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## Free Falling: Declining Inflation-Adjusted Payment for Arthroplasty Surgeons

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## ABSTRACT

**Background:** Over the past decade, there have been ongoing concerns over declining surgeon compensation for lower extremity arthroplasty. We aimed to determine changes in surgeon payment, patient charges, and overall reimbursement rates for patients undergoing unicompartmental arthroplasty (UKA) and both primary and revision total knee (TKA) and hip (THA) arthroplasty.

**Methods:** Using Medicare data from 2012 to 2017, we determined inflation-adjusted changes in annual surgeon payment (professional fee), patient charges, and reimbursement rate (payment-to-charge ratio) for UKA and primary/revision TKA and THA. Both nonweighted and weighted (by procedure frequency/volume) means were calculated.

**Results:** Inflation-adjusted surgeon payment decreased for all procedures analyzed, with primary TKA (−17%) and THA (−11%) falling the most. Payment for UKA increased the most (+30%). There was a small increase in charges for THA revision (+2.2%, +2.1%, and +3.2% for acetabulum only, femur only, and both components, respectively). Charges for primary TKA (−3.7%) and THA (−1.5%) decreased slightly. The reimbursement rate for all procedures fell with UKA (−15%), TKA (−14%), and THA (−10%) falling the most. After weighting by procedure frequency/volume and combining all surgeries, average charges fell slightly (−0.7%), whereas surgeon payment (−13%) and reimbursement rate (−12%) fell more sharply.

**Conclusion:** Although patient charges have grown in pace with the inflationary rate for primary and revision TKA and THA, surgeon payment and reimbursement rates have fallen sharply. The orthopedic community needs to be aware of these financial trends to communicate to payers and health care policy makers the importance of protecting a sustainable payment infrastructure.

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Total knee (TKA) and hip (THA) arthroplasty are two of the most successful procedures in orthopedic surgery in improving patient quality of life [1]. These procedures are also 2 of the most commonly performed procedures in the United States. Over 1,000,000 procedures are performed annually [2,3], with over 60% being paid for by Medicare [4]. Despite the success of TKA and THA, there have been ongoing concerns over declining surgeon compensation in performing these surgeries [5–7]. In addition, there have also been concerns of undercompensation for revision arthroplasty procedures, given the complexity, higher work

intensity, greater resource utilization, and increased perioperative complications associated with these cases compared with primary joint arthroplasty [8–10].

Although the decline in payment over the past 2 decades has been previously described [5,11], only surgeon fee estimates have been investigated. These studies have not assessed actual retrospective Medicare surgeon payment and contain no information on patient charges. Our primary aim was to determine changes in surgeon payment, patient charges, and overall reimbursement rate (defined as the payment-to-charge ratio) for patients undergoing unicompartmental knee arthroplasty (UKA) and primary and revision TKA and THA, using retrospective Medicare compensation data.

## Methods

We used Medicare data from 2012 to 2017 to assess surgeon payments (professional surgeon fees), patient charges (billed by

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provider), and procedure volumes related to the following procedures: primary TKA (CPT 27447), revision TKA (total, CPT 27487), UKA (CPT 27446), primary THA (CPT 27130), conversion to THA (27132), revision THA (acetabulum only, CPT 27137), revision THA (femur only, CPT 27138), and revision THA (total, CPT 27134) [12]. Other arthroplasty CPT codes, including 27442 (KA, femur or tibia), 27443 (KA, femur or tibia with debridement/synovectomy), and 27445 (hinged TKA) were excluded in this analysis because of low procedure volumes (<500 for all years analyzed). We utilized the consumer price index over the same period to adjust for inflation to show monetary degradation from 2012 [13] (Table 1).

