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Quantifying Surgeon Work in Total Hip and Knee Arthroplasty: Where Do We Stand Today?

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ABSTRACT

Background: Physician work is a critical component in determining reimbursement for total joint arthroplasty (TJA). The purpose of this study is to quantify the time spent during the different phases of TJA care relative to the benchmarks used by the Centers for Medicare and Medicaid Services.
Methods: We retrospectively reviewed all patients captured in our institutional joint database between January 1, 2014, and December 31, 2018. Four phases of care were assessed: (1) preoperative period following the decision to proceed with TJA and leading to the day before surgery, (2) immediate 24 hours preceding surgery (preservice time), (3) operative time from skin incision to dressing application (intraservice time), and (4) postoperative work including day of surgery and the following 90 days.
Results: A total of 666 procedures were analyzed (379 total hip arthroplasties and 287 total knee arthroplasties). The mean preoperative care coordination, preservice, intraservice, immediate post-service, and 91-day global period times were 21.9 ± 10, 84.1, 114 ± 24, 35, and 150 ± 37 minutes, respectively. Except for a slightly higher preoperative time associated with Medicare coverage ($P = .031$), there were no differences in the other phases of care by payer type. There were no temporal differences between 2014 and 2017. However, in 2018, there were significant increases in preoperative and intra-service times (6 and 20 minutes, respectively, $P < .001$) which were accompanied with a significant decrease in postoperative service time (34 minutes, $P < .001$).
Conclusion: Even when performing TJA under the most optimal conditions, the overall time has remained stable over the past 5 years and consistent with current benchmarks.

Services provided by healthcare professionals need to be identified and reported in a way that is universally understood. To accomplish this goal and ensure consistent and accurate reporting of health claims, the American Medical Association (AMA) developed the Current Procedural Terminology (CPT) coding system in 1966 [1,2]. Since then, the CPT codes, which are identified by 5-digit numbers, have become universally accepted as a standardized coding system for healthcare services and procedures [1,2]. Once a CPT code is approved by the AMA's CPT Editorial Panel, the AMA's Relative Value Scale Update Committee (RUC) then determines the appropriate relative value unit for each CPT code [1,2] based on 3 components: physician work, practice expense, and professional liability insurance [3]. CPT evaluation is conducted by the Centers for Medicare and Medicaid Services (CMS) every 5 years [4].

Physician work is defined time and intensity associated with providing a particular service and is a major component of the total relative value unit [3]. Physician work is further broken down into that spent before, during, and after the service is completed. Originally, the method for establishing physician work was based on surveys administered directly to representative physician samples [4,5] although currently the RUC relies on specialty societies to conduct surveys of their membership [4].

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On November 1, 2018, CMS identified CPT codes 27130 (total hip arthroplasty [THA]) and 27447 (total knee arthroplasty [TKA]) as potentially misvalued, thereby prompting revaluation of these codes [6]. This request was triggered by Anthem, the largest health insurer in the United States, based on a 2016 pilot study that found physician intraservice time to be inflated (87 and 83 minutes for THA and TKA, respectively, compared to the 100-minute benchmark used by CMS) [7]. In response to this inquiry, arthroplasty researchers developed data pertaining to the perioperative work associated with THA and TKA. To date, there have been at least 3 published reports on this topic. Two independent groups assessed operative time [8,9] and 1 quantified the immediate preoperative and postoperative work [10]. Collectively, those reports indicated that there have been no major deviations from current benchmarks with actual physician work either equaling or exceeding those benchmarks.

The purpose of this study is to quantify surgeon work associated with providing primary, unilateral THA and TKA. Four components were assessed: (1) preoperative period following the decision to proceed with surgery and leading to the day before surgery, (2) immediate 24 hours preceding surgery (preservice time), (3) operative time from skin incision to dressing application (intraservice time), and (4) postoperative work including day of surgery and the following 90 days. It is our hope that this study along with data from other institutions could help inform decision-making by stakeholders on an issue that holds profound impact on total joint arthroplasty (TJA) care.

Materials and Methods

Institutional review board approval was obtained. Our institutional joint database was queried for all patients who underwent elective, primary, unilateral THA (CPT code 27130) and TKA (CPT code 27447) from January 1, 2014, through December 31, 2018. Only procedures performed by fellowship-trained surgeons were included in the database. There were 4 surgeons during the study period with everyone performing at least 50 THAs/TKAs per year. Complex primaries (conversion from previous hip surgery, removal of hardware, etc.), those requiring co-surgeon assistance, cases with intraoperative complications requiring additional procedures or nonroutine care, and outliers (greater than 2 standard deviations from the mean operative time) were excluded. All surgeries were performed at a single public academic institution with assistance of orthopedic surgery residents or advanced practice practitioners. A variety of surgical approaches were used for THA. The choice of implants used was also variable depending on each surgeon's preference but were individually consistent. Patient enrollment in the joint database is voluntary and requires an informed consent. The average capture rate of our database (percentage of enrolled to eligible patients) is 59%.

