0-64	1.26	0.86-1.84	.240		1.10	0.73-1.65	.665
	65-74	reference						
	75+	0.69	0.52-0.90	.007		0.71	0.55-0.92	.010
Sex	Female vs male	0.89	0.72-1.09	.246		1.08	0.87-1.34	.473
Race	Black vs White	0.62	0.39-1.00	.049		0.52	0.33-0.82	.005
ASA status[b]	1	reference						
	2	0.97	0.65-1.43	.868		0.88	0.43-1.79	.720
	3 or 4	0.75	0.47-1.17	.204		0.85	0.40-1.78	.661
Primary payor	Medicare	reference						
	Commercial	0.85	0.44-1.65	.640		0.90	0.48-1.69	.743
	Medicaid	0.71	0.14-3.72	.689		>999.99	0.00-[e]	.974
	Other	0.77	0.54-1.10	.145		0.97	0.65-1.45	.893
LOS ≥ 5[c]	Yes	0.76	0.61-0.94	.012		0.66	0.54-0.82	.000
Discharge disposition	Home	reference						
	Rehab	0.88	0.68-1.13	.315		0.87	0.68-1.10	.235
	SNF[d]	0.85	0.56-1.30	.459		1.02	0.69-1.50	.924
	Other	1.18	0.25-5.56	.835		0.91	0.28-2.90	.867

OR, odds ratio.
[a] Adjusted for age, sex, race, ASA status, primary payor, length of stay and discharge disposition.
[b] ASA, American Society of Anesthesiologist (ASA) physical status classification.
[c] LOS ≥5 is length of stay at least 5 days.
[d] SNF is skilled nursing facility.
[e] >999.99.

*p =0.001, ** p = 0.003, *** p = 0.023
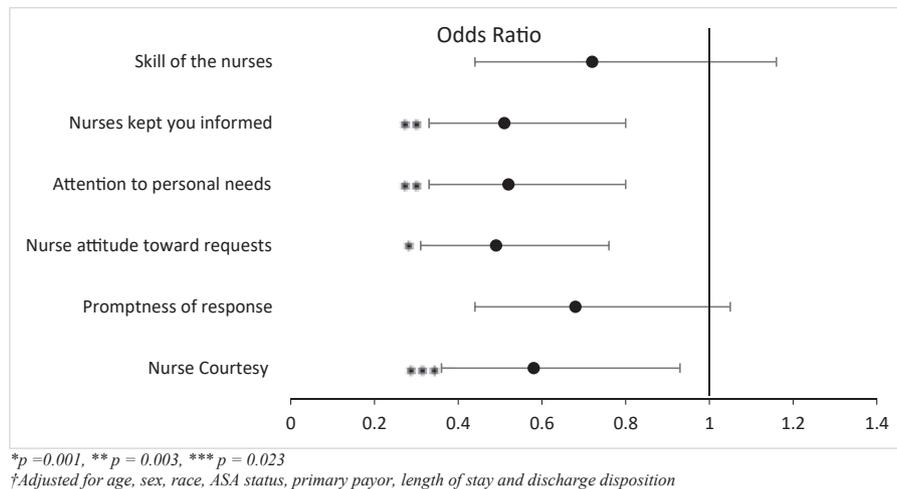†Adjusted for age, sex, race, ASA status, primary payor, length of stay and discharge disposition

Figure 3. Knee cohort: likelihood of Black patients being completely satisfied with the nurses' care *P =.001, **P = .003, ***P = .023, †Adjusted for age, sex, race, ASA status, primary payor, length of stay, and discharge disposition.

following hip and knee arthroplasty. This was reinforced by the systematic reviews completed by Mehta et al. and Goodman et al., which found few articles that investigated racial disparities between Black and White individuals undergoing THA and TKA, respectively [7,8]. In addition, Halawi et al. found that Hispanic patients were more likely to be dissatisfied after TKA and THA due to outcomes including persistent pain and functional limitations but did not investigate their response to the hospital experience [19]. Interestingly, Silva et al. found that African Americans compared to White patients and lower SES patients, were more likely to report higher levels of inpatient satisfaction after knee arthroplasty [3]. These differences can possibly be attributed to the questions they sampled from the Hospital Consumer Assessment of Healthcare Providers and Systems survey. They selected questions based on the hospital inpatient value-based purchasing program, which financially incentivizes hospitals to meet standards of patient satisfaction.