The reimbursement rate, defined as payment-to-charge ratio, was calculated for all surgeries. Descriptive statistics were used to report trends over time in surgeon payment, patient charges, and overall reimbursement rate. Linear regression was used to determine the strength of correlation for changes in payment, patient charges, and reimbursement rate over time.  $R^2 \geq 0.8$  was considered a strong trend or change over the period analyzed. Both nonweighted and weighted (by procedure frequency and volume) means were calculated for surgeon payment, patient charge, and reimbursement rate.

## Results

Of the CPT codes analyzed, the number of total knee and hip arthroplasty procedures performed under the Centers of Medicare and Medicaid (CMS) grew 19.8% (from 692,788 in 2012 to 829,711 in 2017). Primary TKA and THA comprised most of all cases analyzed during this period (Table 2). From 2012 to 2017, the consumer price index showed a cumulative inflation rate of +7.1% (Table 1).

For surgeon payment from 2012 to 2017, before adjusting for inflation, primary TKA (−11%) and THA (−5%) fell the most while UKA (+39%) increased the most. After adjusting for inflation, surgeon payment decreased for all procedures analyzed except for UKA (Figs. 1 and 2). Inflation-adjusted payment for primary TKA (−17%) and THA (−11%) fell the most while payment for UKA increased (+30%).

For patient charges from 2012 to 2017, after adjusting for inflation, changes remained in pace with inflation for all procedures aside from UKA, which increased 53% (Table 3). The reimbursement rate (surgeon payment to patient charge ratio) for each surgery was  $\leq 0.23$  for all surgeries for all years. Over this period, the reimbursement rate for all procedures fell with UKA (−15%), TKA (−14%), and THA (−10%) falling the most (Figs. 3 and 4).

Finally, after adjusting for inflation and procedure frequency/volume and combining all surgeries, overall charges remained nearly unchanged (−0.7%), whereas surgeon payment (−13%) and reimbursement rate (−12%) fell more sharply (Table 3).

## Discussion

In this study, we found that inflation-adjusted Medicare surgeon payments and reimbursement rates for primary and revision TKA and THA decreased from 2012 to 2017. The greatest decreases in payment and reimbursement rate were seen in primary TKA and

THA. Although the reimbursement rate for UKA also fell, payment grew by over 30%. Aside from UKA, charges remained nearly consistent with inflation. A decrease in overall surgeon payment and reimbursement rate was still observed after weighing for procedure frequency and volume.

Our results of surgeon payment are consistent with those reported in previous studies. Mayfield et al. found that from 2000 to 2019, average physician inflation-adjusted payment decreased by −31.9% for all hip arthroplasty procedures and by −33.3% for all knee arthroplasty procedures [5]. The greatest decreases were seen in primary TKA and THA at −40.6% and −37.1%, respectively, with an average decrease in inflation-adjusted reimbursement rates for all procedures of −1.7% per year. However, our study uses a different methodology in an attempt to more accurately capture the financial changes during the period analyzed. First, Mayfield et al. used the Physician Fee Schedule Look-Up Tool [14] where as our study used an actual retrospective Medicare payment database. The Physician Fee Schedule Look-Up Tool reports the national payment amount (carrier code 0000000) and is only an estimate that can be far higher than the actual average Medicare-allowed amount [12]. For example, in 2013, this tool estimates the physician fee for TKA (27447) to be \$1552.81 while the retrospective Medicare payment database [12] shows an average of \$1054.58. Although the importance and value of temporal reimbursement studies is in presenting trends, our study uses actual reported averaged payments and improved accuracy for these calculations. Otherwise, the magnitude of payment decline may be under-recognized.

Second, our study also contains data on procedural charges as well as reimbursement rates, which are important to take into account for a holistic picture of payment over time. In addition, our study reports both nonweighted and weighted means of physician payment. Reporting only nonweighted means can lead to erroneous findings, because payment decreases in higher volume procedures (primary TKA and THA) will have a larger effect on average compensation when weighted appropriately. For example, the nonweighted average decline in payment for all CPT codes analyzed was −3.1% (Table 3). After weighting by procedure volume, overall payment fell nearly −13%, a four-fold difference. Because primary TKA and THA showed the greatest declines in payment and were the highest volume procedures, Mayfield and Haglin may underestimate the total actual payment decline. Similarly, a nonweighted average of patient charges shows an increase of +6.9%; however, this is only due to a larger increase in UKA patient charges. A weighted average shows a slight decrease of −0.7%, which is in pace with inflation, suggesting that surgeons are not charging patients higher rates despite declines in both surgeon payment and reimbursement rate.

