Original Research

Comparative Analysis of Total Knee Arthroplasty Outcomes Between Arthroplasty and Nonarthroplasty Fellowship Trained Surgeons

Vivek Singh, MD [a], Trevor Simcox, MD [b], Vinay K. Aggarwal, MD [a],
Ran Schwarzkopf, MD, MSc [a], William J. Long, MD, FRCSC [a, *]

[a] NYU Langone Orthopedic Hospital, NYU Langone Health, New York, NY, USA
[b] NYU Winthrop Hospital, Department of Orthopedic Surgery, Mineola, NY, USA

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ABSTRACT

Background: An adult reconstruction (AR) fellowship is designed to provide advanced training for a broad range of primary reconstructive and complex knee revision surgeries. This study aims to identify outcome differences between primary total knee arthroplasty (TKA) performed by AR fellowship-trained surgeons and non-AR (NAR) fellowship-trained surgeons.

Material and Methods: We retrospectively reviewed 7415 patients who underwent primary TKA from 2016 to 2020. Two cohorts were established based on whether the operation was performed by an AR or NAR fellowship-trained surgeon. Demographic, clinical data, and patient-reported outcome measures were collected at various time-points (preoperatively, 3 months, 1 year). Demographic differences were assessed with chi-square and independent sample *t*-tests. Primary outcomes were compared using multilinear regressions, controlling for demographic differences.

Results: AR surgeons performed 5194 (70%) cases while NAR surgeons performed 2221 (30%) cases. Surgical time (minutes) significantly differed between the 2 groups (101.26 vs 111.56; $P < .001$). Length of stay, 90-day all-cause readmissions, revisions, and all-cause emergency department visits did not statistically differ ($P = .079$, $P = .978$, $P = .094$, and $P = .241$, respectively). AR surgeons were more likely to discharge their patients home than NAR surgeons ($P = .001$). NAR group reported lower KOOS, JR scores at 3 months and 1 year (preop: 45.30 vs 45.79, $P = .728$; 3 months: 64.73 vs 59.47, $P < .001$; 1 year: 71.66 vs 69.56, $P = .234$); however, only 3-month scores statistically differed. Veterans RAND-12 Physical and Mental components scores (VR-12 PCS and MCS) were not statistically significant at any time-point between the cohorts. Delta-improvements preoperatively to 1 year in KOOS, JR (26.36 vs 23.77; $P < .001$) and VR-12 PCS (11.98 vs 10.62; $P < .001$) scores were significantly higher for the AR cohort but did not exceed the minimal clinically important difference.

Conclusion: This study demonstrates significantly shorter surgical times and greater improvements in KOOS, JR and VR-12 PCS scores associated with TKAs performed by AR fellowship-trained surgeons.

Level III Evidence: Retrospective Cohort Study

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Background

Total knee arthroplasty (TKA) has proven to be one of the most effective surgical interventions for pain relief and functional recovery in patients with advanced degenerative or rheumatoid arthritis of the knee [1]. As the general population ages, the number of TKAs performed will undoubtedly continue to rise. Recent estimates suggest that by the year 2030, the rate of TKAs will have grown by 85% [2]. With this projected increase in volume, financial reimbursement is being associated more closely with quality of care and perioperative metrics, thus both physicians and hospitals are incentivized to improve patient outcomes [3,4].

Current literature suggests that subspecialty fellowship training increases surgeon exposure to both volume and variety of cases [5]. An adult reconstruction (AR) fellowship is designed to provide advanced training for a broad range of primary reconstructive and complex knee and hip revision surgeries. Recent studies have

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* Corresponding author. 301 East 17th Street, New York, NY 10003, USA.
Tel.: +1 646 293 7515.
E-mail address: William.Long2@nyulangone.org

demonstrated fewer complications and decreased cost [6] for hemiarthroplasties because of femoral neck fractures performed by AR fellowship-trained surgeons than those performed by general orthopedists [7], suggesting there may be a significant advantage to undergoing AR fellowship training. In addition, a recently published study that evaluated the impact of AR fellowship training in total joint arthroplasty (TJA) stated that for both total hip and knee arthroplasty, procedures were associated with significantly shorter surgical times and length of stay (LOS) and required fewer opioids when AR fellowship-trained surgeons than NAR fellowship-trained surgeons performed the joint replacement [8].

