

## Original Research

# The Trend of Medicare Reimbursement for Total Joint Arthroplasty: Using Mathematical Models to Predict Possible Per-Hour Rate Out to 2030

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## ARTICLE INFO

## Article history:

Received 2 October 2023

Received in revised form

21 February 2024

Accepted 1 May 2024

## Keywords:

Reimbursement

Total joint arthroplasty

Total knee arthroplasty

Total hip arthroplasty

Per-hour income

Medicare

## ABSTRACT

**Background:** While multiple studies have assessed the trends of Medicare reimbursement for orthopedic total joint arthroplasty (TJA) surgeries, none have forecasted reimbursement in relatable per-hour figures. The purposes of this study are to examine trends of reimbursement for primary and revision TJA and translate forecasted primary TJA reimbursement to relatable per-hour compensation.

**Methods:** The Center for Medicare and Medicaid Services reimbursement data from 1992 to 2024 were used to create a historical view of reimbursement for primary and revision TJA. All monetary values were converted to 2023 USD to account for inflation. Polynomial and linear forecast equations were used to predict the future of the TJA reimbursement to 2030. Relative Value Scale Update Committee standard times for procedures were used with the forecasts to establish per-hour rates.

**Results:** Total reimbursement for primary total hip arthroplasty/total knee arthroplasty is forecasted to decrease 85.36%/86.14% by 2030. Using prior trends in reimbursement, TJA procedures are predicted to reimburse at or less than \$100.00 2023 USD per Medicare case by 2030. Moreover, TJA surgeons are forecasted to earn \$13.93/h per primary total hip arthroplasty and \$14.97/h per primary total knee arthroplasty by 2030.

**Conclusions:** This study highlights the concerning trends for both primary and revision arthroplasties as TJA surgeons are on a path to earn below minimum wage for primary TJAs by 2030. Mathematical models forecast a bleak future for orthopedic TJA reimbursement. This downward trajectory poses a risk to access and quality of care.

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## Introduction

Over the last 31 years, the Center for Medicare and Medicaid Services (CMS) has been steadily reducing the reimbursement of various medical and surgical procedures. As of 2024, CMS has implemented a 3.37% cut to Medicare reimbursement across the medical field as a whole. These reductions are often touted as victories for physicians by lawmakers since they are less than the

previously planned 8.5% decrease. Using a narrower focus, orthopedics has experienced more drastic cuts to both total and physician reimbursement than many other specialties [1-3]. Since 2009, Medicare has reduced its total spending on elective primary total joint replacement (TJA) by more than \$1 billion annually [4]. From 2000 to 2015, orthopedic surgeons lost an average of 29% of their total reimbursement rates, with price per work relative value unit (wRVU) decreasing by an average of 39% [5]. In that same period, adult reconstruction physicians lost 39% and 45% of their reimbursements and wRVUs, respectively [5]. Moreover, current literature has predicted that orthopedic surgical work will be compensated at the same hourly rate as orthopedic clinical

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procedures as early as 2024 [6]. Given that these figures were made prior to the most recent CMS cuts, the outlook for orthopedic TJA reimbursement is concerning.

This history of decreasing Medicare reimbursement, combined with outpacing economic inflation, an already elevated level of burnout within the field of orthopedics, and the increasing size of the Medicare joint replacement patient population, poses a critical concern for the future of access to quality care [7-9]. Prior studies have examined historical rates of Medicare reimbursement over isolated periods of time. This study aims to (1) expand upon previous literature and predict the financial impact of The Center for Medicare and Medicaid Services (CMS) cuts into the year 2030 using established mathematical means of forecasting; (2) translate forecasted primary TJA reimbursement to per-hour compensation in 2023 US Dollars (USD), using Relative Value Scale Update Committee (RUC) standard times, such that the future financial sustainability of these procedures can be ascertained; (3) examine the reimbursement of Current Procedural Terminology (CPT) codes pertaining to revision TJA procedures and track their financial forecast out to 2030.

## Material and methods

The CMS physician fee schedule lookup tool was used to capture the Medicare reimbursement rates, conversion factors, and wRVU from 2007 to 2030. The national payment amounts for the following CPT codes pertaining to primary and revision TJA were identified: 27130, 27440, 27132, 27134, 27137, 27138, 27486, 27487, 27488. These codes were chosen for their description of a primary TJA of any or all compartments, revision TJA of any or all components, and component swaps. Codes for irrigation and debridement procedures were excluded as no hardware is changed or revised in these procedures. A description of the CPT codes analyzed within this study can be found in [Appendix 1](#). All values were then converted to 2023 USD using The Bureau of Labor Services Consumer Price Index (BLS CPI) calculator. The calculator was utilized in this study to directly convert the value of all reimbursement to 2023 USD to both provide a uniform standard of comparison and remove the confounding variable of inflation from past and future monetary values. The use of this calculator allows for reimbursement values from the past, as well as predictions from the future, to be directly comparable across years.

