

Systematic Review

Comparing economic outcomes and reimbursement trends between primary total knee arthroplasty and unicompartamental knee arthroplasty

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Background

Economic outcomes are of paramount importance in the American healthcare market as healthcare costs continue to rise. The Centers of Medicare and Medicaid Services (CMS) introduced the relative value unit (RVU) in 1992 to operationalize economic outcomes of healthcare interactions and procedures available to patients. The purpose of this study is to compare the RVU and dollar compensations, operative times, and compensation rates of unicompartamental knee arthroplasty (UKA) vs total knee arthroplasty (TKA) in the context of procedural and perioperative care requirements.

Methods

The National Surgical Quality Improvement Program database was used to query all UKAs and TKAs (current procedural terminology codes 27446 and 27447, respectively) performed between January 1, 2015 and December 31, 2017. 162,239 cases were analyzed: 157,107 TKAs and 5,132 UKAs. For all economic and medical variables, unpaired t-test and Pearson's chi-squared test were used to compare continuous and categorical data, respectively.

Results

RVUs for UKAs and TKAs were 17.48 and 20.72, respectively. The mean operative time for UKAs was 83.80 ± 30.13 minutes and 89.43 ± 31.88 minutes for TKAs ($p < 0.001$). The mean RVU/min for UKAs and TKAs were 0.23 ± 0.08 and 0.26 ± 0.09 , respectively ($p < 0.001$). Dollar reimbursements for UKA vs TKA were as follows: per minute (\$8.46 vs \$9.36) and per case (\$630.85 vs \$747.78). TKAs were associated with longer hospital length of stay (2.52 ± 3.20 vs. 1.43 ± 2.72 days; $p < 0.001$), quicker onset of deep wound

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infection (18.46 ± 7.24 vs. 21.43 ± 5.19 days; $p < 0.001$), and higher rates of 30-day unplanned hospital readmission (3.07% vs. 1.87%; $p < 0.001$).

Conclusion

The study found the contemporary RVU reimbursement model adequately accounts for increased operative time and perioperative care demands associated with TKA compared to UKA, as RVU and dollar compensation rates per case and per minute were significantly greater for TKAs.

INTRODUCTION

Increasing healthcare costs, which are projected to rise to a staggering 20% of United States Gross Domestic Product (GDP) by 2025 (CMS 2018), continue to undermine healthcare access and agency for millions of Americans (Wammes et al. 2018; Bush 2018; Beller 2008). While efforts to mitigate the rising financial burden of healthcare have been multifaceted, providers and policymakers have increasingly begun to focus on physician compensation reform (McMahon 1990; Landon et al. 2014). Such efforts to streamline reimbursement policies have largely centered how to operationalize the concepts of economic outcomes and healthcare value.

Economic outcomes are of paramount importance in the American healthcare market and maximizing value is imperative for physicians, patients, payors, and politicians alike. Despite difficulties of accurately assessing the absolute and relative economic outcomes of various healthcare services (Hsiao et al. 1988; Childers and Maggard-Gibbons 2020), relative value units (RVUs) have emerged as the consensus measurement tool used to operationalize such outcomes. Introduced by the Centers of Medicare and Medicaid Services (CMS) in 1992, the RVU constitutes the main healthcare reimbursement metric and is divided into the following three components: work RVU, practice expense RVU, and malpractice RVU (Jacobs et al. 2017; Baadh et al. 2016). Work RVU encompasses physicians' time, skill, and effort in offering a service. Practice expense RVU includes non-physician clinical and nonclinical labor—overhead—that goes into offering services. Malpractice RVU, also referred to as professional liability insurance RVU, accounts for malpractice and other insurance costs. When combined, these 3 RVU components establish a physician's value or worth in providing a service.

In addition to coming under scrutiny for its alleged bias toward surgical procedures over nonprocedural visits (Rosner and Falk 2020; Schwartz et al. 2014), the RVU metric has been criticized for its failure to accurately reflect resources allocated to various types of surgical procedures (Sodhi et al. 2018). For instance, while increasingly complicated and time-intensive procedures like revision cases are expected to—and usually do—receive higher RVU assignments than relatively simpler cases like primary cases, the specific values assigned to each procedure may not always accurately account for the proportional discrepancy in physicians' work and effort (Sodhi et al. 2018; Katz and Melmed 2016). In one case, that of total knee arthroplasty, primary cases are reimbursed at higher rates than revision cases, perhaps reflecting quality incentives to minimize re-

vision cases (Peterson et al. 2018). It should be noted that the RVU economic outcome assignments in question not only stem from the work RVU component, but also the practice and expense RVU component, as more complicated cases often require greater pre-operative and post-operative care and follow-up (Katz and Melmed 2016).

