Undervaluation of Perioperative Work for ACL Reconstruction by Relative Value Scale Update Committee Methodology in a Single Surgeon's Practice

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Objectives: The purpose of this study was to determine the accuracy of the Relative Value Update Committee (RUC) and Centers for Medicare & Medicaid Services current times and work relative value units (wRVUs) for the perioperative work involved in anterior cruciate ligament (ACL) reconstruction by directly timing perioperative tasks as they occur in real time.

Methods: The RUC was contacted to obtain a list of perioperative tasks and the corresponding times allotted for the tasks involved in arthroscopically aided ACL reconstruction (Current Procedural Terminology code 29888). The tasks that occurred both inside and outside the operating room were timed by the attending physician as the event occurred. The time for each task was then multiplied by its respective Centers for Medicare & Medicaid Services–assigned intensity coefficient to calculate the wRVU. Calculated and allotted wRVUs were compared for accuracy.

Results: The tasks timed in this study were allotted 100 minutes by the RUC and a total wRVU value of 2.026. Our study found that these tasks took 132.1 minutes and had a total wRVU value of 2.713. The overall time it takes to perform perioperative tasks in arthroscopically aided ACL surgeries is underestimated by 32.1 minutes, which results in an undervaluation of the total wRVU value by 0.687.

Conclusions: The perioperative wRVU assigned by the RUC underestimates the amount of time assigned to perform the required tasks. The RUC should consider using prospective times collected by physicians to calculate a more accurate wRVU. In addition, the RUC should consider how modern patient care practices and requirements have increased the intensity of work for physicians.

Key Words: ACL reconstruction, healthcare valuation, perioperative workload, physician compensation, relative value units (RVUs)

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In 1965, the Centers for Medicare & Medicaid Services (CMS) was created to provide health insurance to patients 65 years and older and people with a limited income funded by state and federal sources.[1,2] Before 1992, payment rates were based on customary charges, meaning physicians received payments based on usual, customary, and reasonable charges.[3] In 1989, legislation was enacted to replace the previous system, based on the thought that this system rewarded increased spending.[3] In response, CMS designed a fixed payment system called the Medicare Physician Fee Schedule, which contains a relative value unit (RVU) for the codes that involve provider services and procedures.[3,4]

Based on research that CMS implemented along with a research team at the Harvard School of Public Health, four dimensions defining physician work were identified: time, technical skill and physical effort, mental effort and judgment, and psychological stress.[4–6] CMS decided to compensate physicians according to these dimensions, with time serving as one coefficient and consolidation of the latter three dimensions into a coefficient known as intensity.[5,6] This resulted in a system known as the Relative Value Scale, influenced by the Relative Update Committee (RUC) recommendations, which is based on surveys completed by practicing physicians.[5,6] Each year the RUC meets to determine which procedures need updated RVUs, based on surveys completed by physicians.[5] Approximately 90% of recommendations are accepted by CMS despite minimal research into the accuracy of their values,[7–9] and the decisions of the RUC also affect private insurers and Medicaid program reimbursement rates.[5] As such, the RUC plays a significant role in physician compensation.

Many procedures go 5 to 10 years without an update from the RUC.[10] Furthermore, studies have shown that an increase in preventive health care has increased the time it takes to complete perioperative tasks and the intensity of the work.[11] Spending more time with patients before procedures and increasing patient education may improve patient outcomes. This increased workload intensity and time may be underestimated by the RUC. Current studies also have shown that RUC RVUs

Key Points

- The Relative Value Update Committee allocates 100 minutes for perioperative tasks in anterior cruciate ligament reconstruction, while the actual observed time is 132.1 minutes.
- The study found a work relative value units value of 2.713, higher than the RUC's 2.026, indicating undervaluation. This undervaluation affects physician compensation, not reflecting the increased workload.
- The study suggests using real-time data for more accurate and frequent updates to work relative value units calculations.