However, a paucity in literature remains regarding the impact of AR fellowship training on patient outcomes after primary TKA compared with surgeons who did not undergo such additional training. The primary purpose of this study is to identify outcome differences between primary TKAs performed by AR fellowship-trained surgeons and non-AR (NAR) fellowship-trained surgeons as assessed by surgical time, LOS, 90-day all-cause adverse events such as readmissions and revisions, all-cause emergency department (ED) visits, discharge disposition, and patient-reported outcome measures (PROMs).

Material and methods

Upon obtaining approval from our institutional review board, we retrospectively studied patients who underwent primary unilateral TKA between July 2016 and March 2020 at a single urban, academic, tertiary institution. Informed consent for data collection was obtained for all patients included in this study. Two cohorts were established based on whether the operation was performed by an AR or NAR fellowship-trained surgeon. All AR surgeons included in this study underwent at least one full year of postgraduate AR fellowship training. Patients undergoing bilateral TKA, revision TKA, or nonelective TKA for trauma, tumor, or other reasons were excluded from this study. All patients included in this study participated in our institution-wide comprehensive total joint pathway program which encompasses uniform standardized protocols for all aspects of perioperative care.

The primary outcome measurements were surgical time, LOS, 90-day all-cause readmissions, 90-day all-cause revisions, all-cause ED visits, discharge disposition, and PROMs. We evaluated the Knee Injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS, JR) and the Veterans RAND-12 Physical and Mental components (VR-12 PCS and MCS) scores as the PROMs of interest. KOOS, JR and VR-12 PCS and MCS scores were collected preoperatively as well as at 3 months and 1 year postoperatively and compared. Surgical time was derived from calculating the difference between the time a patient enters the operating room and the time the patient exits.

As part of our institution's standard of care, patients were preoperatively registered for an electronic patient engagement application (Force Therapeutics, New York, NY) by clinical care coordinators at the time of surgical scheduling. The electronic patient engagement application uses mobile and web technology to wirelessly deliver digital PROM surveys at predefined time intervals. Baseline patient demographics including age, gender, body mass index, race, smoking status, and American Society of Anesthesiologists (ASA) score, as well as surgeon experience assessed by years in practice and utilization of robotics or navigation intraoperatively, were obtained from our electronic data warehouse (Epic Caboodle. version 15; Verona, WI) using Microsoft SQL Server Management Studio 2017 (Redmond, WA).

Knee injury and osteoarthritis outcome score for joint replacement

The KOOS, JR is a 7-question short-form PROM, derived from the original KOOS, which represents "knee health" as it combines pain, symptoms, and functional limitations into a single composite score [9]. Scoring is kept on a 100-point scale, with 0 representing complete knee disability and 100 representing perfect knee health. Using the anchor-based approach, Lyman et al. [10] proposed that the minimal clinically important difference (MCID) for the KOOS, JR ranged from 7 to 18.

Veterans RAND 12-item health survey physical and mental components

VR-12 is a patient-reported global health measure that is used to assess and evaluate an overall general health perspective of a patient. Derived from the VR-36 survey, the VR-12 includes 12 original questions that differ from the VR-36. The questions in this survey coincide with 7 different health domains including general health perceptions, physical functioning, role limitations due to physical and emotional problems, bodily pain, energy or fatigue levels, social functioning, and mental health. The responses are summarized into 2 separate scores: a Physical Component Score (PCS) and a Mental Component Score (MCS), which then provides an important contrast between the respondents' physical and psychological health status [11,12]. The mean VR-12 PCS and MCS scores are set at 50 points. Higher scores represent superior function, and each 10-point increment above or below the mean corresponds to one standard deviation [13]. The MCID for the VR-12 PCS and MCS is approximated at 5 [14].

