

# Are Work Relative Value Units Correlated With Operative Duration of Common Surgical Procedures?

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**W**ork relative value units (wRVUs) are the clinician component of the RVU. Alongside practice expense RVUs and malpractice RVUs, wRVUs are designed to capture the relative “work” involved for a physician to perform a given task, including both the time and the intensity required to perform a procedure.<sup>1</sup> By eliminating variables such as fee schedules and geographical costs, wRVUs are a theoretically neutral way to quantify physician workload and productivity, with higher wRVU assignments recognizing increased technical complexity, mental effort and judgment, psychological stress, and time investment. wRVUs consist of 3 parts: preservice work, the service itself, and postservice work. For surgical procedures, this translates into preparation for the surgery, the surgical procedure itself, and the postoperative care (such as transport of patient, postoperative orders, paperwork including dictation of surgery report, communication with patient and family, postoperative visits from date of surgery through discharge, and office visits within the global period). Compensation for postoperative care within a procedure-specific global period is included in the wRVU calculation and accounts for approximately 25% of Medicare payments,<sup>2</sup> but recent data suggest that postoperative visits occur less often than expected, meeting projected frequency for 4% of procedures with a 10-day global period and 39% of procedures with a 90-day global period.<sup>3</sup> For this reason, the time spent in the operating room may represent a reasonable approximation of the relative effort and case complexity for a given procedure. A common opinion of surgeons across surgical specialties is that wRVUs may be arbitrary, not linked to any rational measure, and unfairly low for longer, more complex cases—which may have the unintended consequence of encouraging physicians to focus their practice around performing a large number of straightforward procedures while reducing the number of longer, more complex cases performed.<sup>4</sup>

The wRVUs for given procedures are part of the Medicare fee schedule determined by a committee of physician representatives and are based on technical complexity of the procedure and the expertise needed to perform it, including the time needed to perform the procedure itself and the time needed for necessary

## ABSTRACT

**OBJECTIVES:** Work relative value units (wRVUs) quantify physician workload. In theory, higher wRVU assignments for procedures recognize an increase in complexity and time required to complete the procedure. The fairness of wRVU assignment is debated across specialties, with some surgeons arguing that reimbursement may be unfairly low for longer, more complex cases. For this reason, we sought to assess the correlation of wRVUs with operative time in commonly performed surgeries.

**STUDY DESIGN:** We analyzed the National Surgical Quality Improvement Program database, selecting the 15 most performed surgical procedures across specialties in a 90-day global period, using Current Procedural Terminology codes.

**METHODS:** Calculation and comparison of mean operative time and mean wRVUs were performed for each of the 15 procedures. Cases with missing values for wRVUs or operative time and cases with an operative time of less than 15 minutes were excluded. The Spearman correlation coefficient was calculated to evaluate the strength of correlation between operative duration and wRVUs.

**RESULTS:** A total of 1,994,394 patients met criteria for analysis. The lowest mean wRVU was 7.78 (95% CI, 7.77-7.78) for inguinal hernia repair; the highest was 43.50 (95% CI, 43.37-43.60) for pancreatectomy. The shortest mean operative time was 51.0 (95% CI, 50.8-51.1) minutes for appendectomy; the longest was for pancreatectomy at 324.6 (95% CI, 323.2-326.0) minutes. The Spearman correlation coefficient was 0.81.

**CONCLUSIONS:** In our analysis, we found a strong correlation between operative duration and wRVU assignment. Thus, the reimbursement of physicians depending on wRVUs is fair for the most commonly performed surgical procedures across specialties.

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postoperative care.<sup>5</sup> For example, the wRVU for an endoscopic resection of a bladder tumor (a relatively straightforward outpatient surgery) is 4.64, whereas the wRVU for a radical cystectomy with neobladder is 44.26. In other words, the cystectomy with neobladder takes about 10 times the “work” of the transurethral resection. Although most physicians have an intuitive sense of the relative difficulty of their procedures, defining, quantifying, and comparing surgical complexity of different procedures, especially across specialties, is very difficult.<sup>6</sup>

Because complexity is difficult to assess quantitatively, we hypothesized that time might be being used as an alternative, simplified metric on which to base wRVUs. The objective of our study was to assess the correlation of wRVUs with operative time in commonly performed surgical procedures. We hypothesized that wRVUs correlate with mean operative time for different surgeries.