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were significantly different between longer (>110 minutes of intraoperative time) and shorter (≤110 minutes of intraoperative time) procedures, with the study demonstrating an undervaluation of intensity for the longer procedures by an average of 3.47 work RVUs (wRVUs) per hour.[12] In addition, previous studies have shown undervaluation of wRVUs in the setting of shoulder arthroplasty, knee arthroplasty, and hip arthroplasty.[11,13]

No literature to date has investigated whether this discrepancy is present in the RUC's RVU estimation for perioperative work for anterior cruciate ligament (ACL) reconstruction. The purpose of this study was to determine the accuracy of the RUC and CMS current times and wRVUs for the perioperative work involved in ACL reconstruction surgery by directly timing perioperative tasks as they occur. We hypothesize that the RUC underestimates the amount of time it takes to perform the perioperative work for ACL reconstruction surgery.

METHODS

We obtained a list of perioperative tasks and times assigned to those tasks for arthroscopically aided ACL reconstruction based on the Current Procedural Terminology code 29888 from the RUC. Among these tasks, only perioperative preservice work and postservice work were included. Intraservice tasks, all of the tasks performed from the first skin incision until the final skin closure, were excluded. When calculating the total perioperative work, CMS subdivides preservice and postservice work into time- and group-specific subsections. Preservice work is performed before the procedure, and postservice work is completed after the procedure. Preservice work is subdivided into three categories: preevaluation, prepositioning, and prescrub; dress; and wait time. Postservice work included all of the tasks performed immediately following the surgery. CMS assigns an intensity coefficient to each category and multiplies this coefficient by estimated procedural time to determine the appropriate RVU for that category.

Furthermore, some perioperative tasks are performed outside the operating room (OR), and some tasks are performed in the OR. Tasks performed outside and inside the OR were prospectively timed by the attending physician as the event occurred (Table 1). During the preevaluation period, the following tasks were timed outside the OR: writing preadmission orders for preoperative medications, imaging and preprocedure testing review, updating history and physical (H&P), and meeting with the patient to review the plan and obtain consent. During the preevaluation period, tasks were timed inside the OR as follows: positioning as well as prescrub, dress, and wait times. The immediate postservice tasks recorded in real time included tasks timed inside and outside the OR. The following postevaluation tasks were prospectively timed: applying dressing and brace, arriving at the postanesthesia care unit, consulting with the family and patient postoperatively to discuss the postoperative regimen, communicating with other healthcare professionals, writing prescriptions, dictating and writing the formal operative note, and completing other medical records. Thirty ACL reconstruction surgeries were timed during a 3-month period. All of the surgeries in this study were performed by one board-certified sports medicine fellowship-trained orthopedic surgeon at a single hospital. This study was approved by an institutional review board (IRB-300011048, exempt category 4).

TABLE 1. Components of preservice and postservice tasks

Task	Average time, min[a]
Preservice	76.2
Write preadmission orders for preoperative medications	6.5 ± 1.4
Imaging and preprocedure testing review	12.8 ± 1.8
Updating H&P	5.0 ± 0.8
Meet with patient to review plan and obtain consent	15.5 ± 2.8
Positioning	19.2 ± 3.6
Prescrub, dress, and wait	17.2 ± 2.5
Postservice	55.9
Application of dressing and knee brace	3.7 ± 0.9
Brace on in OR at arrival to the PACU	11.6 ± 2.5
Consult with family and patient to discuss postoperative regimen	11.9 ± 2.7
Communicate with healthcare professionals	10.3 ± 1.8
Write prescriptions	4.4 ± 1.1
Dictate and write formal op-note	7.1 ± 1.5
Complete other medical records (eg, discharge summary, insurance)	6.9 ± 1.0
Total average perioperative time	132.1

H&P, history and physical; op-note, operative note; OR, operating room; PACU, postanesthesia care unit.

[a]Data expressed as means ± standard deviations.