Statistical analysis

A binary variable was created to identify AR and NAR fellowship-trained surgeons based on the completion of an AR fellowship. Statistical differences in numeric, continuous variables were detected using independent sample 2-sided t-tests. Chi-squared (χ^2) test was used for categorical variables. Descriptive data are represented as means $\pm$ standard deviation. Multivariate linear and logistic regressions were performed to control for potential confounding variables and reported as beta coefficients for generalized linear models, or as exponentiated beta coefficients for logistic regressions. These regression models were used to compare surgical time, LOS, 90-day all-cause readmissions, 90-day all-cause revisions, all-cause ED visits, discharge disposition, KOOS, JR, and VR-12 PCS and MCS scores at each of the set time points (preoperatively, 3 months, and 1 year) between TKAs performed by AR and NAR surgeons. Confounding variables were selected from statistically significant demographic variables, which included age, race, ASA class, smoking status, and the use of intraoperative technology. A P value of less than .05 was considered to be significant. All statistical analyses were performed using SPSS v25 (IBM Corporation, Armonk, New York).

Results

A total of 7415 primary TKA cases were identified: 5194 (70%) performed by AR fellowship-trained surgeons and 2221 (30%) by NAR fellowship-trained surgeons. There were 31 AR fellowship-trained surgeons and 23 NAR fellowship-trained surgeons included. Patients that underwent TKA by AR fellowship-trained surgeons tended to be older than those that underwent surgery by NAR fellowship-trained surgeons (66.68 $\pm$ 9.37 vs 65.75 $\pm$ 9.53; $P < .001$). They were also more likely to be of Caucasian descent ($P < .001$). AR fellowship-trained surgeons were more likely to operate on patients with an ASA score of III ($P = .039$) and non-smokers ($P = .011$) than NAR fellowship-trained surgeons. AR surgeons were less likely to use intraoperative technology (ie, navigation or robotics) than NAR surgeons (4.5% vs 6.5%; $P < .001$).

There were no statistical differences between the 2 cohorts in terms of gender ($P = .090$), body mass index (32.37 ± 6.54 vs 32.65 ± 6.96; $P = .116$), and surgeon experience assessed by years in practice (19.32 ± 11.18 years vs 23.56 ± 12.09 years; $P = .195$). The full comparison of patient demographic data is shown in Table 1.

Mean surgical time was found to be significantly shorter for TKAs performed by AR fellowship-trained surgeons than for TKAs performed by NAR fellowship-trained surgeons (101.26 ± 38.40 minutes vs 111.56 ± 33.52 minutes; $P < .001$). In addition, 90-day all-cause readmissions (4.7% vs 4.7%; $P = .994$), 90-day all-cause revisions (1.4% vs 2.0%; $P = .068$), and all-cause ED visits (3.3% vs 3.7%; $P = .313$) did not statistically differ between AR surgeons and NAR surgeons. Mean LOS between TKAs performed by AR surgeons and NAR surgeons did not statistically differ (2.66 ± 1.57 vs 2.70 ± 1.60; $P = .368$). Ninety-eight (1.8%) patients in the AR cohort were same-day discharged (LOS = 0 days) while 78 (3.5%) patients in the NAR cohort were same-day discharged. Patients in the AR surgeon cohort were statistically more likely to be discharged directly to their homes than patients in the NAR cohort (83.0% vs 81.0%; $P = .034$). These findings are summarized in Table 2.

Multivariate linear and logistic regression to control for baseline differences between cohorts was performed and found that both surgical time and home discharge remained significant (Table 3). Surgical time for NAR surgeons increased by 9.64 minutes (95% confidence interval: 7.82-11.46; $P < .001$) compared with that for AR surgeons. Home discharge for NAR surgeons demonstrated a decreased odds ratio of 0.80 compared with AR surgeons (95% confidence interval: 0.70-0.91; $P = .001$). LOS, 90-day all-cause adverse events (readmissions and revisions), and all-cause ED visits remained statistically insignificant between both cohorts.