## MATERIALS AND METHODS

We retrospectively analyzed a cohort of surgical patients using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database for 2011 to 2017. ACS-NSQIP is a nationally validated, risk-adjusted program to determine and improve the quality of surgical care. Preoperative and postoperative data, including reimbursement data, are available out to 30 days post operation and are collected by trained reviewers in more than 600 participating hospitals.<sup>7</sup> This study was institutional review board–exempt research.

We selected the 15 most performed surgical procedures within the NSQIP database across specialties with a 90-day global period, using the Current Procedural Terminology (CPT) code. We chose procedures with a 90-day global period because they are more comparable in complexity than less complex procedures with a 10-day global period. We added similar CPT codes for the same procedure to make the analysis broader and more objective. For example, laparoscopic/robot-assisted radical prostatectomy (CPT 55866) is 1 of the 15 most performed procedures. The CPT codes 55840, 55845, 55842, 55810, 55812, and 55815 all describe open radical prostatectomy procedures, which are less frequently performed than the laparoscopic/robot-assisted version. For our broad-strokes purposes, the time needed to perform the procedures is similar, and their wRVU designations are similar; therefore we bundled them together to capture the broadest basket of prostatectomies possible. We dealt with all 15 procedures accordingly. A list of the CPT codes included in our analysis is shown in the [eAppendix Table](#) (available at [ajmc.com](#)). The procedures in descending order of frequency were inguinal hernia repair, cholecystectomy, mastectomy, appendectomy, colectomy, knee arthroplasty, hysterectomy, thyroidectomy, hip arthroplasty, thrombendarterectomy, laminectomy,

## TAKEAWAY POINTS

The fairness of reimbursement according to work relative value units (wRVUs) is debated across specialties, with some arguing that reimbursement may be unfairly low for longer, more complex cases. Our study of a national sample examining the 15 most performed surgical procedures in general, orthopedic, vascular, urologic, and gynecologic surgery shows that wRVUs have real-world logic for common surgical procedures and that they scale with operative time. Contrary to time spent for postoperative care, which often does not occur as often as expected, time spent in the operating room represents a reasonable approximation of the relative effort for a given procedure.

- ▶ wRVUs correlate well with mean operative time for different surgeries.
- ▶ Reimbursement for physicians depending on wRVUs is fair for the most commonly performed surgical procedures across specialties.

radical prostatectomy, pancreatectomy, parathyroidectomy, and femoropopliteal bypass.

We extracted the variables *optime*, which denominates the skin-to-skin time, and *workrvu* from the data set. Because every CPT code accounts for a different amount of wRVUs, we determined the mean wRVUs and mean operative time of the grouped CPT codes for each procedure. Cases with missing values for wRVUs ( $n=714$ ) were excluded. We also excluded cases with missing operative time or operative time less than or equal to 15 minutes to decrease the likelihood of inaccurate data ( $n=8557$ ). We then calculated the Spearman correlation coefficient to evaluate the strength of correlation between wRVUs and operative time. This coefficient was chosen because of non–normally distributed data of 2 continuous variables. Statistical analyses were performed using Stata IC version 16 (StataCorp). As a sensitivity analysis, mean operative time for a given case divided by mean wRVUs was calculated, and our findings of relative constancy remained robust.