RESULTS

Of the 30 patients in our study, 17 (56.7%) were male and 13 (43.3%) were female. The average age of our study population was 24.4 years (±12.0). The calculated average preevaluation time was 76.2 min, including writing preadmission orders for preoperative medications (6.5 ± 1.4), imaging and preprocedure testing review (12.8 ± 1.8), updating the history and physical (5.0 ± 0.8), reviewing plan and obtaining consent with the patient (15.5 ± 2.8), positioning the patient (19.2 ± 3.6), as well as prescrub, dress, and wait times (17.2 ± 2.5) (Table 1). The average time for immediate postservice tasks was 55.9 minutes (Table 1). These tasks included application of the dressing and knee brace (3.7 ± 0.9), the time from putting on the knee brace in the OR to the patient's arrival at the postanesthesia care unit (11.6 ± 2.5), the consult with the family and patient after surgery to discuss the postoperative regimen (11.9 ± 2.7), communication with other healthcare professionals (10.3 ± 1.8), writing prescriptions (4.4 ± 1.1), dictation and writing the formal operative note (7.1 ± 1.5), and completion of other medical records (6.9 ± 1.0). The recorded times for each period were multiplied by CMS assigned intensity coefficient to calculate the wRVU for each category (Table 2). The total time allotted by the RUC for perioperative tasks was 100 minutes, along with a total wRVU value of 2.026. Our study found that these perioperative tasks took 132.1 minutes, with a total wRVU value of 2.713 (Table 2).

DISCUSSION

The most important finding of this study is that current RUC- and CMS-assigned wRVUs underestimate the perioperative work

TABLE 2. Comparison of wRVUs: RUC vs study data

Task	Intensity coefficient	RUC standard		Study data	
		min	wRVUs	min	wRVUs
Preservice		75		76.2	
Preevaluation	0.0224	45	1.008	39.8	0.892
Prepositioning	0.0224	15	0.336	19.2	0.430
Prescrub, dress and wait time	0.0081	15	0.1215	17.2	0.139
Postservice	0.0224	25	0.560	55.9	1.252
Total		100	2.026	132.1	2.713

RUC, Relative Value Update Committee; wRVUs, work relative value units.

surrounding ACL reconstructions. Our study determined that the RUC currently underestimates the perioperative work involved in ACL reconstruction surgeries by 32.1 minutes. Of those 32.-1 minutes, 30.9 minutes were in the perioperative postservice category and represented an unaccounted 0.692 wRVUs by the current RUC calculation methodology. Regarding overall wRVUs, our study determined the value of perioperative work in ACL reconstruction surgeries to be 2.713, a 33.9% increase when compared with the current wRVU that CMS uses to compensate physicians.

The findings of our study align with findings from similar studies of other procedures in the orthopedic field.[13,14] Specifically, these studies identified that approximately 2 hours are currently unaccounted for in total hip arthroplasty and total knee arthroplasty procedures during the perioperative period, and 14.5 minutes are unaccounted for in shoulder arthroplasty procedures.[11,13] This discrepancy is further highlighted in the literature, showing an inadequate increase in reimbursement rates for more complex revision procedures compared to primary total knee arthroplasty and total shoulder arthroplasty procedures.[15,16] Collectively, these studies agree that physician workload has demonstrated a consistent upward trajectory over time.

One reason that the current wRVUs may be underestimated is that efforts to improve patient surgical outcomes by providing evidence-based preoperative assessments along with fine-tuned surgical procedures to fit individual patients have resulted in increases in the perioperative workload for physicians.[17,18] Addressing and educating patients about nutrition and postoperative regimens has proven effective in reducing the postoperative length of stay and the number of postoperative complications. The emphasis on providing greater patient education has increased the time physicians spend in the perioperative period, however.[14,19–21]

The implementation of the electronic medical record (EMR) system also has contributed to increasing the time spent on documentation of medical records and other related tasks such as reviewing imaging and preprocedure review.[22] Studies have compared the proportion of workload that was spent on tasks regarding documentation pre- and postimplementation of the EMR system and determined that physician workload has increased a total of 28% (from 19% pre-EMR to 37% post-EMR implementation).[23] In addition, time spent reviewing images and patient charts has doubled from 7.4% to 15.9% after the implementation of the EMR system in hospitals.[23] Lastly, there has been a 9.0% rise in the time physicians are dedicating to documentation (eg, discharge summary, insurance), which contributes to the overall increase in time spent during the perioperative period.[23]