In another study, Hariri et al. found that between 1992 and 2007, inflation-adjusted Medicare reimbursement rates for primary and revision TKA and THA decreased at rates of 42% and 45%, respectively [15]. Moreover, they found that total joint arthroplasty had the greatest decline among the twenty-five most common orthopedic inpatient procedures that were analyzed, emphasizing the importance of understanding trends in reimbursement for these procedures over time. Using Medicare reimbursement data from 2000 to 2016, Eltorai et al. found that primary TKA and THA had among the greatest inflation-adjusted compound annual decreases of the 27 most commonly performed orthopedic procedures in the United States [11]. Our findings illustrate similar trends of declining payment and reimbursement for primary total joint arthroplasty but also include other metrics of reimbursement including patient charges and reimbursement ratios.

In recent years, there has been a shift away from fee for service to alternative payment models. The most notable alternative payment model is the bundled pay model, which was initially

**Table 1**  
Consumer Price Index Inflation From 2012 to 2017.

|     | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-----|------|------|------|------|------|------|
| CPI | —    | 1.6% | 3.2% | 3.1% | 4.5% | 7.1% |

CPI, consumer price index.

For example, a \$1071 professional fee payment in 2017 would be equivalent to \$1000 in 2012 dollars after adjusting for inflation.

**Table 2**  
Total Knee and Hip Arthroplasty CMS Procedure Volumes From 2012 to 2017.

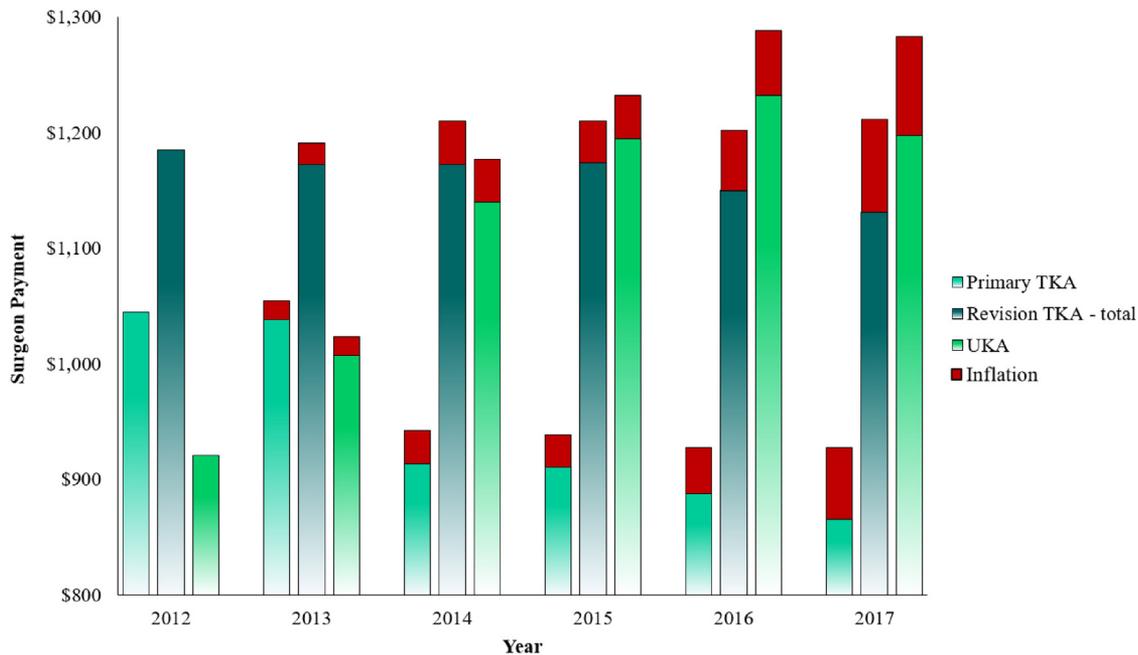
| Procedure (CPT Code)            | 2012    | 2013    | 2014    | 2015    | 2016    | 2017    | 2012 – 2017 Δ (%) |
|---------------------------------|---------|---------|---------|---------|---------|---------|-------------------|
| Primary TKA (27447)             | 413,166 | 427,748 | 422,265 | 438,226 | 474,632 | 484,167 | +17.2%            |
| Revision TKA—total (27487)      | 23,099  | 23,287  | 22,746  | 22,614  | 23,580  | 24,694  | +6.9%             |
| UKA (2744)                      | 20,656  | 22,643  | 25,355  | 26,025  | 28,487  | 28,321  | +37.1%            |
| Primary THA (27130)             | 195,843 | 207,493 | 214,868 | 229,925 | 244,131 | 253,309 | +29.3%            |
| Conversion to THA (27132)       | 8818    | 8807    | 9125    | 9031    | 9284    | 9350    | +6.0%             |
| Revision THA—tab only (27137)   | 8077    | 7670    | 7411    | 6563    | 6361    | 6219    | -23.0%            |
| Revision THA—femur only (27138) | 5287    | 6213    | 6324    | 6100    | 6327    | 6556    | +24.0%            |
| Revision THA—total (27134)      | 17,842  | 17,931  | 17,497  | 17,182  | 16,884  | 17,095  | -4.2%             |
| Total volume                    | 692,788 | 721,792 | 725,591 | 755,666 | 809,686 | 829,711 | +19.8%            |