## RESULTS

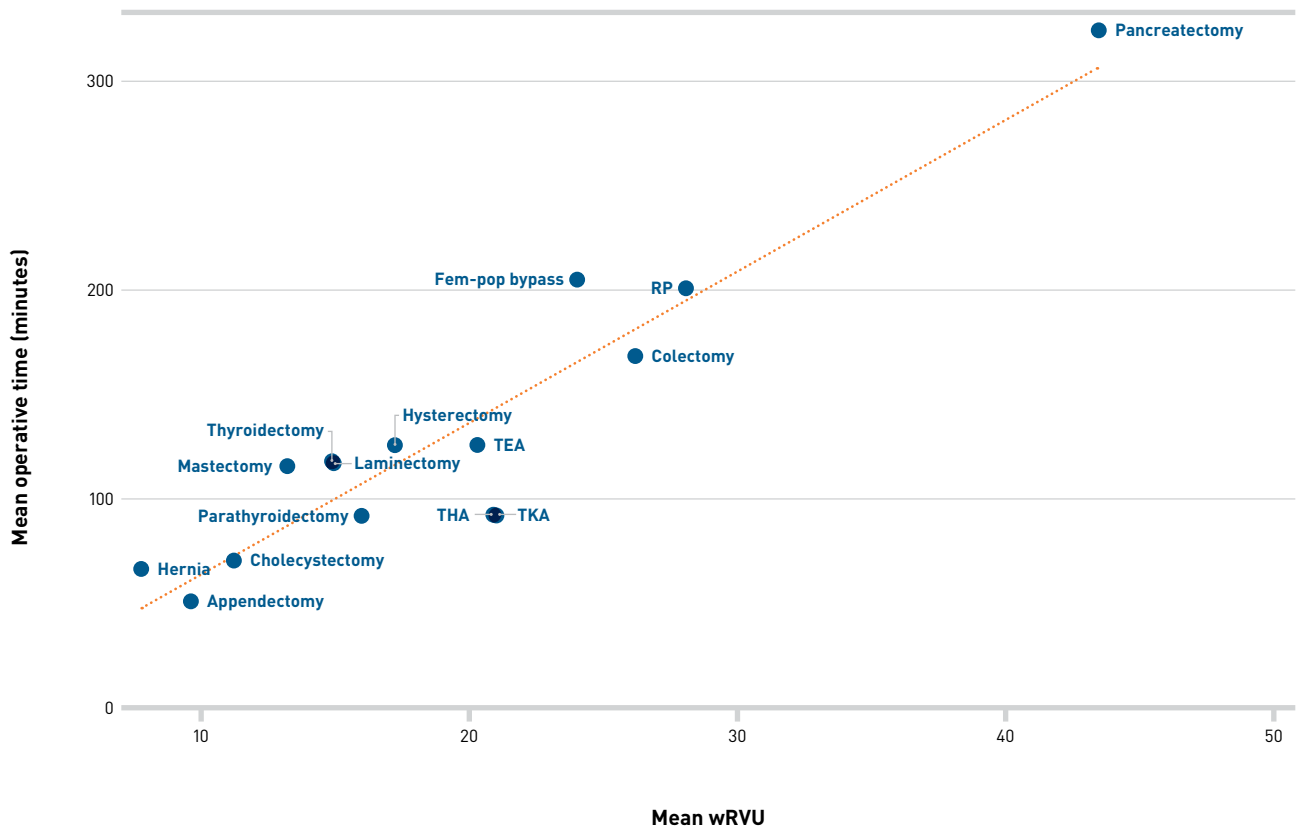
A total of 1,994,394 patients met criteria for analysis. The lowest mean wRVU was 7.78 (95% CI, 7.77-7.78) for inguinal hernia repair, followed by appendectomy at 9.62 (95% CI, 9.61-9.62). The highest mean wRVU was 43.50 (95% CI, 43.37-43.60) for pancreatectomy, and the second highest was 28.10 (95% CI, 28.04-28.12) for radical prostatectomy. The shortest mean operative time was 51.0 (95% CI, 50.8-51.1) minutes for appendectomy, followed by inguinal hernia repair with a mean operative time of 66.6 (95% CI, 66.4-66.8) minutes. The longest mean operative time was for pancreatectomy at 324.6 (95% CI, 323.2-326.0) minutes, followed by femoropopliteal bypass with a mean operative time of 205.2 (95% CI, 203.8-206.5) minutes.

The Spearman correlation coefficient for all procedures was 0.81. As depicted in the [Figure](#), the 15 most frequently performed procedures congregate around the line of best fit.

## DISCUSSION

The fairness of wRVUs remains a source of disagreement among surgeons across specialties, with significant implications for

**FIGURE.** Relationship Between Mean wRVUs and Mean Operative Time With Line of Best Fit for the 15 Most Performed Procedures



Fem-pop bypass, femoropopliteal bypass; RP, radical prostatectomy; TEA, thrombendarterectomy; THA, total hip arthroplasty; TKA, total knee arthroplasty; wRVU, work relative value unit.

reimbursement or at the very least the attribution of resources. Our results show that wRVUs strongly correlate with operative time for common procedures across surgical specialties. Although the complexity of different procedures is difficult to quantify and postoperative care is proving to be inaccurately projected,<sup>3</sup> operative time is an objectively evaluable variable in wRVU assignment.