The methods that the RUC and CMS have used to determine wRVUs for procedures have not adequately accounted for the extent of physician workload in the perioperative period. When the RUC and CMS assess the relative values for Current Procedural Terminology codes, the largest factor placed into consideration is the physician work component, which accounts for approximately 52% of the relative value.[24] This factor is calculated by multiplying the time spent providing the service by the intensity of the physician's effort. The identification of these two elements resulted from the collaboration of small cohorts of physicians across various specialties surveyed by the American Medical Association. These surveys had low and unreliable response rates, ranging from 55.9% to 69% per specialty, along with a lack of objective confirmation, which was a significant factor in the underestimation of the perioperative work in ACL surgeries.[25] The intensity coefficients for preservice and postservice have not changed since the publication of the original 1988 Harvard study and range from 0.0081 to 0.0224 wRVUs/minute for various surgeries.[26] Furthermore, modern care pathways are evolving rapidly, and the RUC often goes 5 to 10 years without updating the coefficient.[10]

As research continues to provide us with more information regarding ACL reconstruction surgical techniques, it is of increasing importance that the RUC reevaluate the methods that it uses in calculating the wRVU for procedures. For example, more attention has been given to posterior tibial slope, and thus physicians are making more preoperative measurements to determine the best procedure.[27] Also, as new techniques emerge, such as ACL repair, there is a greater need for education of other healthcare professionals such as physical therapists and athletic trainers regarding appropriate rehabilitation protocols.[28] The expansion of knowledge introduces additional layers of complexity, time, and effort in the perioperative period. Failure to adapt will continue to widen the gap between the perioperative work performed and the compensation provided by CMS. Recognizing these advancements, the RUC should consider adjustments to wRVU calculations more frequently to more accurately capture the evolving nature of the perioperative work that is undertaken by physicians.

This study is not without limitations. The data used for this study were collected from one surgeon. Furthermore, this study focuses on a single academic hospital system. As such, the data may not be extrapolated to other surgeons or other types of surgical settings such as surgery centers. In addition, the EMR system used, EMR requirements, and individual

hospital protocols may vary among hospitals and would likely affect the results.

CONCLUSIONS

The perioperative wRVU assigned by the RUC underestimates the amount of time assigned to perform the required tasks. The RUC should consider using prospective times collected by physicians to calculate a more accurate wRVU. In addition, the RUC should consider how modern patient care practices and requirements have increased the intensity of work for physicians.