Physician-specific total reimbursement for all procedures was calculated from  $(wRVU \times \text{conversion factor}) \times (1 + \text{CPI})$  using BLS CPI values adjusted for inflation to 2023 USD, with 2024 USD values being back-converted to 2023 USD to show how new cuts follow the predicted forecasts. Using this information, along with data from previous literature to serve as both a benchmark for comparison as well as a data point to improve the sampling of the predictive models, several forecast graphs were created showing the trend of Medicare global period reimbursement from the year 1992 to May 2030 [10].

Within each forecast graph, a third-order polynomial and/or linear trend line was fit to all the Medicare reimbursement timelines and extrapolated to 2030. Using this modeling system allows for prior reimbursement to not be under- or over-assumed and for all values, both current and past, to contribute accurate predictive power for future predictions. Linear forecasts are included on graphs, where clearly legible, to demonstrate this phenomenon. In data sets where points from as far back as 1992 were not available, such as physician-specific reimbursement, the third-order models were extended back to that time to show accurately predicted proportional changes compared to documented prior values such as those seen in the fee schedule figures. Revision timelines do not include linear forecasts as the graphs would not be able to show

clear comparison between procedures with 2 forecasts per CPT code.

The  $R^2$  correlation constants were calculated for each timeline independently and displayed within the graph. The equations for the lines of best fit were also captured and used to find the predicted values for reimbursement through 2030. A per-hour income rate for primary procedures was calculated, using both the predictive models and literature-established RUC times, by plugging the number identifier (0-43) of the year in question into the predictive equation associated with the said procedure and dividing that outcome by  $(RUC \text{ time in min}/60(\text{min}/\text{hour}))$  [11]. These times were not calculated within this study and do not exist within other literature for any of the revision CPT codes analyzed herein. Therefore, we were unable to calculate the per-hour rate for revisions as there was no uniform standard for time.

## Results

Using the forecasting equations, Medicare primary and revision TJA global periods will be reimbursed at or less than \$100.00 2023 USD by the year 2029/2030. The correlation constants derived from these trendline equations were all greater than 0.9619, with the linear trends being greater than 0.82 ([Appendix 2](#)).

### Primary procedures

The total reimbursement, according to Medicare facility fee schedules and prior literature, of primary total hip arthroplasty (THA) and total knee arthroplasty (TKA) have decreased 66.67% and 68.86% since 1992, respectively [10]. The data fit the third-order polynomial trendline with a correlation constant of 0.9619 and 0.9646 for primary THA and primary TKA, respectively. The corresponding linear trend lines had correlation coefficients of 0.8239 and 0.864 for primary THA/TKA, respectively. The third-order system predicted total reimbursement decreases of 85.36% and 86.14% for THA and TKA, respectively, by 2030 ([Figs. 1 and 2](#)). The physician-specific reimbursement, which has not been previously examined, for Medicare primary THA decreased 48.90% since 2007, while TKA reimbursement declined 52.07% ([Figs. 3 and 4](#)). Overall, when compared to literature reports in 2015, Medicare reimbursement for primary TJA has decreased, on average, an additional 14.19%, equating to an additional 1.77% average loss in reimbursement per year [5]. When looking at literature reports from 1992, the average loss per year has equated to 2.12% [10].

For primary TJAs by the year 2030, it is predicted that surgeons will be earning \$93.78/\$101.55 for the entire global period of Medicare primary THA/TKA when adjusted to 2023 USD ([Figs. 3 and 4](#)). Applying the RUC standard times of 404 minutes for THAs and 407 minutes for TKAs with these predicted physician reimbursements, the projected per-hour income rates were \$13.93 for THAs and \$14.97 for TKAs in 2023 USD [11].

### Revision procedures

From 2007 to 2024, Medicare revision THA and TKA saw a corresponding average decline of 43.30% and 43.13%, respectively ([Figs. 5 and 6](#)), equating to a 2.54% average loss per year. When examining the mathematical forecasts, all correlation constants were greater than 0.9699. Moreover, revision procedure codes could earn less than the equivalent of \$200 2023 USD for the Medicare global period by the year 2029 and are expected to cost the surgeon money, when equated to 2023 USD, as early as 2030. Compared to previous literature, which described an average decline of 27.39% for rTHA from 2002 to 2019, this study has shown an additional average decline of 26.33% across all CPT codes