Demographic variables collected were age, sex, body mass index, American Society of Anesthesiologists physical status classification, and payer type (commercial, Medicare, Medicaid, or other). The primary outcome was time spent in delivering THA and TKA. Four phases of care were assessed: (1) preoperative period following the decision to proceed with surgery and leading to the day before surgery, (2) immediate 24 hours preceding surgery (preservice time), (3) operative time from skin incision to dressing application (intraservice time), and (4) postoperative work including day of surgery and the following 90 days. Items included in the preoperative period were patient visits (each visit is booked into a 15-minute appointment at our institution), patient phone calls (estimated 3 minutes per phone call), and medication/dural medical equipment orders (estimated 2 minutes per encounter). Items included in the preservice time were evaluation time, positioning time, and scrub, dress, and wait time. Preservice evaluation time consisted of calling the patient the night before surgery (5 minutes), placing preoperative orders (5 minutes), patient counseling/consent review/site marking/communication with staff (15 minutes), electronic medical record documentation (5 minutes), templating (10 minutes), prepositioning time (while anesthesia/nursing care is completed), and positioning, scrub, dress, and wait time. The latter 2 items were allocated an aggregate of 20.8 and 23.3 minutes, respectively, based on averaging our prospectively collected data for those tasks in 519 consecutive patients. Postservice work was divided into that performed immediately following surgery (immediate postservice work) and subsequent care up to 90 days following the day of surgery. Immediate postservice work included transfer to hospital bed and recovery unit (5 minutes), entering postoperative orders and brief operative note (10 minutes), communication with family (5 minutes), operative note dictation (10 minutes), and patient evaluation in the recovery unit/review of radiographs (5 minutes). Day of surgery and global 90-day period items included inpatient visits with corresponding documentation (15 minutes per visit), discharge planning consisting of discharge summary/instructions/face-to-face attestation (20 minutes), calling the patient after discharge (5 minutes), clinic visits (15 minutes per visit), responding to patient phone calls (3 minutes per call), medication(s)/physical therapy orders (2 minutes per encounter), and completing return to work forms (3 minutes per form).

Continuous variables were described using mean and standard deviation. Categorical variables were described using frequency and proportion. Multiple 1-way analysis of variance tests were used to examine the differences in time between payer types over the study period. Pairwise comparisons using Bonferroni's method were used to adjust for the multiple comparisons. An alpha level of 0.05 was set for all comparisons. All statistical analyses were performed using Stata 15.1 (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LP).

Results

A total of 666 procedures were analyzed (379 THAs and 287 TKAs). The mean age was 61 ± 12 years, body mass index 30 ± 6, and American Society of Anesthesiologists score 2.3 ± 1. There were 318 (48%) females and 348 (52%) males. Payer mix consisted of 211 (32%) commercial insurance, 86 (13%) Medicare, 295 (44%) Medicaid, and 74 (11%) other coverage. Table 1 summarizes the baseline characteristics of the study group.

For the combined THA/TKA analysis, the mean preservice and immediate postservice times were 84 and 35 minutes, respectively. The median intraservice time was 111 minutes (range, 65-199). The

Table 1
Baseline Characteristics of the Study Group.

Variable	
Age (y)	61 ± 12
American Society of Anesthesiologists physical classification system	2.3 ± 1
Body mass index	30 ± 6
Sex	
Female	318 (48%)
Male	348 (52%)
Procedure	
Total hip arthroplasty	379 (57%)
Total knee arthroplasty	287 (43%)
Payer type	
Commercial	211 (32%)
Medicare	86 (13%)
Medicaid	295 (44%)
Other	74 (11%)

Table 2
Comparison of Work Time Between the 2019 CMS PFS and Our Data.