This study did not find patient sex, ASA status, and primary payor associated with complete satisfaction. Regarding sex, the data has been inconsistent [20]. However, some studies report that females are less likely to be satisfied in medical/surgical services, trauma, and acute surgery, and orthopaedic outpatient settings [3,20,21]. In fact, Freudenberger et al. found that nurse communication had the greatest correlation with hospital ratings [20]. All these studies used the Hospital Consumer Assessment of Healthcare Providers and Systems survey, which does not include the "how well the staff worked together for you" question when inquiring about the overall hospital experience. This question is a part of the PG survey and may have contributed to the lack of statistical significance regarding patient sex in our study.

Regarding SES, 2 studies found that more affluent individuals were more likely to be dissatisfied with their hospital experience after knee arthroplasty [3,22]. Both studies used the Agency of Healthcare Research Quality Algorithm, which includes occupation, income, value of owner-occupied homes, education, and housing structure. These factors are probably more accurate indicators of SES. Therefore, to investigate SES, a more accurate model is needed.

In our study, Black knee patients were less likely to be completely satisfied regarding their nurse's courtesy, promptness of response to the call button, attitude toward requests, attention to personal needs, and ability to keep them informed. The importance of communication was supported by prior research, which found that patients who received a TKA and made negative comments about items such as room conditions and inefficient communication were less likely to recommend their care to peers [23]. Additionally, Delanois et al. reported that for men, pain management most influenced their hospital rating, while for women, staff responsiveness had the greatest influence on their hospital rating after THA [24].

This study had several limitations. First, it was limited to a single high-volume orthopaedic specialty hospital that had few Medicaid patients, which may reduce the generalizability. Our study included 3.9% Black patients, which is lower than the national average of 5% according to the American Joint Replacement Registry [25]. This is likely due to a multitude of reasons regarding participation in research. It is possible we did not meet the national average due to mistrust of academic and research institutions related to historical and current events including the Tuskegee Syphilis experiment or experience with racism or discrimination, fear that research findings would reinforce negative stereotypes about ethnic groups or not directly benefiting the African American community [26]. Another potential reason is our method of reaching out to patients by mail. Medicare respondents to the Medicare Consumer Assessment of Healthcare Providers, which assessed their health care experience showed that compared with non-Hispanic White respondents, Asian respondents were more likely to respond by mail, but African American and Hispanic patients preferred to respond by phone [27]. Similar to another institutional study regarding race, they utilized Press Ganey's HCAPHS survey to measure responder bias after TKA or THA and found that White patients were more likely to return the mailed survey compared to African Americans [28]. Responders in the TKA and THA cohorts of our study were more likely to be White, older, and healthier (Supplemental Tables A and B). Furthermore, about 20% of our patients were 75 year or older, which may not be representative of other orthopaedic centers.

Conclusions

In this study, we found that Black patients were less likely to be completely satisfied with the overall hospital experience after hip and knee arthroplasty using the PG survey. We also observed that Black patients were less likely to be completely satisfied with their perception of the nurses and surgeons. More research is needed to understand the root causes of these disparities in order to implement actionable strategies to reduce them.