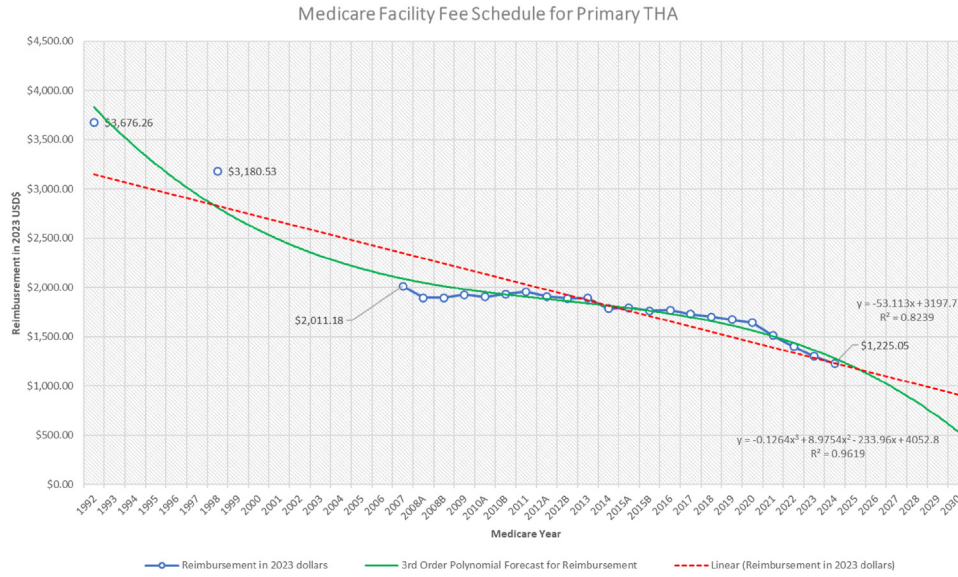


Figure 1. Medicare trends for primary THA from 1992 to present (2024).

examined from 2019 to 2024 [12]. Conversely, literature from the same time period showed an average decline of 24.52% in rTKA reimbursement while this study has shown an additional average decline of 26.33% for all CPT codes included since 2019 [13]. This decline equates to an average additional loss of 5.266% per year since last reporting.

### Discussion

This study demonstrated severe decreases in Medicare reimbursement for orthopedic adult reconstruction surgeons from 1992 to 2024 and Medicare direct physician reimbursement for primary and revision TJAs from 2007 to 2024. The forecasts created in this study predict further decreases for Medicare primary THAs and

TKAs through 2030, which culminates in the prediction that Medicare physician reimbursement of primary TJAs could fall below a total of \$200 in 2023 USD as early as 2028/2029. By 2030, Medicare reimbursements are projected at \$93.78 for primary THAs and \$101.55 for TKAs in 2023 USD. Using RUC standard times for patient care, the predicted hourly income rate of primary THA and TKA are less than the \$15/h minimum hourly wage currently adopted by many states. For comparison, current publicly advertised travel nursing per-hour income is \$87.97 [14]. Given the wide array of indications and perioperative monitoring required in revision settings, there is no established total global time standard for revision TJAs, so a per-hour income rate cannot be established using the models described in this study. It can be inferred, however, that due to the increased surgical and medical complexity of

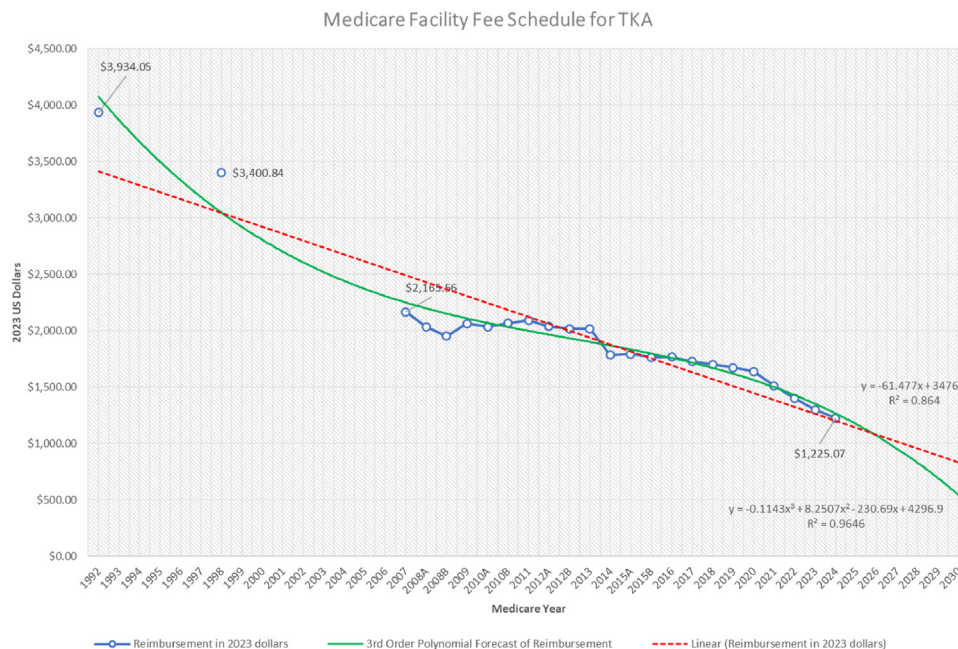


Figure 2. Medicare trends for primary TKA from 1992 to present (2024).