Phase of Care	2019 CMS PFS	Present Study	Difference
Preservice time (min)	75	84	9 (+12%)
Intraservice time (median, min)	100	111	11 (+11%)
Postservice time			
Immediate (min)	20	35	10 (+75%)
Hospitalization and global 90-day period (min)	Not defined	150 ± 37	—
Inpatient visits	3	5 ± 2	2 (+66.7%)
Outpatient visits	3	2.5 ± 1	0.5 (−16.7%)
Preoperative care coordination (following decision to proceed with surgery and excluding preservice time, mean, min)	N/A	22 ± 10	—
Total time for THA and TKA (mean, min)	407	405 ± 41	(−0.5%)

CMS, Centers for Medicare and Medicaid Services; PFS, physician fee schedule; THA, total hip arthroplasty; TKA, total knee arthroplasty; N/A, not applicable.

mean preoperative care coordination time (following decision to proceed with surgery and excluding preservice time) was 21.9 ± 10 minutes. The mean service time for the 91-day global period was 149.6 ± 37 minutes. Table 2 summarizes the service times for the different phases of care.

There were no differences in service time for all phases of care by payer type ($P = .068$, .888, .236, and .216 for preoperative optimization, intraservice, 91-day global period, and total episode of care, respectively). Figure 1 summarizes the surgeon work by payer type.

There were no temporal differences in service time between 2014 and 2017. However, in 2018, we observed an average increase of 6 minutes in preoperative time ($P < .001$) and 20 minutes in intraservice time ($P < .001$). This was accompanied by an average decrease of 34 minutes in the postoperative service ($P < .001$). Figure 2 summarizes the surgeon work time by payer type.

Analyzing data by procedure type showed that TKA required higher total service time than THA (420 ± 40 and 393 ± 38 minutes, respectively, $P < .001$). This was in part driven by higher mean postservice time for TKA (162 ± 36 and 140 ± 35 minutes, respectively, $P < .001$). Table 3 summarizes the surgeon work by procedure type.

Discussion

This study provided a comprehensive assessment of surgeon work for primary TJA. It comes at a critical time as revaluation of THA and TKA CPT codes is underway. While there were variations within the different phases of care, we found that the total surgeon work has remained unchanged from previous benchmarks. Specifically, there was increased preservice, intraservice, and immediate postservice work (+12%, +11%, and +75%, respectively). This was accompanied with decreased postservice time, particularly following hospital discharge. TKA required higher total service time than THA (420 vs 393 minutes), which was in part due to higher frequency of follow-up visits (3 vs 2 visits).

The decision of CMS to label THA and TKA as potentially misvalued procedures stems in part from a 2016 pilot report that found lower actual operative times (87 and 83 minutes for THA and TKA, respectively) compared to the 100-minute benchmark [7]. As a result, most studies to date have focused on assessing operative time. Chughtai et al [8] retrospectively reviewed 12,567 consecutive TJAs performed between 2015 and 2019 at a multihospital healthcare system. Only cases carried out by surgeons performing at least 100 TJAs per year during the study period were included. The authors found that the mean intraservice time for primary THA and TKA was 96.4 and 103.6 minutes, respectively. Similarly, in a retrospective review of 1313 primary THAs and 1300 primary TKAs performed by 4 fellowship-trained surgeons at 3 hospitals within a single academic institution between 2015 and 2019, Shah et al [9] found that the mean intraservice time was 102 and 116 minutes for THA and TKA, respectively. Elective and fracture cases were included in that study. Wasterlain et al [10] went beyond just assessing intraservice time to analyze preservice and immediate postservice times. Data were prospectively collected in 121 patients and retrospectively in 1000 patients who underwent primary TJA by 7 arthroplasty surgeons at a single academic institution. The authors reported that the mean total preservice and immediate

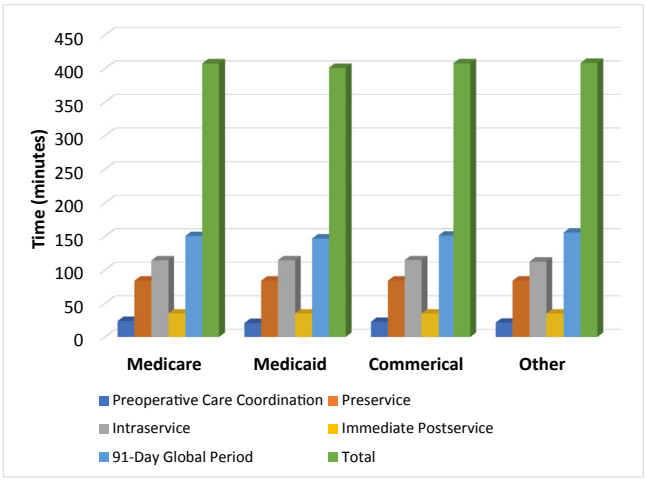

Fig. 1. Surgeon work time by payer type.