Studies on the use and equity of RVUs in orthopaedic surgery are limited and have only recently surfaced as a popular topic of research in the field. Most studies have examined the adequacy of current RVU assignments in reimbursing various procedures. Studies comparing RVU assignment for primary versus revision total hip arthroplasty (THA) (Sodhi et al. 2018), primary versus conversion THA (Sodhi et al. 2019), primary versus revision total ankle arthroplasty (TAA) (Sodhi et al. 2017), primary versus revision total knee arthroplasty (TKA) (Peterson et al. 2018), and septic versus aseptic revision TKA (Samuel et al. 2020) have produced mixed conclusions regarding the current CMS RVU reimbursement scheme. While the hip and knee arthroplasty studies found inequities in RVU/minute such that the more complicated case was not adequately reimbursed relative to the simpler case, the ankle study concluded that the more complex revision TAA was appropriately assigned a higher RVU/minute value than its primary counterpart. These studies and others (Molloy et al. 2020; Gabor et al. 2019; Quan et al. 2021) discuss various orthopaedic surgical procedures and their respective RVU/minute values in the context of healthcare administration and acknowledge the potential for the current reimbursement scheme to incentivize physicians to narrow their practice's focus—potentially overlooking various patient populations in need of relatively “lower RVU value” procedures.

Given national focus on rising healthcare costs and heightened examination of RVUs as a viable physician compensation metric in orthopaedics as well as across all medical specialties, further insight into reimbursement equity and potential biases in RVU assignment is needed. Such analysis is not only important for physicians as they seek an equitable payment structure, but also for patients and patient-advocates as they guard against surgeons narrowing their patient selection. As such, the purpose of this study is to further analyze RVU use and equity by comparing unicompartmental knee arthroplasty (UKA) and total knee arthroplasty (TKA). In this study, we compare (1) the mean RVUs; (2) the mean operative times; (3) the mean RVU/minute; and (4) the mean compensation and compensation rates in dollars, all in the context of post-operative medical outcomes and complication rates.

METHODS

DATABASE

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) is a validated national surgical database that has been utilized extensively in surgical outcomes research (American College of Surgeons 2020). The ACS NSQIP database provides robust data with excellent inter-rater reliability from participating hospitals nationwide. Regular audits have demonstrated an overall disagreement rate of less than 2% for reported variables (Shiloach et al. 2010).

The ACS NSQIP database was queried to identify cases of primary total knee arthroplasty (TKA) and primary unicompartmental knee arthroplasty (UKA) that were performed between January 1st, 2015 and December 31st, 2017. Because NSQIP data is public and universally de-identified, the institutional review board deemed this study exempt.

PATIENT AND SURGICAL VARIABLES

Several patient-, surgical-, and compensation- based variables were extracted for each surgical case. Patient variables included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) class, and various comorbidities. The medical comorbidities included were: diabetes, smoking, chronic obstructive pulmonary disease (COPD), ascites, congestive heart failure (CHF), hypertension, renal failure, dialysis use, and chronic steroid use. Age was categorized into the following sub-groups: under 60, between 60-69, between 70-79, between 80-89, and over 90 years-old at the time of the procedure. BMI was categorized into the following groups: underweight (<18.5 kg/m²), normal (18.5 – 24.9 kg/m²), overweight (25.0 – 29.9 kg/m²), and obesity classes I (30.0 – 34.9 kg/m²), II (35.0 – 39.9 kg/m²), and III (40.0+ kg/m²). All patients were assigned to the following ASA classes: class 1 (no disturbance in function), class 2 (mild disturbance in function), class 3 (severe disturbance in function), and class 4 (life threatening disturbances). All medical comorbidities were reported as dichotomous variables (e.g. yes/no).

Patient medical outcomes and complications were assessed using the following variables: mean length of hospital stay, occurrence of and mean time to superficial surgical site infections (SSI), occurrence of and mean time to deep SSI, return to OR, and unplanned any-cause readmissions. All outcome and complication variables were analyzed within a 30-day time frame of the index operation, as is standard given the ACS NSQIP database's short term outcome reporting.