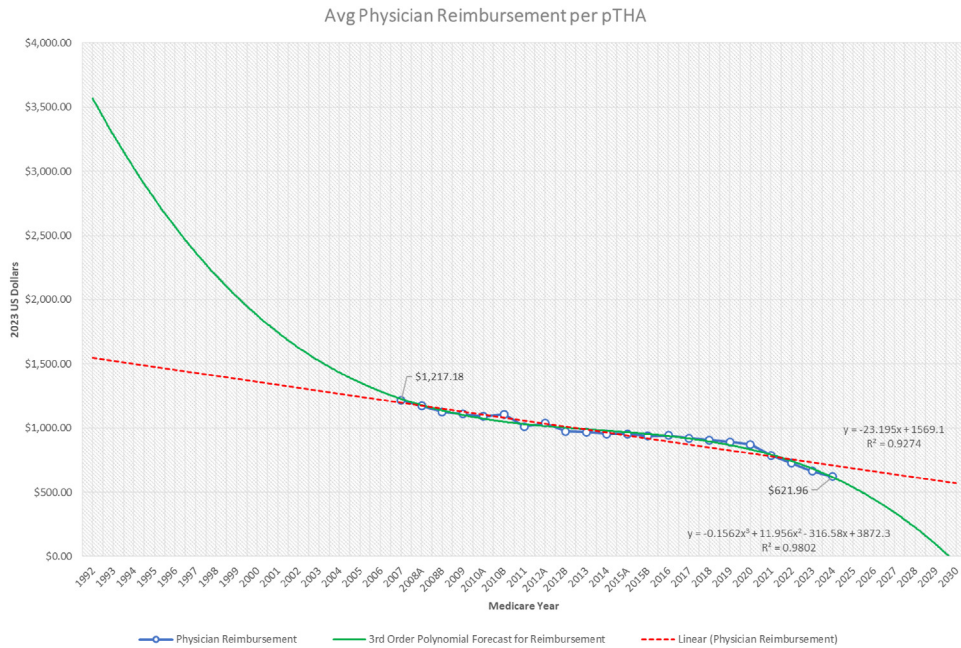


Figure 3. Surgeon reimbursement forecast for primary THA.

revision TJA care, the per-hour income rates for these procedures would be less than those of their primary counterparts.

These figures highlight a growing discrepancy between public perception of orthopedic reimbursement and reality, with studies showing patients viewing THA reimbursement as being 26 times greater than it truly is [15]. To date, few studies have attempted to quantify the entirety of work that goes into a full episode of care for a Medicare TJA patient and relate that work into a widely relatable metric such as per-hour income. Given the projected overall and per-hour income per Medicare TJA global period described in this study, concerns arise as to the ability for the field adult reconstruction to attract future surgeons to pursue this training. As of 2020, the only orthopedic fellowship that provided a net-positive

impact on future earnings was spine, with adult reconstruction being net neutral [16]. These bleak forecasts for the financial landscape of adult reconstruction may shift talent to other orthopedic subspecialties or away from orthopedic surgery completely. Furthermore, prior studies were conducted before the extraordinary levels of inflation that the US economy has experienced since 2020, so the financial outlook for adult reconstruction has likely worsened further.

Ultimately, the greatest concern these predictions raise is the sustainability of access to quality primary and revision arthroplasty care going forward. Current literature predicts that primary TJAs will increase in incidence by as much as 71%-84.9% with revisions following suit by as much as 70%-182% by 2030 [7,9]. Moreover, as of