Preoperative KOOS, JR scores did not statistically differ between patients who had their surgery performed by an AR surgeon compared with a NAR surgeon (45.30 vs 45.79; $P = .728$). Three-month postoperative KOOS, JR scores were significantly greater for patients that underwent TKA by an AR surgeon than those for patients that underwent TKA by an NAR surgeon (64.73 vs 59.47; $P < .001$); this approached, but did not exceed, the proposed MCID. One-year postoperative KOOS, JR scores were greater for patients that underwent TKA performed by an AR surgeon than those for patients that underwent TKA performed by an NAR surgeon; however, this finding was not statistically significant (71.66 vs 69.59; $P = .234$). VR-12 PCS and MCS scores did not statistically differ at any time point, which included preoperatively (30.73 vs 30.83, $P = .589$; 48.75 vs 49.46, $P = .178$) as well as 3 months (38.60 vs 37.27, $P = .099$; 51.82 vs 51.81, $P = .747$) and 1 year (42.71 vs 41.45, $P = .084$; 53.30 vs 54.34, $P = .227$) postoperatively between the 2 cohorts. These findings are summarized in Table 4.

Mean improvement in KOOS, JR scores preoperatively to 3 months postoperatively was significantly greater for patients who underwent TKA performed by an AR surgeon than for patients who underwent TKA performed by an NAR surgeon (19.43 ± 8.50 vs 13.68 ± 8.35; $P < .001$). Mean improvement in KOOS, JR scores preoperatively to 1 year postoperatively was significantly greater for those with an AR fellowship-trained surgeon than that for those with an NAR fellowship-trained surgeon (26.36 ± 9.56 vs 23.77 ± 9.07; $P < .001$). Delta changes from baseline in VR-12 PCS scores followed a similar trend, as patients who underwent TKA with an AR surgeon achieved statistically greater improvement both preoperatively to 3 months postoperatively (7.87 ± 5.43 vs 6.44 ± 5.38; $P < .001$) and preoperatively to 1 year postoperatively (11.98 ± 5.83 vs 10.62 ± 5.93; $P < .001$). Patients in the AR surgeon cohort achieved a statistically greater preoperative to 3-month improvement in VR-12 MCS scores (3.07 ± 7.48 vs 2.35 ± 7.25; $P < .001$). However, there was no statistical difference in VR-12 MCS improvement preoperatively to 1 year between the 2 cohorts (4.55 ± 7.44 vs 4.88 ± 7.25; $P = .078$). However, most of these differences are statistically significant, and some approached, but none exceeded, the proposed MCID for both the KOOS, JR [10] and the VR-12 PCS and MCS [14]. These findings are summarized in Table 5.

Table 1
Patient demographics (n = 7415).

Characteristics	AR surgeons (n = 5194)	Non-AR surgeons (n = 2221)	P value
Age	66.68 ± 9.37	65.75 ± 9.53	<.001
Gender			.090
Female	3600 (69.3%)	1495 (67.3%)	
Male	1594 (30.7%)	726 (31.3%)	
BMI (kg/m^2)	32.37 ± 6.54	32.65 ± 6.96	.116
Race			<.001
Caucasian	2885 (55.5%)	1150 (51.8%)	
African American	1085 (20.9%)	414 (18.6%)	
Asian	289 (5.6%)	124 (5.6%)	
Other	935 (18.0%)	533 (24.0%)	
ASA			.039
1	82 (1.6%)	51 (2.3%)	
2	2573 (49.6%)	1120 (50.7%)	
3	2427 (46.8%)	980 (44.3%)	
4	108 (2.1%)	60 (2.7%)	
5	1 (0.0%)	0 (0.0%)	
Smoking status			.011
Never smoker	3071 (59.1%)	1287 (57.9%)	
Former smoker	1766 (34.0%)	737 (33.2%)	
Current smoker	357 (6.9%)	197 (8.9%)	
Surgeon experience (y)	19.32 ± 11.18 (n = 31)	23.56 ± 12.09 (n = 23)	.195
Robotics or navigation used	239 (4.5%)	139 (6.5%)	<.001

AR, adult reconstruction; ASA, American Society of Anesthesiologists; BMI, body mass index.
P values are derived from 2-sample *t*-test for numerical values or χ^2 tests for categorical values.

Table 2
Clinical outcomes.