It is therefore reassuring that in our sample, wRVUs correlate well with the time required to perform a given procedure. Examples of unfairly assigned reimbursement exist across specialties. Sodhi and colleagues from Cleveland Clinic in Ohio analyzed the compensation for primary surgery versus revision of total hip, knee, and ankle arthroplasty. They found lower RVU-per-minute assignment in revision cases compared with primary cases in hip and knee arthroplasty, indicating an unfair reimbursement, as revision cases are usually more complex. They argued that there needs to be a shift to increase the RVU per minute for revision cases.<sup>8</sup> Our data show that both total hip and knee arthroplasty receive more wRVUs compared with other procedures with the same mean operative time, leading to a possible conclusion that revision cases earn relatively

fewer RVU per unit of time than primary cases so that a relatively fair wRVU assignment per unit of time for the whole basket of total joint cases is maintained. Chan et al found that orthopedic and urologic surgical procedures received higher payments than they would have if benchmark times for surgical duration (calculated using NSQIP and Relative Value Scale Update Committee [RUC] data) had been used. Nevertheless, they found that RUC time estimates of 293 surgical procedures examined between 2005 and 2015 were neither systematically longer nor shorter than benchmark times.<sup>9</sup>

**Limitations**

A limitation of our study is that the 15 most performed surgeries are in large part general surgery procedures; we did not evaluate cardiothoracic, plastic, or ophthalmic surgery. Furthermore, we had limited ability to account for upcoding, which might occur in many of the most complex procedures. For example, when performing a radical cystectomy, one of the most complex procedures in the urological field, the surgeon commonly codes radical cystectomy, radical prostatectomy (in men) or radical hysterectomy (in women),

pelvic lymphadenectomy, exclusion of small intestine from pelvis, and ureterotomy for insertion of indwelling stent. In our analysis, we examined only the primary CPT code and wRVUs for each listed procedure. We acknowledge that robotic cases and laparoscopic cases compare to their open counterparts differently with regard to operative time (laparoscopic often being shorter than robot assisted). However, because there is no extra compensation in the RVU model for robotic assistance, robotic and laparoscopic cases cannot be reliably separated by CPT code, so we included the procedures together. Another limitation is that the database includes only participating hospitals, which may not be representative of national practice patterns. Of particular importance, for-profit outpatient surgical centers may be undercounted in our analysis. Additionally, wRVUs for less frequently performed procedures may not correlate as well with operative time.

## CONCLUSIONS

Our analysis shows that wRVUs have real-world logic for common surgical procedures and that they scale with operative time, which seems to be the most objective variable in RVU assignment. Thus, the reimbursement of physicians depending on wRVUs is fair for the most commonly performed surgical procedures. ■

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**eAppendix Table.** Current Procedural Terminology codes for the 15 most performed procedures in NSQIP 2011-2017 with 90-day global period (similar CPT codes were added and grouped together for each procedure)

	Procedure	CPT codes
1	Inguinal hernia repair	49520, 49521, 49505, 49507, 49525, 49650, 49651
2	Cholecystectomy	47562, 47563, 47564, 47600, 47605, 47610, 47612, 47620
3	Mastectomy	19301, 19302, 19303, 19304, 19305, 19306, 19307
4	Appendectomy	44950, 44955, 44960, 44970, 44979
5	Colectomy	44140, 44141, 44143, 44144, 44145, 44146, 44147, 44160, 44204, 44205, 44207
6	Knee arthroplasty	27447, 27446, 27445, 27440, 27441
7	Hysterectomy	58240, 58210, 58180, 58152, 58200, 58260, 58267, 58262, 58263, 58270, 58290, 58293, 58291, 58292, 58294, 58285, 58275, 58280
8	Thyroidectomy	60220, 60225, 60240, 60254, 60252, 60260, 60271, 60270, 60212, 60210
9	Hip arthroplasty	27130
10	Thrombendarterectomy	35301, 35331, 35321, 35361, 35363, 35371, 35372, 35306, 35351, 35355, 35341, 35303, 35311, 35302, 35305, 35304
11	Laminectomy	63001, 63003, 63005, 63011, 63012, 63015, 63016, 63017, 63045, 63048, 63046, 63047, 63020, 63030, 63035, 63040, 63043, 63044, 63042
12	Radical prostatectomy	55840, 55845, 55842, 55866, 55810, 55815, 55812
13	Pancreatectomy	48145, 48140, 48146, 48153, 48154, 48150, 48152, 48153, 48155, 48160
14	Parathyroidectomy	60500, 60502, 60505
15	Femoropopliteal bypass	35556, 35583, 35656