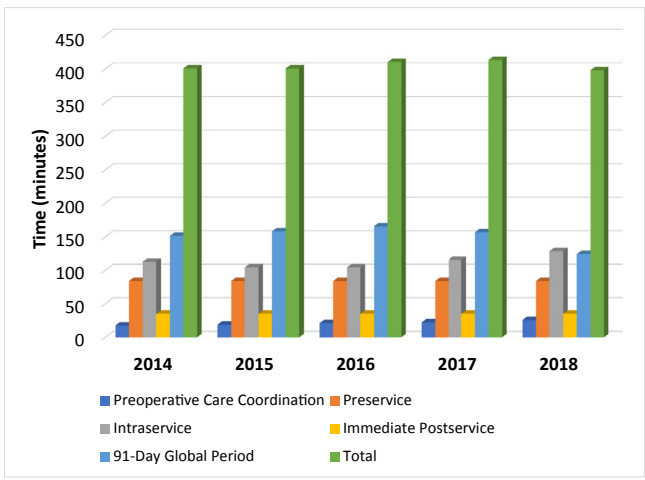

Fig. 2. Surgeon work time by year.

Table 3
Surgeon Work by Procedure Type.

Phase of Care	Total Hip Arthroplasty	Total Knee Arthroplasty
Preservice time (mean, min)	84	84
Intraservice time (median, min)	109	113
Postservice time		
Immediate (mean, min)	35	35
Hospitalization and global 90-day period (mean, min)	140 ± 35	162 ± 36
Inpatient visits (mean)	4.6 ± 2.1	5.2 ± 1.8
Outpatient visits (mean)	2.4 ± 1	2.7 ± 1
Preoperative care coordination (following decision to proceed with surgery and excluding preservice time, mean, min)	21 ± 9	23 ± 11
Total time for THA and TKA (mean, min)	393 ± 38	420 ± 40

THA, total hip arthroplasty; TKA, total knee arthroplasty.

postservice times were 83 and 30 minutes, respectively (compared to 75 and 20 minutes used as benchmarks).

Providing contemporary and accurate quantification of physician work in TJA is critical to help guide policymakers. This requires data from centers across the country reflecting diverse geographic regions, TJA volume, case complexity, payer types, and practice settings among other variables. Such data will likely show heterogeneity in physician work reflecting the different variations. There will also likely be heterogeneity within individual institutions reflecting surgeon experience, surgical techniques, and available resources. As such, quantifying surgeon work is a complex task, and altogether it lends to the concern among arthroplasty surgeons that CMS' decision to label THA and TKA as potentially misvalued procedures a premature step. This concern is further compounded by the realization that the devaluation inquiry was triggered by Anthem, an entity that stands to immensely benefit from devaluation of TJA procedural codes. There is also concern of unintended adverse consequences on patient care with speed trumping quality.

The past 5 years have witnessed tremendous improvements in TJA care that made rapid recovery and outpatient surgery feasible. However, this has led to proliferation of additional preoperative tasks that are usually not accounted for in the calculation of surgeon work [11,12]. A central component among those tasks is optimization of modifiable risk factors [11]. In one study, 74% of patients undergoing primary, elective TJA had at least 1 modifiable risk factor [13]. Preoperative optimization could be a time-consuming process, often requiring patient counseling, coordination of care with other healthcare providers, and delaying surgery. It may also require extended inpatient observation to minimize the risk of medical complications and readmissions (eg, patients with cardiovascular disease and diabetes). As our study has shown, while the total surgeon work has remained stable over the past 5 years, there was a shift toward increased work in earlier phases of care.

Our study should be interpreted in the context of some limitations. First, it is a retrospective review from a single tertiary public academic center. As such, the results may not be generalizable to other institutions. Second, we used conservative estimates for certain tasks and could not quantify a number of other tasks (eg, completing medical leave paperwork, coordination of care with other providers, collection of quality metrics, administrative burden for compliance with outpatient surgery, etc.). We also focused on cases with most optimal conditions (eg, only cases performed by fellowship-trained surgeons and those within 2 standard deviations of the mean operative time were included). The RUC does not provide a reward for performing TJA more efficiently just as it does not provide a disincentive for decreased efficiency. Therefore, this study likely underestimates actual physician work. Third, the study represents cases of 4 surgeons at different career stages: 1 midcareer and 3 early career surgeons. However, everyone was fellowship-trained and performed at least 50 TJAs per year. Fourth, 44% of patients in our study had Medicaid coverage and only 13% were Medicare beneficiaries, which may limit generalizability to standard US-based practices.

In conclusion, our study confirms previous reports that physician work associated with TJA has remained stable and is consistent with current benchmarks. Multicenter studies representing diverse range of geographic, demographic, and institutional variations are needed to accurately ascertain the work involved in providing primary TJA. Until such data become available, we support current valuation of THA and TKA.

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