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

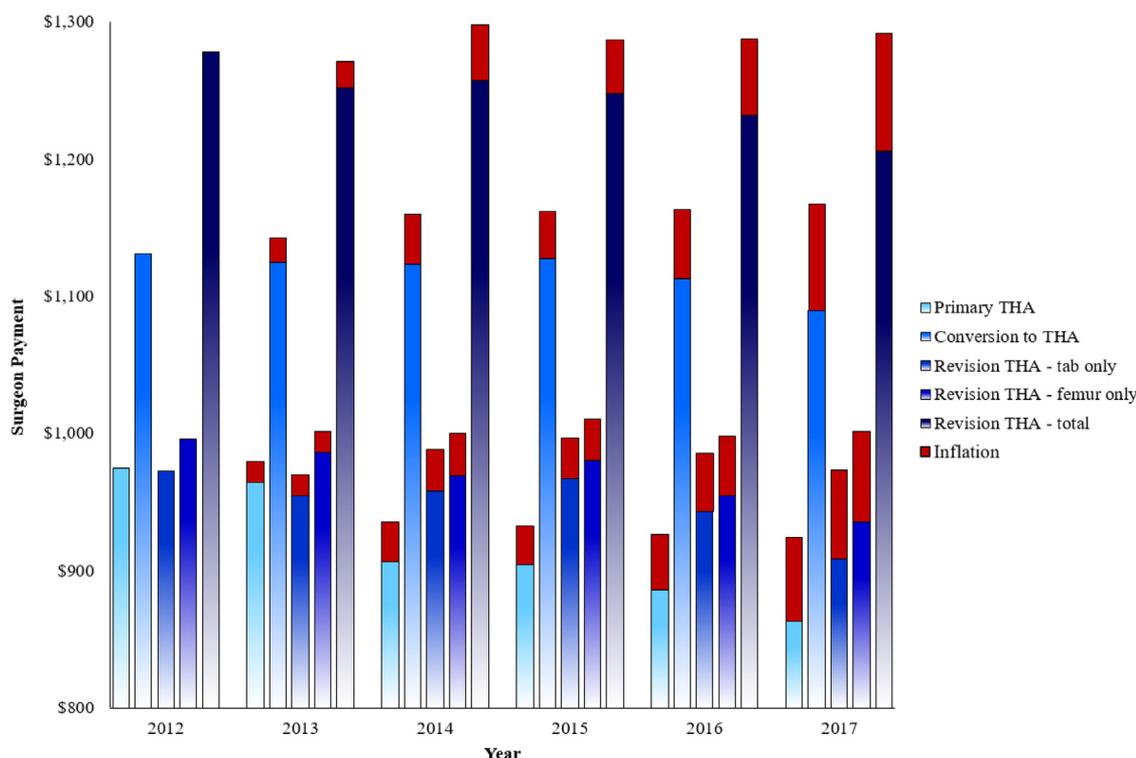
introduced as the Bundled Care for Improvement Initiative in 2012 [16]. In April 2016, CMS introduced the Comprehensive Care for Joint Replacement model [17]. Through such models, hospitals receive a single payment for each episode of care, allowing them to determine how to distribute costs, including payment attributed to surgeons. In theory, this would motivate and allow surgeons to benefit from increased profits by decreasing implant and surgery-related costs as well as adopting comprehensive perioperative protocols to decrease perioperative complication rates, which can be expensive to manage [18]. Subsequent studies have found that bundled care models have maintained or improved quality while reducing costs in TKA and THA [19–21]. However, as hospitals continue to adopt bundled payment models, these models need to be commensurately applied to the appropriate surgical setting (outpatient, observation less than two midnights, and inpatient status greater than two midnights). CMS' recent removal of TKA and THA from the inpatient-only list has led to large revenue losses for hospitals receiving payment commensurate with an outpatient surgery despite providing inpatient care [28].