Variable	AR surgeons	Non-AR surgeons	P value
Surgical time (min)	101.26 ± 38.40	111.56 ± 33.52	<.001
LOS (d)	2.66 ± 1.57	2.70 ± 1.60	.368
90-d All-cause readmissions	243 (4.7%)	104 (4.7%)	.994
90-d All-cause revisions	73 (1.4%)	44 (2.0%)	.068
All-cause ED visits	170 (3.3%)	83 (3.7%)	.313
Discharge disposition			.034
Home	4311 (83.0%)	1798 (81.0%)	
Other facility	883 (17.0%)	423 (19.0%)	

AR, adult reconstruction; ED, emergency department; LOS, length of stay.
P values are derived from 2-sided *t*-test for continuous variables and chi-squared tests for categorical variables.

Table 3
Multivariable regression of clinical outcomes between AR and NAR fellowship-trained surgeons.

Variable	Effect of NAR surgeons (95% CI)	P value
Surgical time (min)	9.64-min increase (7.82 to 11.46)	<.001
LOS (d)	0.07-d increase (−0.01 to 0.14)	.079
90-d All-cause readmissions	Odds ratio: 1.00 (0.79 to 1.27)	.974
90-d All-cause revisions	Odds ratio: 0.72 (0.49 to 1.06)	.093
All-cause ED visits	Odds ratio: 0.86 (0.65 to 1.12)	.258
Home discharge	Odds ratio: 0.80 (0.70 to 0.91)	.001

AR, adult reconstruction; CI, confidence interval; ED, emergency department; LOS, length of stay.
P values are derived using multivariable linear regressions for numerical values and multinomial logistic regressions for categorical value. These regressions account for demographic differences between groups.

Table 4
Patient-reported outcome measures.

Time period	AR surgeons	Non-AR surgeons	Effect of non-AR surgeons (unstandardized beta coefficients) [95% CI]	P value
KOOS, JR				
Preop	45.30 ± 13.76 (n = 861)	45.79 ± 13.69 (n = 255)	0.34 [−1.60 to 2.29]	.728
3 m	64.73 ± 13.05 (n = 820)	59.47 ± 12.49 (n = 217)	−4.82 [−6.78 to 2.86]	<.001
1 y	71.66 ± 15.85 (n = 620)	69.56 ± 14.81 (n = 161)	−1.67 [−4.42 to 1.08]	.234
VR-12 PCS				
Preop	30.73 ± 7.96 (n = 1040)	30.83 ± 7.93 (n = 252)	0.30 [−0.79 to 1.40]	.589
3 m	38.60 ± 8.96 (n = 883)	37.27 ± 8.85 (n = 219)	−1.13 [−2.46 to 0.21]	.099
1 y	42.71 ± 9.71 (n = 666)	41.45 ± 9.89 (n = 176)	−1.44 [−3.07 to 0.20]	.084
VR-12 MCS				
Preop	48.75 ± 12.40 (n = 1040)	49.46 ± 11.96 (n = 252)	1.17 [−0.54 to 2.88]	.178
3 m	51.82 ± 10.73 (n = 883)	51.81 ± 10.59 (n = 219)	0.26 [−1.35 to 1.87]	.747
1 y	53.30 ± 10.20 (n = 666)	54.34 ± 10.59 (n = 176)	1.07 [−0.67 to 2.82]	.227

AR, adult reconstruction; CI, confidence interval; KOOS, JR, Knee Injury and Osteoarthritis Outcome Score for Joint Replacement; VR-12 PCS, Veterans RAND-12 Physical Component Score; VR-12 MCS, Veterans RAND-12 Mental Component Score.
P values are derived from a multivariable linear regression. These regressions account for demographic differences between groups.