CURRENT PROCEDURAL TERMINOLOGY (CPT) CODES

CPT codes are standardized medical codes maintained by the American Medical Association. They are used to uniformly identify medical, surgical, and diagnostic services, and help determine practitioner reimbursement. Category 1 CPT codes, which were used for this study, correspond to a specific procedure or service provided by a physician. CPT

codes 27446 and 27447 were used in this study to identify UKA and TKA patients, respectively.

SURGICAL AND COMPENSATION VARIABLES

The total operative time in minutes was assessed for each case, as reported as the "OPTime" variable in the ACS NSQIP database. The relative value unit (RVU) for each case was reported as the "work RVU" variable, as defined in the ACS NSQIP database. The RVU per minute was calculated for each case by dividing the total RVUs by the operative time.

A Medicare conversion factor of 36.0896 dollars per each RVU was used to estimate the total reimbursement in dollars for each surgical case (CMS 2020). Reimbursement per minute was calculated for each case by dividing the total reimbursement by the operative time. Between January 1st, 2015 and December 31st, 2017, the work RVU assigned to primary TKA or primary UKA procedures did not change.

EXCLUSION CRITERIA

Any cases with concurrent procedures performed—as identified by concurrent CPT codes and/or relative value units (RVUs)—were excluded from the final analysis (n = 13,957 total cases). Bilateral and revision procedures were excluded from the final analysis. Any cases with incomplete patient or surgical data were also excluded. Cases with operative times less than 30 minutes or greater than 480 minutes were excluded (n = 482 total cases; unlikely value, likely to be a data entry error).

DATA ANALYSIS

The data for the TKA and UKA cohorts were collected from the NSQIP database and entered into an Excel spreadsheet (2021 Microsoft Office Professional Plus; Redmond, WA). Pearson's chi squared (χ^2) test was used to compare differences in categorical variables – including sex, age class, BMI class, prevalence of medical comorbidities, and ASA class between the TKA and UKA groups, as well as categorical medical outcome variables.

The mean and standard deviation of the continuous variables of interest – RVUs, case length, RVUs per minute, total reimbursement, reimbursement per minute, and continuous post-surgical outcome variables – were reported for both the TKA and UKA groups. Unpaired t-tests were used to compare differences in these variables of interest between the two groups.

All statistical analyses were performed using SPSS Version 24.0 (Armonk, NY: IBM Corp). Statistical significance was defined as $p < 0.05$ for all statistical analyses.

RESULTS

176,678 cases were identified. 14,439 cases were excluded due to concurrent procedures, incomplete records, or operative time less than 30 minutes or greater than 480 minutes. 162,239 cases were included in the final analysis, with 157,107 TKA cases and 5,132 UKA cases. Patient demographic data is summarized in [Table 1](#). Overall, patients

Table 1. Summary of patient demographics and medical burden

	UKA [n = 5,132]	TKA [n = 157,107]	P
Sex			
Male	2566 (50.0%)	60347 (38.4%)	<0.001
Female	2566 (50.0%)	96759 (61.6%)	
Age			
Under 60	1636 (31.9%)	34558 (22.0%)	<0.001
Between 60-70	1884 (36.7%)	61221 (39.0%)	0.001
Between 70-80	1229 (23.9%)	47412 (30.2%)	<0.001
Between 80-90	366 (7.1%)	13455 (8.6%)	<0.001
Over 90	17 (0.3%)	461 (0.3%)	0.623
BMI (kg/m²)			
Underweight	25 (0.5%)	856 (0.5%)	0.580
Normal	585 (11.4%)	14372 (9.1%)	<0.001
Overweight	1680 (32.7%)	41726 (26.6%)	<0.001
Obese Class I	1566 (30.5%)	45513 (29.0%)	0.016
Obese Class II	833 (16.2%)	31123 (19.8%)	<0.001
Obese Class III	443 (8.6%)	23517 (15.0%)	<0.001
Comorbidities			
Diabetes	784 (15.3%)	28957 (18.4%)	<0.001
Smoking	496 (9.7%)	13083 (8.3%)	<0.001
COPD	133 (2.6%)	5561 (3.5%)	<0.001
Ascites	0 (0.0%)	28 (0.0%)	>0.999
Congestive Heart Failure	11 (0.2%)	488 (0.3%)	0.223
Hypertension	2850 (55.5%)	102088 (65.0%)	<0.001
Renal Failure	2 (0.0%)	34 (0.0%)	0.412
Dialysis	9 (0.2%)	253 (0.2%)	0.801
Chronic Steroid Use	95 (1.9%)	5557 (3.5%)	<0.001
ASA Class			
Class 1 (No disturbance)	168 (3.3%)	2878 (1.8%)	<0.001
Class 2 (Mild disturbance)	2936 (57.2%)	75338 (48.0%)	<0.001
Class 3 (Severe disturbance)	1970 (38.4%)	76052 (48.4%)	<0.001
Class 4+ (Life threatening)	56 (1.1%)	2655 (1.7%)	<0.001
Missing Data	2 (0.0%)	184 (0.0%)	0.104