Acknowledgments

Conflicts of interest

References

[1] Mistry JB, Gwam CU, Chughtai M, et al. Factors influencing patients' hospital rating after total joint arthroplasty. Orthopedics 2017;40:377–80.
[2] Nuyen B, Altamirano J, Fassiotto M, Alyono J. Effects of surgeon sociodemographics on patient-reported satisfaction. Surgery 2021;169:1441–5.
[3] Peres-da-Silva A, Kleeman LT, Wellman SS, et al. What factors drive inpatient satisfaction after knee arthroplasty? J Arthroplasty 2017;32:1769–72.
[4] Patel NK, Kim E, Khlopas A, et al. What influences how patients rate their hospital stay after total hip arthroplasty? Surg Technol Int 2017;30:405–10.
[5] Chughtai M, Jauregui J, Mistry JB, et al. What influences how patients rate their hospital stay after total knee arthroplasty? Surg Technol Int 2016;28:261–5.
[6] Singh JA, Lu X, Rosenthal GE, Ibrahim S, Cram P. Racial disparities in knee and hip total joint arthroplasty: an 18-year analysis of national Medicare data. Ann Rheum Dis 2014;73:2107–15.
[7] Mehta BY, Bass AR, Goto R, et al. Disparities in outcomes for Blacks versus Whites undergoing total hip arthroplasty: a systematic literature review. J Rheumatol 2018;45:717–22.
[8] Goodman SM, Parks ML, McHugh K, et al. Disparities in outcomes for African Americans and Whites undergoing total knee arthroplasty: a systematic literature review. J Rheumatol 2016;43:765–70.
[9] Rudisill SS, Varady NH, Birir A, Goodman SM, Parks ML, Amen TB. Racial and ethnic disparities in total joint arthroplasty care: a contemporary systematic review and meta-analysis. J Arthroplasty 2022;38:171–187.e18.
[10] De Cassai A, Boscolo A, Tonetti T, Ban I, Ori C. Assignment of ASA-physical status relates to anesthesiologists' experience: a survey-based national-study. Korean J Anesthesiol 2019;72:53–9.
[11] Voskuijl T, Hageman M, Ring D. Higher Charlson Comorbidity Index Scores are associated with readmission after orthopaedic surgery. Clin Orthop Relat Res 2014;472:1638–44.
[12] Dy CJ, Lyman S, Boutin-Foster C, Felix K, Kang Y, Parks ML. Do patient race and sex change surgeon recommendations for TKA? Clin Orthop Relat Res 2015;473:410–7.
[13] Oliver MN, Wells KM, Joy-Gaba JA, Hawkins CB, Nosek BA. Do physicians' implicit views of African Americans affect clinical decision making? J Am Board Fam Med 2014;27:177–88.
[14] Greenwald AG, Nosek BA, Banaji MR. Understanding and using the implicit association test: I. An improved scoring algorithm. J Pers Soc Psychol 2003;85:197–216.
[15] Cohen-Levy WB, Sloan M, Shoag JM, Chen AF, Bedair HS. Regional implicit bias does not account for racial disparity in total joint arthroplasty utilization. J Arthroplasty 2021;36:3845–9.
[16] Haravrd TH. Discrimination in America: final summary. Chan School of Public health, National Public Radio, & Robert Wood Johnson Foundation; 2018. p. 13. https://www.hsph.harvard.edu/wp-content/uploads/sites/94/2018/01/NPR-RWJF-HSPH-Discrimination-Final-Summary.pdf. [Accessed 1 September 2023].
[17] Takeshita J, Wang S, Loren AW, et al. Association of racial/ethnic and gender concordance between patients and physicians with patient experience ratings. JAMA Netw Open 2020;3:e2024583.
[18] Cherf J. A Snapshot of U.S. Orthopaedic surgeons: results from the 2018 OPUS survey. https://www.aaos.org/aaosnow/2019/sep/youraaos/youraaos01/; 2019. [Accessed 9 September 2022].
[19] Halawi MJ, Jongbloed W, Baron S, Savoy L, Williams VJ, Cote MP. Patient dissatisfaction after primary total joint arthroplasty: the patient perspective. J Arthroplasty 2019;34:1093–6.
[20] Freudenberger DC, Baker EA, Siljander MP, Rohde RS. Factors driving patient perception of quality care after primary total hip and total knee arthroplasty. J Am Acad Orthop Surg Glob Res Rev 2018;2:e061.
[21] Elliott MN, Lehrman WG, Beckett MK, Goldstein E, Hambarsoomian K, Giordano LA. Gender differences in patients' perceptions of inpatient care. Health Serv Res 2012;47:1482–501.
[22] Vovos TJ, Ryan SP, Hong CS, et al. Predicting inpatient dissatisfaction following total joint arthroplasty: an analysis of 3,593 hospital consumer assessment of healthcare providers and systems survey responses. J Arthroplasty 2019;34:824–33.
[23] Bovonratwet P, Shen TS, Islam W, Ast MP, Haas SB, Su EP. Natural language processing of patient-experience comments after primary total knee arthroplasty. J Arthroplasty 2021;36:927–34.
[24] Delanois RE, Gwam CU, Mistry JB, et al. Does gender influence how patients rate their patient experience after total hip arthroplasty? Hip Int 2018;28:40–3.
[25] Surgeons, A.A.o.H.a.K. Racial and ethnic disparities in hip and knee arthroplasty. https://hipknee.aahks.org/racial-and-ethnic-disparities-in-hip-and-knee-arthroplasty/; 2021. [Accessed 30 July 2023].
[26] Scharff DP, Mathews KJ, Jackson P, Hoffsuemmer J, Martin E, Edwards D. More than Tuskegee: understanding mistrust about research participation. J Health Care Poor Underserved 2010;21:879–97.
[27] Klein DJ, Elliott MN, Haviland AM, et al. Understanding nonresponse to the 2007 Medicare CAHPS survey. Gerontologist 2011;51:843–55.
[28] Cleveland Clinic Orthopaedic Arthroplasty, G. Press Ganey Administration of Hospital Consumer Assessment of Healthcare Providers and Systems Survey Result in a Biased Responder Sample for Hip and Knee Arthroplasties. J Arthroplasty 2019;34:2538–43.

