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## Are We Appropriately Compensated by Relative Value Units for Primary vs Revision Total Hip Arthroplasty?

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## ABSTRACT

**Background:** Relative value units (RVUs) are used to evaluate the effort required for providing a service to patients in order to determine compensation. Thus, more complicated cases, like revision arthroplasty cases, should yield a greater compensation. However, there are limited data comparing RVUs to the time required to complete the service. Therefore, the purpose of this study is to compare the (1) mean RVUs, (2) mean operative times, and (3) mean RVU/minute between primary and revision total hip arthroplasty (THA) and (4) perform an individualized idealized surgeon annual cost difference analysis.

**Methods:** A total of 103,702 patients who underwent primary (current procedural terminology code 27130) and 7273 patients who underwent revision THA (current procedural terminology code 27134) were identified using the National Surgical Quality Improvement Program database. Mean RVUs, operative times (minutes), and RVU/minute were calculated and compared using Student *t*-test. Dollar amount per minute, per case, per day, and year was calculated to find an individualized idealized surgeon annual cost difference.

**Results:** The mean RVU was  $21.24 \pm 0.53$  (range, 20.72–21.79) for primary and  $30.27 \pm 0.03$  (range, 30.13–30.28) for revision THA ( $P < .001$ ). The mean operative time for primary THA was  $94 \pm 38$  minutes (range, 30–480 minutes) and  $152 \pm 75$  minutes (range, 30–475 minutes) for revision THA ( $P < .001$ ). The mean RVU/minute was  $0.260 \pm 0.10$  (range, 0.04–0.73) for primary and  $0.249 \pm 0.12$  (range, 0.06–1.0) for revision cases ( $P < .001$ ). The dollar amounts calculated for primary vs revision THA were as follows: per minute (\$9.33 vs \$8.93), per case (\$877.12 vs \$1358.32), per day (\$6139.84 vs \$5433.26), and a projected \$113,052.28 annual cost difference for an individual surgeon.

**Conclusion:** Maximizing the RVU/minute provides the greatest “hourly rate.” The RVU/minute for primary (0.260) being significantly greater than revision THA (0.249) and an annualized \$113,052.28 cost difference reveal that although revision THAs are more complex cases requiring longer operative time, greater technical skill, and aftercare, compensation per time is not greater.

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With the increasing costs of healthcare, there has been continued interest to find changes that can lower the overall financial burden on the entire system [1–5]. One of the many factors under analysis is physician compensation [6]. Currently, there

are 4 common physician reimbursement models in place: fee-for-service, capitation, performance-based, or a combination of the 3 [7,8]. However, even with these 4 models, there is still no consensus as to which reimbursement model is best. Additionally, how to measure value in healthcare is still complex and challenging [9,10].

Relative value units (RVUs) are the main driving force for the fee-for-service reimbursement model used by the Centers for Medicare and Medicaid Services (CMS) [11,12]. The RVU system is divided into 3 components: physician work, practice expense, and professional liability insurance [13–15]. Physician work incorporates time, technical skill, and overall physician effort. Practice expense includes the majority of overhead required to

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complete any given procedure. Professional liability insurance accounts for malpractice and other insurance premiums. Although these 3 components may sum to a total RVU, the physician work RVU is of most importance as this value is what essentially determines the physician's worth for a given procedure. Therefore, logically, more complicated cases, such as revision cases, have higher RVUs assigned than less complicated cases, such as primary cases. However, not all aspects of a physician work are valued equally because it has been noted that the RVU system has distinct preferences for surgical procedures over cognitive visits like clinical encounters [13]. This preference creates a distinct issue as more complicated cases, like revision THAs, require greater aftercare and surgeon involvement during inpatient and outpatient follow-up. Therefore, although different RVUs are assigned to different procedures, appropriate value may not always be provided for the physician [13].

A number of studies in various fields of medicine have questioned the use of RVUs to help determine physician compensation and have indicated potential flaws and room for improvement [16–19]. Furthermore, there are limited data confirming the conjecture that RVUs appropriately correlate with physician work and effort [19]. However, to the author's best knowledge, there are currently no studies analyzing RVU use in orthopedics. Therefore, the purpose of the study was to further analyze the use of RVUs by comparing 2 orthopedic procedures of different complexity: primary total hip arthroplasty (THA) and revision THA. Specifically, we compared (1) the mean RVUs; (2) the mean operative times; and (3) the mean RVU/minute between primary and revision THA and (4) extrapolated that data to perform an individualized idealized surgeon annual cost difference analysis in order to identify differences in reimbursement for a physician's operative time.