who underwent TKAs were more likely to be female and significantly older than UKA patients. TKA patients also displayed a significantly higher proportionality of obesity and various comorbidities including diabetes, COPD, hypertension, and chronic steroid use. UKA patients were significantly more likely to be smokers. UKA patients were significantly more likely to be classified as ASA Class 1 or 2, whereas TKA patients were significantly more likely to be classified as ASA Class 3 or 4+.

MEAN RVUS

The RVUs for 5,132 UKA and 157,107 TKA cases were 17.48 and 20.72, respectively. The CMS-assigned RVUs did not change during the duration of the study period.

MEAN OPERATIVE TIMES

Mean operative times for the two cohorts were calculated and compared. The mean operative time for the 5,132 UKA cases was 83.80 minutes $\pm$ 30.13 (range: 30 to 480 minutes). The mean operative time for the 157,107 TKA cases was 89.43 minutes $\pm$ 31.88 (range: 30 to 480 minutes). The 83.80-minute mean operative time for UKA cases was found to be significantly shorter than the 89.43-minute mean operative time for TKA cases ($p < 0.001$).

MEAN RVU/MINUTE

The mean RVU/minute for the UKA cases was 0.23 RVU/min $\pm$ 0.08 (range: 0.05 to 0.58), while the mean RVU/minute for the TKA cases was 0.26 RVU/min $\pm$ 0.09 (range: 0.04 to

Table 2. Comparisons of average RVU, case length, and RVU/min for each procedure

	UKA [n = 5,132]	TKA [n = 157,107]	P
RVU	17.48	20.72	
Case length (min)	83.80 ± 30.13	89.43 ± 31.88	<0.001
RVU/min	0.23 ± 0.08	0.26 ± 0.09	<0.001

Table 3. Comparisons of average reimbursement for each procedure

	UKA [n = 5,132]	TKA [n = 157,107]	P
Reimbursement per case (\$)	630.85	747.78	
Reimbursement per minute (\$/min)	8.46 ± 2.99	9.36 ± 3.19	<0.001

0.69). The 0.23 mean RVU/minute for the UKA cases was found to be significantly lower than the 0.26 mean RVU/minute for the TKA cases ($p < 0.001$). The percent difference between the two cohorts was 13% greater for the TKA group ([Table 2](#)).

COMPENSATION ANALYSIS

The UKA case reimbursement rate was \$630.85, while the TKA case reimbursement rate was \$747.78. Given their linear relationship with the RVUs, these reimbursement rates did not change during the duration of the study period. For the UKA cases, the reimbursement rate was found to be $\$8.46 \pm 2.99$ per minute (range: \$1.77 to \$21.03), while for TKA cases, it was found to be $\$9.36 \pm 3.19$ (range: \$1.57 to \$24.93). Akin to the RVU/min rates, TKA cases were compensated with a significantly higher reimbursement rate per minute than UKA cases ($p < 0.001$) ([Table 3](#)).

MEDICAL OUTCOMES AND COMPLICATIONS

The cohort of patients who underwent TKA had a longer mean hospital length of stay (2.52 ± 3.20 days vs. 1.43 ± 2.72 days; $p < 0.001$), shorter mean time to deep surgical site infection (18.46 ± 7.24 days vs. 21.43 ± 5.19 days; $p < 0.001$), and higher rates of unplanned hospital readmission (3.07% vs. 1.87% of patients; $p < 0.001$). There was also a statistically insignificant trend toward TKA patients having higher rates of return to the OR within 30 days of the index operation (1.14% vs. 0.88% of patients; $p = 0.076$). There were no statistically significant differences reported in the occurrence of or mean time to superficial surgical site infection or occurrence of deep surgical site infection ([Table 4](#)).