Discussion

As patients continue to remain active and live longer [15], it is projected that there will be approximately 3.5 million primary TKAs performed each year in the United States by the year 2030 [16]. A shortage of AR surgeons has been predicted for years, with expectations for massive increases in both primary and revision arthroplasty cases within this same time frame [17,18]. While the number of AR fellowship positions has increased over the years, it has become increasingly competitive [19] which may explain why some residents are shying away from pursuing AR fellowship training, creating a strain on the future supply of arthroplasty surgeons [20]. Few studies have investigated the relationship between surgeon specialization and outcomes [21-26]. Prior reports have encompassed a limited number of surgical specialties, with few being published within orthopedics. Our study demonstrates that patients who underwent primary TKA performed by AR fellowship-trained surgeons were found to have significantly lower surgical times and greater improvement preoperatively to 3 months and 1 year as assessed by the KOOS, JR questionnaire than patients who underwent primary TKAs performed by NAR fellowship-trained surgeons. To our knowledge, this study is the first to report such findings for primary TKAs concerning PROMs following up cases performed by AR fellowship-trained surgeons and NAR fellowship-trained surgeons.

Analysis of baseline demographics found that AR surgeons tended to operate on slightly older patients with more pre-existing comorbidities as shown by their ASA score. These differences in age and ASA score are likely generalizable to most geographic regions and may be explained by AR surgeons selectively performing more

Table 5
Delta improvement in PROMs.

Time period	AR surgeons	Non-AR surgeons	P value
KOOS, JR			
Preop to 3 m	19.43 ± 8.50	13.68 ± 8.35	<.001
Preop to 1 y	26.36 ± 9.56	23.77 ± 9.07	<.001
VR-12 PCS			
Preop to 3 m	7.87 ± 5.43	6.44 ± 5.38	<.001
Preop to 1 y	11.98 ± 5.83	10.62 ± 5.93	<.001
VR-12 MCS			
Preop to 3 m	3.07 ± 7.48	2.35 ± 7.25	<.001
Preop to 1 y	4.55 ± 7.44	4.88 ± 7.25	.078

AR, adult reconstruction; KOOS, JR, Knee Injury and Osteoarthritis Outcome Score for Joint Replacement; PROM, patient-reported outcome measures; VR-12 PCS, Veterans RAND-12 Physical Component Score; VR-12 MCS, Veterans RAND-12 Mental Component Score.
P-values are derived from 2-sample t-test.

complex cases on higher risk patients because of their additional experience likely gained in their fellowship training and to a more referral-based sub-specialty focus. Through our analysis of baseline demographic data, we noted that AR surgeons at our institution perform a higher number of TKA cases than NAR surgeons and tend to provide care for different groups of patients. Although we performed linear regression analysis to account for baseline demographic differences, these differences in patient populations are reflective of actual practice trends and may provide reasons for the observed differences in outcome between the 2 cohorts.

A recent study conducted by Mahure et al. [8] which evaluated the impact of AR fellowship-training in TJA found that for both total hip and knee arthroplasty, patients had significantly shorter surgical times, LOS, and required fewer opioids when their procedure was performed by AR fellowship-trained surgeons than patients who underwent the procedure performed by NAR fellowship-trained surgeons. In addition, patients who had their TJA performed by AR surgeons achieved higher Activity Measure for Post-Acute Care scores and were discharged home more often than those who had their TJA performed by NAR surgeons. Our findings validate their study with regard to surgical times as well as discharge disposition, as we found shorter surgical times and discharge to home more likely for TKAs performed by AR surgeons than for TKAs performed by NAR surgeons. Although our findings trended similarly to the aforementioned study concerning LOS, they were not statistically significant although approached significance when controlling for potential confounding variables, which may be attributed to the lower number of patients included in our study.

Previous literature has suggested that surgical volume and surgeon experience are factors in achieving shorter operative times and lower complication rates, implying that familiarity and repetition with specific procedures and implants increase technical skills and the ability to perform a procedure with greater proficiency [27-30]. While we were unable to calculate exact annual primary arthroplasty case volumes for all surgeons included in the study, we accounted for surgical experience in the present study by taking the mean years in practice of surgeons in both cohorts (AR: 19.32 ± 11.18 years vs NAR: 23.56 ± 12.09 years; P = .195). A study conducted by Mabry et al. [7] which included 298 patients who underwent hemiarthroplasty because of femoral neck fracture found that AR surgeons had significantly lower surgical times and complication risks than both general orthopedists and trauma-fellowship trained surgeons. They proposed that the additional AR fellowship training allowed for increased familiarity with the nuances of component positioning and thus a shorter learning curve. This may be a reason as to why we observed significantly shorter surgical times with cases performed by AR fellowship-

trained surgeons than with cases performed by NAR fellowship-trained surgeons (101.26 ± 38.40 minutes vs 111.56 ± 33.52 minutes; $P < .001$). It may be possible that this large difference in surgical times could be due to NAR surgeons being more likely to use intraoperative technology, which often adds to the time spent in the operating room.