Although many insurance and private carriers base their physician payment on national Medicare values, some physician employment contracts use relative value unit (RVU) generation

to compute compensation. The observed decline in surgeon fees presented in the present study is especially worrisome considering that insurance companies have suggested that TKA and THA are overvalued surgeries in terms of RVU allotments. RVU assignments are established by the American Medical Association Relative Value Scale Update Committee (RUC) and are based on physician work, practice expense, and professional liability [22]. In 2018, Anthony Mader, vice president of the health insurance company Anthem, Inc. suggested that RVUs for TKA and THA were overvalued and requested that CMS review them [23]. He argued that this was due to overvaluation of pre-, intra-, and post-service time based on a report by the Urban Institute. The report, which was based on findings from three institutions, found that median skin-to-skin operative time was 83 minutes for TKA and 87 minutes for THA, below the expected operative time of 100 minutes for each [24]. As a result, the RVU allotments for these procedures are currently under review by the RUC. However, other studies have yielded varying results for intraoperative time of these procedures, ranging from 82 to 116 minutes for primary TKA and 85 to 102 minutes for primary THA [25–27], suggesting the possibility that these procedures may be as much undervalued as overvalued.



**Fig. 1.** Surgeon payment for primary and revision total knee arthroplasty for Medicare patients, 2012 to 2017. The total length of each column represents the actual surgeon payment for each surgery for the given year. The segments in red show the fraction of payment lost after adjusting for inflation. The largest drop in payment occurred in between 2013 and 2014 for primary TKA. Unicompartmental arthroplasty was the only surgery with an upward trend in payment.



**Fig. 2.** Surgeon payment for primary and revision total hip arthroplasty for Medicare patients, 2012 to 2017. The total length of each column represents the actual surgeon payment for each surgery for the given year. The segments in red show the fraction of payment lost after adjusting for inflation. Note the overall downtrend in payment for all surgeries after accounting for inflation.