REFERENCES

1. DeParle NA. Celebrating 35 years of Medicare and Medicaid. *Health Care Financ Rev* 2000; 22:1–7.
2. DeWalt DA, Oberlander J, Carey TS, et al. Significance of Medicare and Medicaid programs for the practice of medicine. *Health Care Financ Rev* 2005;27:79–90.
3. American Medical Association. Development of the Resource-Based Relative Value Scale. https://www.ama-assn.org/system/files/development-of-the-resource-based-relative-value-scale.pdf. Updated November 8, 2024. Accessed November 23, 2024.
4. Mabry CD, McCann BC, Harris JA, et al. The use of intraservice work per unit of time (IWPUT) and the building block method (BBM) for the calculation of surgical work. *Ann Surg* 2005;241:929–940.
5. American Medical Association. The physician work component. https://www.ama-assn.org/system/files/physician-work-component.pdf. Updated November 8, 2024. Accessed November 23, 2024.
6. US Government Accountability Office. Medicare physician payment rates: better data and greater transparency could improve accuracy. https://www.gao.gov/products/gao-15-434. Published May 21, 2015. Accessed November 23, 2024.
7. Urwin JW, Gudbranson E, Graham D, et al. Accuracy of the Relative Value Scale Update Committee's time estimates and physician fee schedule for joint replacement. *Health Aff (Millwood)* 2019;38:1079–1086.
8. Gornick M, Greenberg JN, Eggers PW, et al. Twenty years of Medicare and Medicaid: covered populations, use of benefits, and program expenditures. *Health Care Financ Rev* 1985;1985 Suppl:13–59.
9. American Medical Association. AMA/Specialty Society RVS Update Committee. https://www.ama-assn.org/about/rvs-update-committee-ruc/rvs-update-committee-ruc. Updated November 11, 2024. Accessed November 23, 2024.
10. Urwin JW, Emanuel EJ. The Relative Value Scale Update Committee: time for an update. *JAMA* 2019;322:1137–1138.
11. Krueger CA, Austin MS, Levicoff EA, et al. Substantial preoperative work is unaccounted for in total hip and knee arthroplasty. *J Arthroplasty* 2020;35:2318–2322.
12. Rothfusz CA, Grits D, Emara AK, et al. Procedures with longer intraoperative times undervalue surgeon work in total joint arthroplasty: a large, nationwide database study. *J Arthroplasty.* 2021;36:3831–3838.
13. Hughes AG, Paul KD, Smith WR, et al. Perioperative work in shoulder arthroplasty is undervalued by Relative Value Scale Update Committee methodology: quantifying shoulder arthroplasty workload in a single surgeon's practice. *Semin Arthroplasty* 2022;32:279–284.
14. Grosso MJ, Courtney PM, Kerr JM, et al. Surgeons' preoperative work burden has increased before total joint arthroplasty: a survey of AAHKS members. *J Arthroplasty* 2020;35: 1453–1457.
15. Belay ES, Charalambous LT, Saltzman EB, et al. Relative value units underestimate reimbursement for revision shoulder arthroplasty. *J Am Acad Orthop Surg* 2022;30:416–420.
16. Patel A, Oladipo VA, Kerzner B, et al. A retrospective review of relative value units in revision total knee arthroplasty: a dichotomy between surgical complexity and reimbursement. *J Arthroplasty* 2022;37:S44–S49.
17. Kim KY, Anoushiravani AA, Chen KK, et al. Perioperative orthopedic surgical home: optimizing total joint arthroplasty candidates and preventing readmission. *J Arthroplasty* 2019;34:S91–S96.
18. Bernstein DN, Liu TC, Winegar AL, et al. Evaluation of a preoperative optimization protocol for primary hip and knee arthroplasty patients. *J Arthroplasty* 2018;33:3642–3648.
19. Wall J, Dhesi J, Snowden C, et al. Perioperative medicine. *Future Healthc J* 2022;9:138–143.
20. Gooneratne M, Grailey K, Mythen M, et al. Perioperative medicine, interventions in surgical care: the role of replacing the late-night review with daytime leadership. *Future Hosp J* 2016; 3:58–61.
21. Tadesse B, Kumar P, Girma N, et al. Preoperative patient education practices and predictors among nurses working in East Amhara comprehensive specialized hospitals, Ethiopia, 2022. *J Multidiscip Healthc* 2023:16:237–247.
22. Baumann LA, Baker J, Elshaug AG. The impact of electronic health record systems on clinical documentation times: a systematic review. *Health Policy* 2018;122:827–836.
23. Asaro PV, Boxerman SB. Effects of computerized provider order entry and nursing documentation on workflow. *Acad Emerg Med* 2008;15:908–915.
24. Maxwell S, Zuckerman S. Impact of resource-based practice expenses on the Medicare physician volume. *Health Care Financ Rev* 2007;29:65–79.
25. McMahon LF Jr. A critique of the Harvard Resource-Based Relative Value Scale. *Am J Public Health* 1990;80:793–798.
26. Childers CP, Maggard-Gibbons M. Assessment of the contribution of the work relative value unit scale to differences in physician compensation across medical and surgical specialties. *JAMA Surg* 2020;155:493–501.
27. Dean RS, DePhillipo NN, LaPrade RF. Posterior tibial slope in patients with torn ACL reconstruction grafts compared with primary tear or native ACL: a systematic review and meta-analysis. *Orthop J Sports Med* 2022;10:23259671221079380.
28. Murray MM, Kalish LA, Fleming BC, et al. Bridge-enhanced anterior cruciate ligament repair: two-year results of a first-in-human study. *Orthop J Sports Med* 2019;7: 2325967118824356.