The implications of our findings are significant with respect to fellowship training as it relates to the financial burden of hospitals. Institutions are continuing to battle the increasing pressure to decrease expenses within bundled-payment models [3,31]. From a hospital's standpoint, it would be of increased financial interest to have TKAs performed by AR surgeons rather than NAR surgeons because of cost savings yielded from shorter surgical times and patients discharged directly to their homes after surgery. Previous literature has suggested that the mean cost of operative time is $37 per minute [32]. In the context of the present study, this suggests that the hospital would yield an average of $381 in savings when AR surgeons performed TKAs compared with that when NAR surgeons performed TKAs. Similar findings have been shown for hip fractures, with AR surgeons demonstrating a lower 90-day cost of care than NAR surgeons [6]. In an era of efficient staggered usage of 2-operating room for procedures, the added 10 minutes may translate to an added 10 minutes in both operating rooms as the second room is waiting idle. Thus, these extra 10 minutes can potentially become 20 minutes of combined surgical time. Theoretically, if AR surgeons perform 6 TKAs in 1 day, they save 120 minutes from the combined 2 operating rooms.

There are several limitations to this study that should be highlighted. The retrospective design represents an area where selection bias may have been introduced as well as potential errors in data entry and coding. In addition, this analysis of readmissions and revisions is limited to the data pertaining to the 90-day episode of care, and therefore, long-term outcomes, costs, and implant life-spans were not obtained. We did not evaluate radiographic data or inpatient complications (although we did compare LOS), both of which may influence postoperative rehabilitation and in turn affect postoperative PROM scores. Although the differences in score improvement from baseline for the KOOS, JR as well as VR-12 PCS and MCS were statistically significant, they may not be clinically relevant because the MCID was not exceeded for either PROM instrument [10,14]. Finally, AR fellowship-trained surgeons performed most TKAs. This accurately represents the current trends in practice within large academic institutions and may not be generalizable to smaller community institutions. Some surgeons included in the NAR cohort completed a fellowship in another orthopedic subspecialty while others never completed a fellowship. Despite these limitations, the results presented suggest that AR-trained surgeons may provide a benefit by reducing health-care expenditures alongside improving patient outcomes. The large sample size and wide variability in surgeons performing TKAs at our institution ensure that the results are not skewed.

Conclusions

As the volume of TKAs rises annually, both surgeons and hospitals continue to ascertain factors that may increase the value of care while reducing costs. This study demonstrates shorter operative times and greater improvement in PROMs associated with TKAs performed by AR fellowship-trained surgeons than in PROMs associated with TKAs performed by NAR fellowship-trained surgeons. Patients who had their TKA performed by an AR fellowship-trained surgeon were also able to be discharged directly home at greater rates after their procedure. These improved patient outcomes provide further support for the value associated with AR fellowship training. There continues to be a need for further prospective studies to evaluate whether these results are consistent at other institutions and to identify other strategies to ensure that all patients are receiving the highest quality of care.

Conflict of interests

R. Schwarzkopf received royalties from Smith is a paid consultant for Smith&Nephew and Intelijoint; has stock or stock options in Intelijoint and Gauss Surgical; received research support from Smith&Nephew and Intelijoint; is in Medical/Orthopaedic publications editorial/governing board of JOA and Arthroplasty Today; and is a board member/committee appointments for AAHKS and AAOS. W. J. Long received royalties from OrthoDevelopment; is in speakers' bureau/gave paid presentations for Convatec, Pacira, and Think Surgical; is a paid consultant for Think Surgical, TJO, Pacira, and DePuy, and A Johnson & Johnson Company; received research support from Elsivior; is in Medical/Orthopaedic publications editorial/governing board of Journal of Arthroplasty; and is a board member/committee appointments for AAOS.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2021.01.007.

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