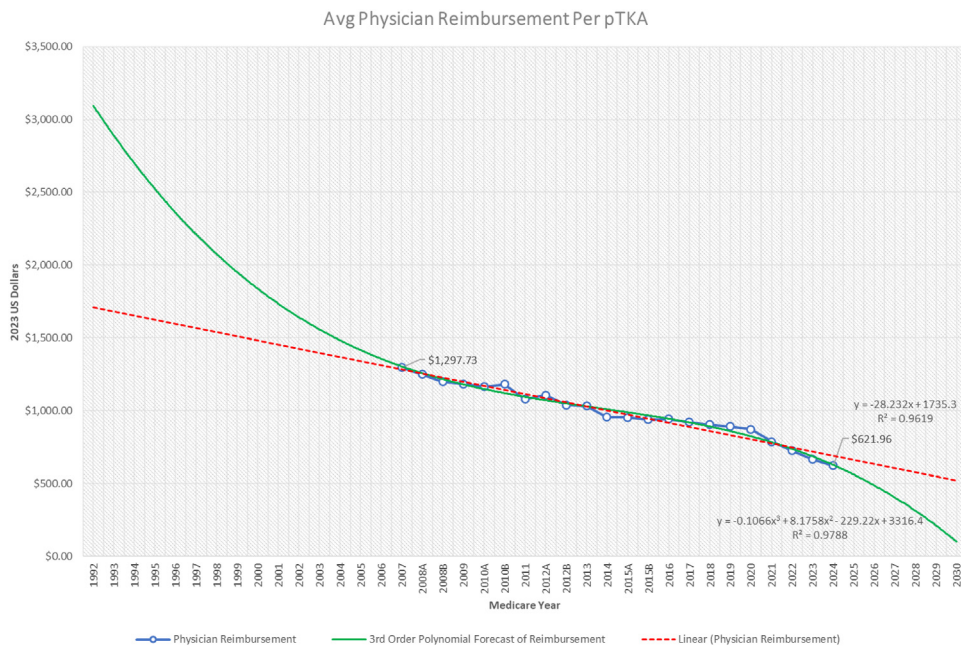


Figure 4. Surgeon reimbursement forecast for primary TKA.

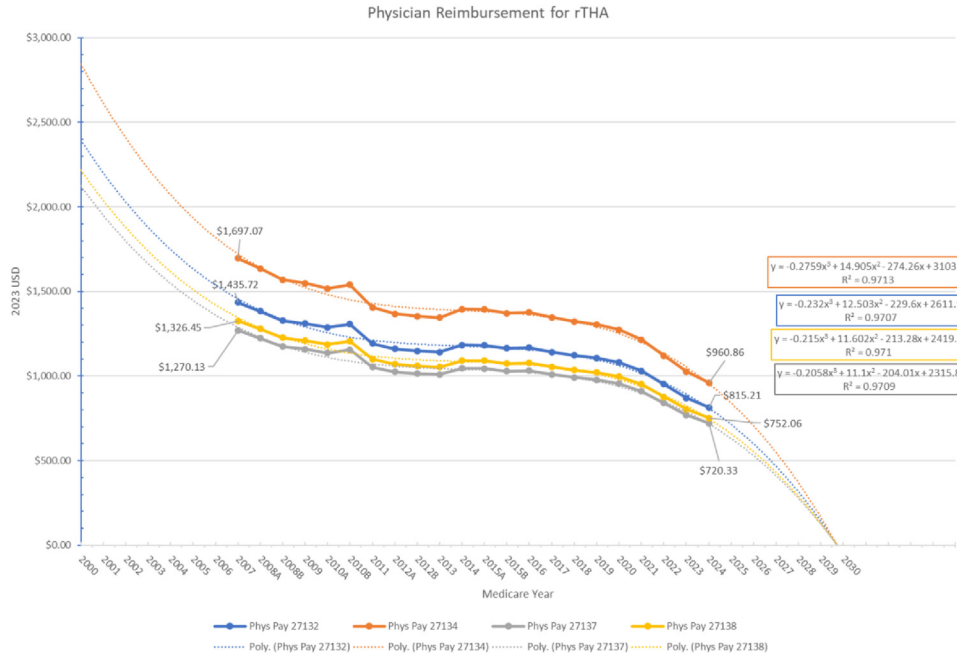


Figure 5. Surgeon reimbursement forecast for revision THA.

2020, it was reported that over 60% of all TJA procedures utilized Medicare as the primary payer, with that percentage expected to increase with the expected increase in average age of the US population [7,11]. The failure to meet this demand will only result in patients losing access to TJAs, which have been shown throughout literature to provide some of the greatest improvements to overall quality of life [17-20]. Similarly, revision TJA are complex and often require highly trained reconstruction specialists to accept and perform these challenging surgeries.

The limitations of this study are that the forecasts of this study are based on 32 years of prior CMS financial data, and future trends can only be predicted using current data and policies. CMS reimbursement cuts proposed year to year change substantially and limit the accuracy of the mathematical forecasts provided herein. These past trends, however, are unsustainable and worthy of focus as they pertain to what could come. Moreover, while these past trends themselves do not affect future possible outcomes, they provide valuable insights as to a pattern or behavior. The