As part of the RVU review process, the American Association of Orthopaedic Surgeons provides recommendations to the RUC via survey data from its members, which inquire about time spent on these procedures, including the preoperative, intraoperative, and postoperative periods [22]. However, given the wide range of reported times, it would be fruitful for recommendations to be more comprehensive and to include results from studies with adequate and representative sample sizes as a more objective measure, as opposed to relying on estimates alone. Future studies are required to investigate the impact of different models of care and reimbursement on patient charges and surgeon pay and reimbursement. Findings from such studies could be used as a means of advocacy when providing recommendations to the RUC, and for addressing the decline in surgeon payment and reimbursement rate.

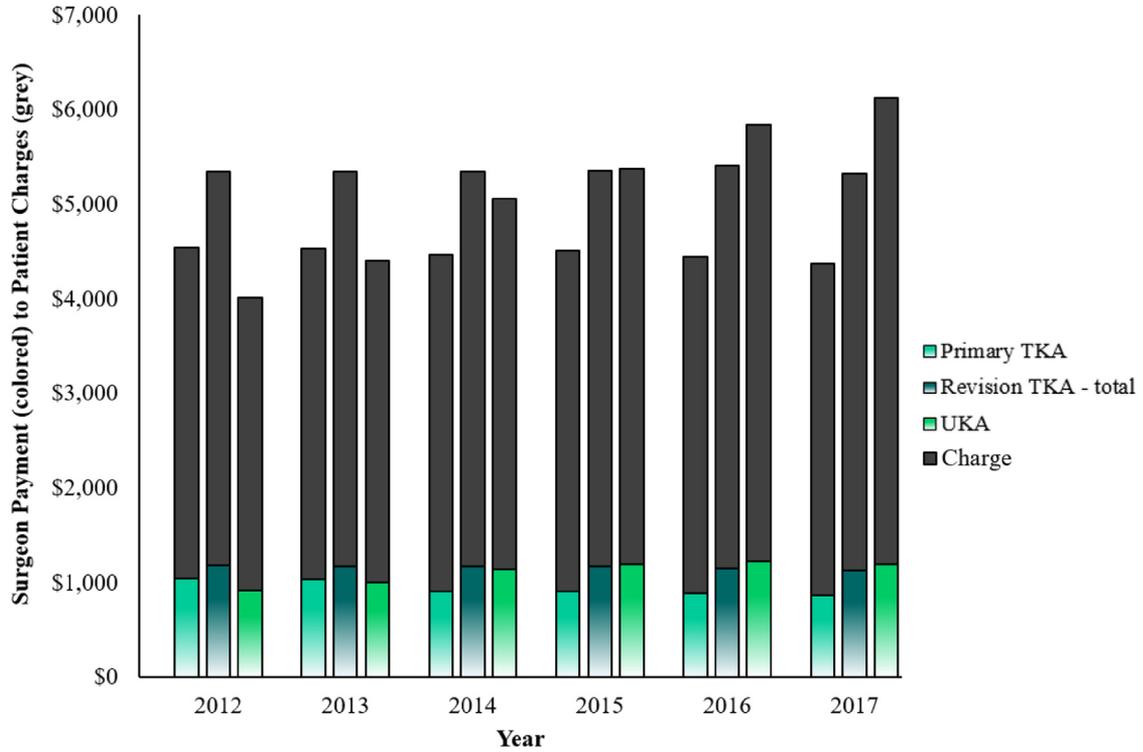
Finally, these findings have important financial implications to both trainees and early-career arthroplasty surgeons. Although specialty training should be based on a passion for the field and to develop an advanced orthopedic skill set, it is disheartening to observe an appreciable decline in surgeon compensation over the past 2 decades. This pattern may steer trainees away from arthroplasty and becomes particularly problematic when models have depicted substantial arthroplasty need and growth over the next 2 decades [29,30]. This may inadvertently lead to a national shortage of fellowship-trained arthroplasty surgeons. Furthermore, in the present day, this problem is accentuated given the recent coronavirus pandemic. There has and will be a substantial delay in resuming elective arthroplasty at case volumes on par with pre-pandemic volumes [31], and even optimistic projections have