DISCUSSION

As the United States' healthcare system continues to prioritize economic outcomes in all patient interactions, orthopaedic surgeons and their colleagues must have the data and tools necessary to make informed value-based healthcare decisions (Burnham et al. 2017). These decisions are not only pertinent to surgeons' fair compensation, but also

to patients, whose care and satisfaction are intimately linked to overall quality and value of surgical care provided (Zgierska, Rabago, and Miller 2014). In this analysis of more than 5,000 UKAs and nearly 150,000 TKAs, we found that (1) TKAs are reimbursed at a higher mean RVU amount compared to UKAs, (2) mean operative time for UKAs is shorter than that of TKAs, (3) reimbursement per minute is significantly less for UKA than TKA, and (4) TKAs are associated with greater rates of patient complications and perioperative care demands than UKAs.

The RVU is the principal metric currently used to quantify the economic outcomes of healthcare interactions. Little data exploring the relationship between RVU values and the nature of their corresponding orthopaedic procedure–complexity, operative time–currently exists in the field, and the limited research that does exist has only recently been published. In our paper, we aimed to compare the RVU values of TKA and UKA procedures and analyze our findings in the context of each procedure's complexity. Theoretically, because TKAs require more operating room time, are associated with increased intraoperative blood loss, result in longer lengths of hospitalization, result in higher postoperative morbidity, and require more involved pain management than UKAs (Leiss et al. 2020; Brown et al. 2012; Schwab et al. 2015), their compensation in terms of gross RVU and RVU/min should be greater. Because RVU values are directly and linearly tied to a monetary amount via a CMS-determined Medicare conversion factor (1 RVU=\$36.0896) (CMS 2021), their actual gross reimbursement and reimbursement per minute in dollars would expectedly be greater as well.

Mean RVU, mean operative time, and mean RVU/min were found to be significantly higher in TKA cases than UKA cases ($p < 0.001$, $p < 0.001$, $p < 0.001$, respectively). Furthermore, given the linear association between RVU and dollars–slope being the CMS Medicare conversion factor of \$36.0896 per RVU, which was unchanged throughout the study period–both mean dollar amount reimbursement rates per case and per minute were higher for TKA cases than UKA cases as well (both $p < 0.001$).

The reasons for differential reimbursement of UKA versus TKA is not entirely clear; however, UKAs appear to place less of a burden on the patient and health care infrastruc-

Table 4. Comparison of medical outcomes and complications for each procedure

	UKA [n = 5,132]	TKA [n = 157,107]	P
Mean hospital length of stay (days)	1.43 ± 2.72	2.52 ± 3.20	<0.001
Occurrence of superficial surgical site infection (SSI) < 30 days	26 (0.51%)	787 (0.50%)	0.955
Mean time to superficial SSI (days)	16.58 ± 8.12	16.50 ± 8.15	0.489
Occurrence of deep SSI < 30 days	7 (0.14%)	167 (0.11%)	0.517
Mean time to deep SSI (days)	21.43 ± 5.19	18.46 ± 7.24	<0.001
Return to OR <30 days	45 (0.88%)	1797 (1.14%)	0.076
Unplanned readmission <30 days	96 (1.87%)	4830 (3.07%)	<0.001

ture. For example, UKAs require shorter required operative time, and patients undergoing UKA typically exhibit a higher degree of physical mobility after surgery, thus requiring significantly less aftercare and overnight hospital stays (Siman et al. 2017). Our study's patient demographic analysis (Table 1) supports the notion that increased perioperative care may be needed for TKA patients relative to UKA patients, as the TKA patients in this study were older, significantly more likely to be classified as Obese Class II and III, and more likely to be classified as high-operative risk patients per increased ASA classification (3 and 4+). TKA patients also exhibited greater rates of various comorbidities including diabetes, COPD, hypertension, and chronic steroid use. While UKA patients were more likely to be smokers, they were also more likely to be younger, of normal weight, overweight, or Obese Class I status, and of lower ASA classifications (1 and 2). Moreover, the literature shows that patients undergoing UKA typically have less pain in the perioperative period compared to patients undergoing TKA, making same-day discharge a more reasonable option for UKA patients (Zgierska, Rabago, and Miller 2014). Lastly, UKAs may be considered less invasive than a TKA, as only one knee compartment is instrumented which results in significantly lower rates of intraoperative blood loss and postoperative blood transfusions (CMS 2021). Despite the advantages of UKA, the potential need for conversion to TKA at a later date is a risk that may impact overall economic outcome of the UKA. For example, the rate of conversion from UKA to TKA is around 5% with a mean time to revision of 3.0 years (Robb et al. 2013) whereas the 10-year rate of revision for primary TKA is approximately 5% (Robb et al. 2013; Postler et al. 2018; Australian Orthopaedic Association 2020; National Joint Registry 2015).