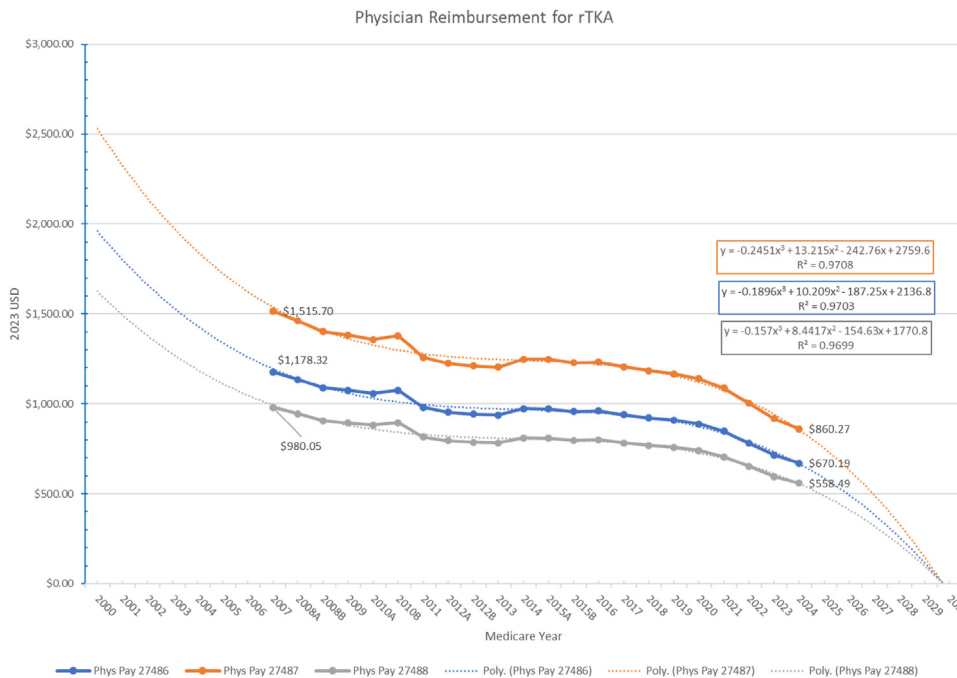


Figure 6. Surgeon reimbursement forecast for revision TKA.

healthcare/healthcare insurance industry, geo-political landscape, and economical welfare all have the potential for significant change in the future, which can drastically alter current predictions. Regardless, the current trends do not appear favorable for the primary stakeholders: the surgeon and patient. Industry leaders and politicians should consider the downstream impact of further reimbursement cuts in primary and revision TJA.

## Conclusions

In conclusion, the downward trend in physician reimbursement for orthopedic TJA procedures continues to be alarming [1,4–6,10,21–25]. We forecast that as early as 2030, orthopedic surgeons will be reimbursed \$13.93/h for primary THA and \$14.97/h for primary TKA (in 2023 USD). Without any corrections to these trends, there are significant risks to access to quality TJA care going forward [6,21,22,26–29]. It is our hope that this study serves as a reference for decision makers and stakeholders when evaluating Medicare reimbursement and the future of TJA care as a whole. As time progresses, further studies will be required to re-evaluate these trends and consider the implications.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflicts of interests

The authors declare there are no conflicts of interest.

For full disclosure statements refer to <https://doi.org/10.1016/j.artd.2024.101434>.

## CRediT authorship contribution statement

**Evan Catton:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Alan Puddy:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Data curation. **Vineet Tyagi:** Validation, Methodology, Investigation, Data curation. **Gregory M. Kurkis:** Validation, Methodology, Investigation, Data curation. **David N. Shau:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