Supplemental Table A
Hip cohort: demographic characteristics of responder vs nonresponder.

Demographics	Responder N = 2517	Nonresponder N = 2619	P-value
Race			<.001[d]
Black	92 (3.7%)	155 (5.9%)	
White	2425 (96.3%)	2464 (94.1%)	
Sex			.757
Female	1364 (54.2%)	1408 (53.8%)	
Age			.007[d]
0-64	1254 (49.8%)	1322 (50.5%)	
65-74	776 (30.8%)	718 (27.4%)	
75+	487 (19.4%)	579 (22.1%)	
ASA status[a]			<.001[d]
1	194 (7.7%)	166 (6.3%)	
2	1934 (76.8%)	1910 (72.9%)	
3	385 (15.3%)	535 (20.4%)	
4	4 (0.2%)	8 (0.3%)	
Charlson comorbidity index			<.001[d]
0	1966 (78.1%)	1922 (73.4%)	
1	437 (17.4%)	528 (20.2%)	
2+	114 (4.5%)	169 (6.5%)	
Primary payor			.481
Commercial	81 (3.2%)	82 (3.1%)	
Medicare	1195 (47.5%)	1231 (47.0%)	
Medicaid	8 (0.3%)	16 (0.6%)	
Other	1233 (49.0%)	1290 (49.3%)	
LOS $\geq$ 5[b]			<.001[d]
Yes	750 (29.8%)	1019 (38.9%)	
Disposition			<.001[d]
Home	1782 (70.8%)	1620 (61.9%)	
Rehab	588 (23.4%)	735 (28.1%)	
SNF[c]	136 (5.4%)	241 (9.2%)	
Other	11 (0.4%)	23 (0.9%)	
Complication, Any			.002[d]
Yes	16 (0.6%)	40 (1.5%)	

[a] ASA, American Society of Anesthesiologist (ASA) physical status classification.
[b] LOS $\geq$ 5 is length of stay at least 5 days.
[c] SNF is skilled nursing facility.
[d] Adjusted for age, sex, race, ASA status, primary payor, length of stay, and discharge disposition.

Supplemental Table B
Knee cohort: demographic characteristics of responder vs nonresponder.

Demographics	Responder N = 2114	Nonresponder N = 2495	*P*-value
Race			<.001[d]
Black	90 (4.3%)	263 (10.5%)	
White	2024(95.7%)	2232 (89.5%)	
Sex			.004[d]
Female	1281 (60.6%)	1616 (64.8%)	
Age			<.001[d]
0-64	780 (36.9%)	1012 (40.6%)	
65-74	828 (39.2%)	808 (32.4%)	
75+	506 (23.9%)	675 (27.1%)	
ASA status[a]			.03
1	51 (2.4%)	59 (2.4%)	
2	1647 (77.9%)	1855 (74.4%)	
3	414 (19.6%)	579 (23.2%)	
4	2 (0.1%)	2 (0.1%)	
Charlson comorbidity index			<.001[d]
0	1504 (71.1%)	1647 (66.0%)	
1	465 (22.0%)	621 (24.9%)	
2+	145 (6.9%)	227 (9.1%)	
Primary payor			<.001[d]
Commercial	81 (3.8%)	109 (4.4%)	
Medicare	1291 (61.1%)	1420 (56.9%)	
Medicaid	1 (0.1%)	16 (0.6%)	
Other	741 (35.1%)	950 (38.1%)	
LOS ≥ 5[b]			<.001[d]
Yes	1102 (52.1%)	1453 (58.2%)	
Disposition			<.001[d]
Home	958 (45.3%)	1034 (41.4%)	
Rehab	949 (44.9%)	1145 (45.9%)	
SNF[c]	191 (9.0%)	290 (11.6%)	
Other	16 (0.8%)	26 (1.0%)	
Complication, any			.010[d]
Yes	15 (0.7%)	38 (1.5%)	