**Table 3**  
Aggregate Changes in Surgeon Payment, Patient Charges, and Reimbursement for Primary and Revision Total Knee and Hip Arthroplasty for Medicare Patients, 2012 to 2017, Adjusted for Inflation.

| Surgery (CPT Code)              | 2012–2017 $\Delta$ | $R^2$             | Charges | $R^2$             | Reimbursement Rate | $R^2$             |
|---------------------------------|--------------------|-------------------|---------|-------------------|--------------------|-------------------|
| Primary TKA (27447)             | –17%               | 0.86 <sup>a</sup> | –3.7%   | 0.81 <sup>a</sup> | –14%               | 0.81 <sup>a</sup> |
| Revision TKA—total (27487)      | –4.6%              | 0.82 <sup>a</sup> | –0.30%  | 0.06              | –4.3%              | 0.84 <sup>a</sup> |
| UKA (2744)                      | +30                | 0.83 <sup>a</sup> | +53     | 0.99 <sup>a</sup> | –15%               | 0.84 <sup>a</sup> |
| Primary THA (27130)             | –11%               | 0.93 <sup>a</sup> | –1.5%   | 0.43              | –10%               | 0.90 <sup>a</sup> |
| Conversion to THA (27132)       | –3.6%              | 0.69              | +0.40%  | 0.14              | –4.0%              | 0.76              |
| Revision THA—tab only (27137)   | –6.6%              | 0.64              | +2.2%   | 0.63              | –8.5%              | 0.96 <sup>a</sup> |
| Revision THA—femur only (27138) | –6.1%              | 0.86 <sup>a</sup> | +2.1%   | 0.61              | –8.0%              | 0.96 <sup>a</sup> |
| Revision THA—total (27134)      | –5.6%              | 0.88 <sup>a</sup> | +3.2%   | 0.70              | –8.6%              | 0.83 <sup>a</sup> |
| <b>Nonweighted average</b>      | –3.1%              |                   | +6.9%   |                   | –9.0%              |                   |
| <b>Weighted average</b>         | –13%               |                   | –0.7%   |                   | –12%               |                   |

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

<sup>a</sup>  $R^2 \geq 0.8$ , suggesting a strong trend or change in the period analyzed. Primary TKA and THA were more heavily weighted because of higher procedural volumes of both surgeries, further decreasing the average compensation values.