## References

- [1] Carter CR, Bhat SB, Clement ME, Krieg JC. Medicare reimbursement and orthopedic surgery: past, present, and future. *Curr Rev Musculoskelet Med* 2017;10:224–32. <https://doi.org/10.1007/s12178-017-9406-7>.
- [2] Simcox T, Safi S, Becker J, Kreinco J, Wilson A. Are orthopedic hand surgeons undercompensated for time spent in the operating room? A study of relative value units. *Hand (N Y)* 2022;18:861–7. <https://doi.org/10.1177/15589447211064361>.
- [3] Simcox T, Kreinco J, Tarazona D, Zouzias I, Grossman M. Current relative value unit scale does not Appropriately compensate for longer orthopedic sports surgeries. *Arthrosc Sports Med Rehabil* 2021;3:e1913–20. <https://doi.org/10.1016/j.asmr.2021.09.009>.
- [4] Blackburn CW, Du JY, Marcus RE. Medicare payments to hospitals and physicians for total hip and knee arthroplasty declined from 2009 to 2019. *J Arthroplasty* 2023;38:419–23. <https://doi.org/10.1016/j.arth.2022.10.002>.
- [5] Walker R, Morrison Z, Campbell M. Trends in orthopedic surgery reimbursement from 2000 to 2015. *Orthopedics* 2020;43:187–90. <https://doi.org/10.3928/01477447-20200213-05>.
- [6] Mayfield CK, Haglin JM, Levine B, Della Valle C, Lieberman JR, Heckmann N. Medicare reimbursement for hip and knee arthroplasty from 2000 to 2019: an unsustainable trend. *J Arthroplasty* 2020;35:1174–8. <https://doi.org/10.1016/j.arth.2019.12.008>.
- [7] Sloan M, Premkumar A, Sheth NP. Projected Volume of primary total joint arthroplasty in the U.S., 2014 to 2030. *J Bone Joint Surg Am* 2018;100:1455–60. <https://doi.org/10.2106/JBJS.17.01617>.
- [8] American Academy of Orthopaedic Surgeons. Fact SHEET: orthopaedic surgeons will need to double total joint arthroplasty Caseload to meet demand by 2050. <https://aaos-annualmeeting-presskit.org/2023/downloads/research-news/AAOS-2023-Annual-Meeting-Media-Fact-Sheet-Orthopaedic-Surgeon-Workforce.pdf>; 2023. [Accessed 28 February 2023].
- [9] Schwartz AM, Farley KX, Guild GN, Bradbury Jr TL. Projections and Epidemiology of revision hip and knee arthroplasty in the United States to 2030. *J Arthroplasty* 2020;35:S79–85. <https://doi.org/10.1016/j.arth.2020.02.030>.
- [10] Hariri S, Bozic KJ, Lavernia C, Prestipino A, Rubash HE. Medicare physician reimbursement: past, present, and future. *J Bone Joint Surg Am* 2007;89:2536–46. <https://doi.org/10.2106/JBJS.F.00697>.
- [11] Halawi MJ, Mirza M, Osman N, Cote MP, Kerr JM, Huddleston JI. Quantifying surgeon work in total hip and knee arthroplasty: where do We stand today? *J Arthroplasty* 2020;35:1170–3. <https://doi.org/10.1016/j.arth.2019.12.006>.
- [12] Acuña AJ, Jella TK, Samuel LT, Schwarzkopf R, Fehring TK, Kamath AF. Inflation-adjusted Medicare reimbursement for revision hip arthroplasty: study showing significant decrease from 2002 to 2019. *J Bone Joint Surg Am* 2021;103:1212–9. <https://doi.org/10.2106/JBJS.20.01643>.
- [13] Jella TK, Acuña AJ, Samuel LT, Schwarzkopf R, Fehring TK, Kamath AF. Medicare physician fee reimbursement for revision total knee arthroplasty has not kept up with inflation from 2002 to 2019. *J Bone Joint Surg Am* 2021;103:778–85. <https://doi.org/10.2106/JBJS.20.01034>.
- [14] Smith-Kimble C. How much do travel nurses Make?. <https://nursejournal.org/careers/travel-nurse/salary/>; 2022. [Accessed 28 February 2023]. *Nurse Journal*. [Nursejournal.org](https://nursejournal.org).
- [15] Boudreau SC, Dombrowsky AR, Arguello AM, Gould S, Brabston 3rd EW, Ponce BA, et al. Patient perception of orthopedic surgeon reimbursement. *South Med J* 2020;113:191–7. <https://doi.org/10.14423/SMJ.0000000000001081>.
- [16] Mead M, Atkinson T, Srivastava A, Walter N. The return on Investment of orthopaedic fellowship training: a ten-year update. *J Am Acad Orthop Surg* 2020;28:e524–31. <https://doi.org/10.5435/JAAOS-D-19-00276>.
- [17] Miettinen HJA, Mäkirinne-Kallio N, Kröger H, Miettinen SSA. Health-Related quality of life after hip and knee arthroplasty Operations. *Scand J Surg* 2021;110:427–33. <https://doi.org/10.1177/1457496920952232>.
- [18] Norman-Taylor FH, Palmer CR, Villar RN. Quality-of-life improvement compared after hip and knee replacement. *J Bone Joint Surg Br* 1996;78:74–7.
- [19] Ethgen O, Bruyère O, Richey F, Dardennes C, Reginster JY. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. *J Bone Joint Surg Am* 2004;86:963–74. <https://doi.org/10.2106/00004623-200405000-00012>.
- [20] Learmonth ID, Young C, Rorabeck C. The operation of the century: total hip replacement. *Lancet* 2007;370:1508–19. [https://doi.org/10.1016/S0140-6736\(07\)60457-7](https://doi.org/10.1016/S0140-6736(07)60457-7).
- [21] McIntyre LF, Beach WS, Stiefel E, Pearson SE. The near-term ramifications of long-term trends in orthopedic surgical reimbursement. *J Arthroplasty* 2021;36:3378–80. <https://doi.org/10.1016/j.arth.2021.05.016>.
- [22] Heckmann ND, Mayfield CK, Chung BC, Levine BR, Della Valle CJ, Lieberman JR. Medicare cuts to hip and knee arthroplasty surgeon fees in 2021: will access to care be Jeopardized? *J Arthroplasty* 2021;36:791–4. <https://doi.org/10.1016/j.arth.2021.01.003>.
- [23] Patel A, Oladipo VA, Kerzner B, McGlothlin JD, Levine BR. A retrospective review of relative value units in revision total knee arthroplasty: a dichotomy between surgical complexity and reimbursement. *J Arthroplasty* 2022;37:S44–9. <https://doi.org/10.1016/j.arth.2022.02.033>.
- [24] Patel A, Oladipo V, Kerzner B, McGlothlin JD, Levine BR. A retrospective review of reimbursement in revision total hip arthroplasty: a disparity between case complexity and RVU compensation. *J Arthroplasty* 2022;37:S807–13. <https://doi.org/10.1016/j.arth.2022.03.025>.
- [25] Lopez CD, Boddapati V, Neuwirth AL, Shah RP, Cooper HJ, Geller JA. Hospital and surgeon Medicare reimbursement trends for total joint arthroplasty. *Arthroplast Today* 2020;6:437–44. <https://doi.org/10.1016/j.artd.2020.04.013>.
- [26] Alvarez PM, McKeon JF, Spitzer Al, Krueger CA, Pigott M, Li M, et al. Socio-economic factors affecting outcomes in total knee and hip arthroplasty: a systematic review on healthcare disparities. *Arthroplasty* 2022;4:36. <https://doi.org/10.1186/s42836-022-00137-4>.
- [27] Atrey A, Pincus D, Khoshbin A, Haddad FS, Ward S, Aktar S, et al. Access to hip arthroplasty and rates of complications in different socioeconomic groups : a review of 111,000 patients in a universal healthcare system. *Bone Joint J* 2022;104-B:589–97. <https://doi.org/10.1302/0301-620X.104B5.BJJ-2021-1520.R2>.
- [28] Judge A, Welton NJ, Sandhu J, Ben-Shlomo Y. Equity in access to total joint replacement of the hip and knee in England: cross sectional study. *BMJ* 2010;341:c4092. <https://doi.org/10.1136/bmj.c4092>.
- [29] McLaughlin J, Eelsey J, Kipping R, Owen-Smith A, Judge A, McLeod H. Access to hip and knee arthroplasty in England: commissioners' policies for body mass index and smoking status and implications for integrated care systems. *BMC Health Serv Res* 2023;23:77. <https://doi.org/10.1186/s12913-022-08999-9>.