In light of these discrepancies on the perceived burdens and costs placed on the healthcare system by UKA and TKA patients, we analyzed various post-operative outcomes for each group. We found that TKA patients experienced significantly longer hospital lengths of stay, as well as shorter mean time to deep surgical site infection and higher rates of unplanned hospital readmission within 30 days. There was also a statistically insignificant trend toward higher rates of returns to the OR for the TKA cohort. Our findings generally agree with previous studies that have documented lower healthcare burden and aftercare requirements for UKA patients relative to TKA patients (Zgierska, Rabago, and Miller 2014; Siman et al. 2017). While the

shorter operative time associated with UKA can be used to rationalize lower gross RVU values associated with the procedure, our findings regarding greater short-term post-operative complications and burden of TKAs align with the higher rate of reimbursement for TKA procedures.

It should also be noted that since the study period, the work RVU value for TKAs has decreased from 20.72 to 19.60 (CMS 2018). The work RVU value for UKAs has remained constant at 17.48. While the TKA RVU value is still higher than that of the UKA, the narrowing of this discrepancy further highlights whether the increased aftercare associated with TKAs, as evidenced by significantly greater hospital length of stay, is properly considered by reimbursement.

Limitations of this study include its retrospective nature and limited data acquisition. As opposed to a prospective study, we were unable to track data and were subject to incomplete data points. Additionally, there may have been bias introduced by our outlier exclusion methods, which were comprised of missing data entries and unlikely operating times. These data points were excluded using methods similar to parallel studies comparing trends in reimbursement for other orthopaedic procedures (Sodhi et al. 2018, 2019). The drawbacks of using a national database include the lack of generalizability to individual cases, surgeons, or medical centers. However, because the data included in this study was sourced from a national database and included over 160,000 viable data points, we believe that an adequate sample size and sufficient generalizability was achieved. Our study also did not include any measure of physician-reported procedure difficulty or any data regarding patient time spent in aftercare/recovery units and clinic visits. Both metrics would have allowed us to strengthen claims regarding the absolute and relative adequacy of physician compensation.

Future studies should not only continue to explore the relationship between RVU values/rates and corresponding procedures—orthopaedic or otherwise—but should also include metrics to further elucidate the relative complexity of various procedures as well as the aftercare and overall clinical time requirements of patients following surgery. These studies, preferably prospective in nature, should also continue to assess the link between RVU reimbursement and monetary reimbursement. The importance of the RVU in our present-day healthcare system should continue to be pressure-tested as the United States and public payors become increasingly value and economic outcome-conscious.

Additionally, we should continue to critically examine the RVU value structure, as misaligned incentives could unintentionally affect the care provided to orthopaedic surgery patients.

CONCLUSION

As the United States healthcare system continues to prioritize value-based care over the traditional fee-for-service paradigm, assessing and operationalizing economic outcomes has grown increasingly important. RVUs, the metric used by Medicare to determine the reimbursement of a given healthcare interaction or procedure, have come under scrutiny for several reasons, not limited to inaccurate and inadequate compensation of various procedures. This study assessed RVU criticism as it pertains to TKA vs. UKA procedure reimbursement. In line with the greater perioperative care demands and longer measured operative times of TKAs, TKA cases were reimbursed with a higher RVU, RVU/min, dollar amount, and dollar per minute rate than UKA cases. Future studies should examine the differences in compensation between TKA and UKA to determine whether the relative differences in reimbursement accurately reflect the true discrepancy in the procedures' complexity and care requirements.

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AVAILABILITY OF DATA AND MATERIALS

American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP), publicly available de-identified data, as mentioned in "Methods" section

AUTHORS' CONTRIBUTIONS

SW performed data analysis and wrote the manuscript, MP performed data collection and analysis and revised the manuscript, EG performed data collection and analysis and revised the manuscript, PS helped direct manuscript drafting and revised the manuscript, KH provided the original research idea as well as constant support and revisions related to the data analysis and manuscript drafting

ETHICS APPROVAL

Not applicable, publicly available de-identified data does not require IRB approval at our institution

CONSENT FOR PUBLICATION

Not applicable, publicly available de-identified data does not require IRB approval or consent for publication at our institution

COMPETING INTERESTS

SW, MP, EG, and PS declare no competing interests or financial disclosures. KH declares the following financial interests:

1. Medacta USA, Moximed Inc–Paid consultant for a company or supplier
2. Medacta USA–Research support from a company or supplier as a Principal Investigator

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