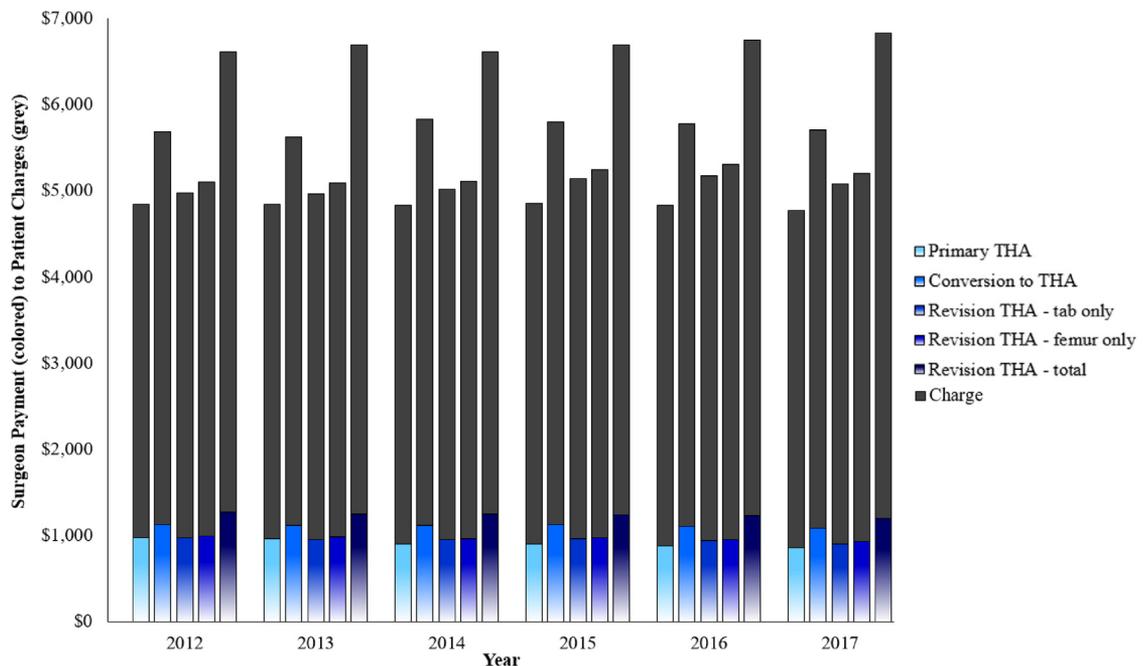


**Fig. 3.** Surgeon payment and patient charges for primary and revision total knee arthroplasty for Medicare patients, 2012 to 2017, adjusted for inflation. Actual physician payment for each type of surgery is shown in color, while the gray bars above shows the patient charge. Payment and charges for primary total knee arthroplasty (TKA) declined at a greater rate compared with revision cases. The reimbursement rate (surgeon payment to patient charge ratio) for each surgery was  $\leq 0.23$  or less for all years.

estimated it will take at least 16 months needed to resume 90% of volume [32].

There are limitations to this study. First, we only utilized Medicare data, which does not take into account trends in private insurance carriers. Nonetheless, the values established by CMS have

a significant effect on the broader market value as private insurers often base their compensation values on CMS averages. Another limitation is that the CMS data we used are national averages that do not account for variations of geographic location in the United States. Although the goals of this study were not to compare how



**Fig. 4.** Surgeon payment and patient charges for primary and revision total hip arthroplasty for Medicare patients, 2012 to 2017, adjusted for inflation. Actual physician payment for each type of surgery is shown in color, whereas the gray bars above shows the patient charge. There was an overall trend in decreasing surgeon payment for all surgeries, with primary total hip arthroplasty (THA) being affected the most.

decreases in total joint arthroplasty payment compare with other orthopedic subspecialties, it should be noted that the RUC is a closed reimbursement system and inflation affects all subspecialties. However, it has been shown that total joint arthroplasty has had relatively sharper decreases in payment than other orthopedic procedures [11]. Strengths of this study include its applicability across the United States and inclusion of procedural charges, actual surgeon payment (as opposed to estimates), and reimbursement rate analysis not included in other analyses [5,11,15]. We also provide weighted compensation averages, which provide an additional metric in assessing overall surgeon payment, patient charges, and reimbursement rate changes for the field of total joint arthroplasty.

## Conclusion

Although patient charges have grown in pace with inflation for primary and revision TKA and THA, surgeon payment and reimbursement rates have fallen sharply, with primary arthroplasty being affected more than revision cases. However, UKA saw both the greatest increase in physician payment as well as volume, suggesting that this surgery may become more prevalent in the years to come. As Medicare payment comprises an increasing proportion of orthopedic surgeons' reimbursements, the observed downward trends in payments and reimbursement rates may lead some practitioners to opt out of Medicare, leading to decreased access to care by elderly patients. As reimbursement models have been shifting toward value-based approaches, including bundled payments [17,19,33,34], orthopedic surgeons have the responsibility to further advocate for changes in payment models. Although patient care should always be the number one priority, the orthopedic community needs to be aware of these financial trends to optimally communicate to payers and health care policy makers in protecting a sustainable payment infrastructure. It is crucial to develop approaches to mitigate these trends or to develop alternative payment strategies to ensure that Medicare patients retain adequate access to care.

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