**Appendix 1**

Analyzed CPT codes

CPT code	Description	wRVU for 2023
27130	Arthroplasty, acetabular, and proximal femoral prosthetic replacement (total hip arthroplasty), with or without autograft or allograft	19.60
27447	Arthroplasty, knee, condyle, and plateau; medial and lateral compartments with or without patella resurfacing (total knee arthroplasty)	19.60
27132	Conversion of previous hip surgery to total hip arthroplasty, with or without autograft or allograft	25.69
27134	Revision of total hip arthroplasty; both components, with or without autograft or allograft	30.28
27137	Revision of total hip arthroplasty; acetabular component only, with or without autograft or allograft	22.70
27138	Revision of total hip arthroplasty; femoral component only, with or without allograft	23.70
27486	Revision of total knee arthroplasty, with or without allograft; 1 component	21.12
27487	Revision of total knee arthroplasty, with or without allograft; femoral and entire tibial component	27.11
27488	Removal of prosthesis, including total knee prosthesis, methylmethacrylate with or without insertion of spacer, knee	17.60

**Appendix 2**

Trendline equations and correlation constants

CPT code	Trend line equation	R2 constant
27130 Facility	$y = -0.1264x^3 + 8.9754x^2 - 233.96x + 4052.8$	0.9619
27130 Facility Linear	$y = -53.113x + 3197.7$	0.8239
27130	$y = -0.1562x^3 + 11.956x^2 - 319.58x + 3872.3$	0.9802
27130 Linear	$y = -23.195x + 1569.1$	0.9274
27447 Facility	$y = -0.1143x^3 + 8.2507x^2 - 230.69x + 4296.9$	0.9646
27447 Facility Linear	$y = -61.477x + 3476.3$	0.864
27447	$y = -0.1066x^3 + 8.1758x^2 - 229.22x + 3316.4$	0.9788
27447 Linear	$y = -28.232x + 1735.3$	0.9619
27132	$y = -0.232x^3 + 12.503x^2 - 229.6x + 2611.9$	0.9707
27134	$y = -0.2759x^3 + 14.905x^2 - 274.26x + 3103.9$	0.9713
27137	$y = -0.2759x^3 + 14.905x^2 - 274.26x + 3103.9$	0.9709
27138	$y = -0.215x^3 + 11.602x^2 - 213.28x + 2419.8$	0.9710
27486	$y = -0.1896x^3 + 10.209x^2 - 187.25x + 2136.8$	0.9703
27487	$y = -0.215x^3 + 11.602x^2 - 213.28x + 2419.8$	0.9708
27488	$y = -0.1896x^3 + 10.209x^2 - 187.25x + 2136.8$	0.9699