## Methods and Materials

### Database

The American College of Surgeons, National Surgical Quality Improvement Program (NSQIP) database from 2008 to 2015 was consulted. The primary purpose of the database is to provide hospitals and surgeons with high-quality data to potentially help reduce complications, save costs, and improve patient outcomes. Hospitals from across the country collect preoperative through 30-day postoperative data. The database contains millions of metric measures such as patient demographics, current procedural terminology (CPT) codes, patient comorbidities, operative times, RVUs, and smoking/alcohol use. All data are collected by a trained surgical clinical reviewer in order to ensure data accuracy [20]. This database is publically available and contains de-identified data; therefore, the institutional review board deemed this study exempt.

### CPT Codes

CPT codes are a standardized system used across the country to identify medical, surgical, and laboratory procedures. The CPT code not only helps identify services provided to patients but also helps determine practitioner reimbursements. Category 1 CPT codes were used for this study as category 1 CPT codes directly correspond to a procedure or service provided by a physician. Use of category 2 CPT codes are often optional, while category 3 CPT codes are provisional codes for new and developing technology, procedures, and services [21]. Specifically, CPT codes 27130 and 27134 were used to identify primary THA and revision THA patients.

### THA Procedure Selection

Hip arthroplasty was chosen for analysis, as primary and revision THAs represent a large part of the overall expenditure of CMS [22]. It is estimated that the CMS program pays for 65% of all hip arthroplasties in the United States and that total cost of THA represents nearly \$40 billion of annual hospital costs [23]. Additionally, as the population in the United States continues to grow, the need for primary and revision THA will also grow [24], only adding to the CMS expenditure. Furthermore, we have additional reports underway analyzing the RVU/minute for other orthopedic procedures, such as total knee arthroplasty, total shoulder arthroplasty, and total ankle arthroplasty.

### Primary THA Patient Selection

CPT code 27130 was used to identify a total of 104,209 primary THA cases. And 441 (0.4%) cases with operative times of less than 30 minutes were excluded (very unlikely value, most likely a mistake in data entry), yielding 103,768 (99.6%). Of these 103,768 patients, 66 cases (0.06%) with operative times greater than 480 minutes were excluded (also, very unlikely value, most likely a mistake in data entry). This yielded a total of 103,702 patients who underwent primary THA with operative times between 30 and 480 minutes. Of these 103,702 cases, 57,451 (55%) were women, while 46,172 (45%) were men. For 79 (0.08%) primary THA cases, gender was not identified.

### Revision THA Patient Selection

A CPT code 27134 was used to identify a total of 7298 revision THA cases. Twenty-seven (0.4%) cases with operative times of less than 30 minutes were excluded (very unlikely value, most likely a mistake in data entry), yielding 7271 (99.6%) cases. Of these 7271 cases, 38 cases (0.5%) with operative times greater than 480 minutes were excluded (also, very unlikely value, most likely a mistake in data entry). This yielded a total of 7233 patients who underwent revision THA. Of these 7233 cases, 3878 (54%) were women, while 3347 (46%) were men. For 8 (0.1%) revision THA cases, gender was not identified.

### Annual Cost Difference Analysis

We performed an annualized cost difference analysis to evaluate reimbursement differences for performing primary and revision THA at an individual surgeon level. We used a standard 10-hour work day, an estimated 160 operative days per year (365 d/y, less 104 weekend days, less 14 days for vacation, less 5 federal holidays, less 1/3 of remaining days for nonoperative days), and a surgeon running one operating room. Using the mean operative times for primary and revision THA, 7 primary or 4 revision THAs can be performed each day. Next, using the CMS-reported RVU conversion factor of \$35.8887/RVU and the RVU/minute, a dollar amount per minute for both primary and revision THAs was calculated. The dollar amount per minute was multiplied by the mean operative minutes for each procedure, yielding a dollar amount per case. This value was then multiplied by the number of primary or revision THAs performed per day (7 primary or 4 revision). The difference in daily compensation was calculated and multiplied by 160 operative days per year, yielding the dollar amount difference an adult reconstructive surgeon could be reimbursed for only performing primary THAs.

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