[a] ASA, American Society of Anesthesiologist (ASA) physical status classification.
[b] LOS ≥ 5 is length of stay at least 5 days.
[c] SNF is skilled nursing facility.
[d] Adjusted for age, sex, race, ASA status, primary payor, length of stay, and discharge disposition.

Supplemental Table C
Hip cohort: patient perception of the nurse by race.

PG nurse questions	Race						Multivariable logistic regression				
	Black			White							
	n	Count	%	n	Count	%	Reference	Level	Adjusted OR[a]	95% Confidence interval	*P*-value
Nurse courtesy	89	67	0.7	2404	1990	0.8	White	Black	0.65	0.39-1.08	.095
Promptness response	90	50	0.5	2364	1509	0.6	White	Black	0.67	0.44-1.04	.071
Nurse attitude toward requests	90	61	0.6	2380	1810	0.7	White	Black	0.69	0.43-1.09	.109
Attention to personal needs	89	58	0.6	2356	1671	0.7	White	Black	0.77	0.49-1.22	.265
Nurses kept you informed	89	56	0.6	2361	1622	0.6	White	Black	0.76	0.48-1.18	.223
Skill of the nurses	90	68	0.7	2345	1878	0.8	White	Black	0.78	0.48-1.29	.339

OR, odds ratio; n, number of patients who responded; count, number of patients who were completely satisfied.
These questions are from the "nurse" portion of the PG survey.
[a] Adjusted for age, sex, race, ASA status, primary payor, length of stay, and discharge disposition.

Supplemental Table D
Hip cohort: patient perception of the surgeon by race.

PG surgeon questions	Race						Multivariable logistic regression				
	Black			White							
	n	Count	%	n	Count	%	Reference	Level	Adjusted OR	95% Confidence interval	P-value
Time spent with you	90	46	0.5	2366	1315	0.5	White	Black	0.85	0.55-1.30	.454
Concern questions/worries	90	60	0.6	2353	1629	0.6	White	Black	0.90	0.57-1.41	.638
Physician kept you informed	89	60	0.6	2348	1576	0.6	White	Black	1.01	0.64-1.60	.973
Courtesy of physician	90	68	0.7	2371	1857	0.7	White	Black	0.86	0.52-1.41	.543
Skill of physician	90	71	0.7	2345	2138	0.9	White	Black	0.34	0.20-0.59	<.001

OR, odds ratio; n, number of patients who responded, Count, number of patients who were completely satisfied.
These questions are from the "surgeon" portion of the PG survey.
[a]Adjusted for age, sex, race, ASA status, primary payor, length of stay, and discharge disposition.

Supplemental Table E
Knee cohort: patient perception of the surgeon by race.

PG surgeon questions	Race						Multivariable logistic regression				
	Black			White							
	n	Count	%	n	Count	%	Reference	Level	Adjusted OR[a]	95% Confidence interval	P-value
Time spent with you	88	41	0.4	1972	997	0.5	White	Black	0.91	0.59-1.41	.680
Concern questions/worries	89	54	0.6	1953	1250	0.6	White	Black	0.88	0.56-1.37	.574
Physician kept you informed	89	54	0.6	1952	1219	0.6	White	Black	0.92	0.59-1.43	.705
Courtesy of physician	88	63	0.7	1973	1478	0.7	White	Black	0.84	0.52-1.35	.467
Skill of physician	89	74	0.8	1955	1739	0.8	White	Black	0.56	0.31-1.01	.053

OR, odds ratio; n, number of patients who responded; count, number of patients who were completely satisfied.
These questions are from the "surgeon" portion of the PG survey.
[a] Adjusted for age, sex, race, ASA status, primary payor, length of stay, and discharge disposition.