Orthopedic Trauma Surgeons Achieve Shorter Operative Times and Lower Implant and Supply Costs Without Compromising Outcomes in Distal Radius ORIF at a Physician-Owned Ambulatory Surgery Center

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Objectives: As orthopedic care becomes increasingly specialized, the allocation of wrist fracture treatment must consider value-based care models. Depending on referral patterns, distal radius fractures are treated by trauma or hand fellowship trained physicians. Our objective is to compare operative time and direct costs between orthopedic trauma and hand fellowship-trained surgeons performing distal radius open reduction and internal fixation (ORIF) at a physician-owned ambulatory surgery center (ASC). Complication data were collected to enable clinical outcome comparison.

Design: Retrospective economic and clinical chart review.

Setting: Physician-owned ASC.

Patients/Participants: 411 patients underwent distal radius ORIF from January 2020 to September 2025.

Intervention: Distal radius ORIF stratified by surgeon fellowship training (hand versus orthopedic trauma).

Main Outcome Measurements: Primary: operative time (minutes) and total direct costs (implant and supply costs, USD). Secondary: nonunion, tendon rupture, unplanned hardware removal, and complex regional pain syndrome (CRPS).

Results: Trauma surgeons had significantly shorter operative times (median 36.5 min, interquartile range [IQR] 27.0–46.1) versus hand surgeons (43.5 min, IQR 33.0–63.3; $p<0.001$) and lower total costs (median $1,011 [IQR $845–$1,386] vs $2,347 [IQR $1,496–$2,782]; $p<0.001$). Complication rates were equivalent between groups (all $p>0.05$).

Conclusions: Orthopedic trauma surgeons perform distal radius ORIF faster and at lower cost than hand surgeons without any difference in complication rates. This finding has significant implications for improved contribution margin, lost opportunity cost, value-based care and ASC efficiency.

Level of Evidence: Level III – Retrospective Comparative Study

Key Words: Distal Radius Fractures; Cost Analysis; Fellowship Training; Operative Efficiency; Value-Based Care

INTRODUCTION

Distal radius fractures represent a substantial source of orthopedic surgical volume in the United States, placing significant demands on musculoskeletal health care resources.[1] The decision regarding which subspecialist should operatively manage these injuries is not standardized and varies by institutional referral patterns, on-call coverage, and practice geography.[2] In many settings, distal radius fractures requiring operative fixation are managed interchangeably by either hand or orthopedic trauma fellowship-trained surgeons. To our knowledge, no paper to date has directly compared these two groups with respect to operative efficiency or economic outcomes.

In the changing healthcare environment, value-based care is paramount as the cost of care has become increasingly unsustainable. In 2026, the Centers for Medicare & Medicaid Services (CMS) is advancing "site neutral" policies reducing hospital payments and moving 285 musculoskeletal procedures from inpatient only to lower cost outpatient centers.[3] Cost reduction and surgical efficiency for common procedures such as distal radius open reduction internal fixation (ORIF) will be increasingly important.

The expanding sub-specialization of orthopedic surgery has generated debate about the ideal distribution of fracture care responsibility.[4] Orthopedic trauma fellowship training is associated with significantly greater operative case volume compared to general orthopedic training.[5] Trauma fellowship programs are specifically designed to optimize operative throughput and familiarity with a broad spectrum of fracture fixation systems, including distal radius plating.[5] In contrast, hand surgery fellowship training centers on wrist anatomy, ligamentous reconstruction, and articular restoration—expertise that, while highly applicable to distal radius fractures, operates within a different operative and economic framework.

The financial impact of surgeon sub-specialization on practice economics is well documented in the orthopedic trauma literature.[6] Dedicated trauma surgeons have been shown to improve operative scheduling efficiency and reduce downstream resource utilization in community-based orthopedic trauma settings.[7] At a physician-owned ambulatory surgery center (ASC), where facility revenue is directly tied to case contribution margin, operative time and implant cost per case can determine the financial sustainability of the ASC, cost savings for patients, and lost opportunity cost.

The true cost of operating room time at an orthopedic ASC is substantial, with published estimates indicating that each additional minute of operative time carries meaningful direct and indirect costs.[8] Perioperative cost reduction strategies such as implant use and operative streamlining have been identified as high-yield targets for improving the value of orthopedic trauma care.[9] Value-based care models demand that clinical outcomes remain the primary benchmark, but efficiency and cost cannot be separated from the delivery of that value, particularly in the ASC environment.

We hypothesized that orthopedic trauma fellowship-trained surgeons would demonstrate (1) shorter operative times, (2) lower implant and supply costs, and (3) equivalent complication rates compared to hand fellowship-trained surgeons performing distal radius ORIF at a physician-owned ASC.

METHODS

Study Design and IRB Approval

Following approval by the Institutional Review Board, the office database was queried to identify all patients who underwent operative fixation of distal radius fractures at a large orthopedic group physician-owned ambulatory surgery center between January 1, 2020 and September 16, 2025. Our practice's hand and trauma surgeons perform distal radius ORIF at multiple sites, but the ASC was chosen over the hospital, as financial data were accurate and available. Informed consent was waived given the retrospective, non-interventional nature of the study.

Patient Selection

Cases were identified using CPT codes 25606 (percutaneous skeletal fixation of distal radial fracture), 25607 (open treatment of distal radial extra-articular fracture or epiphyseal separation with internal fixation), 25608 (open treatment of distal radial intra-articular fracture with internal fixation of 2 fragments), and 25609 (open treatment of distal radial intra-articular fracture with internal fixation of 3 or more fragments). These CPT codes capture the full operative spectrum of distal radius fracture fixation and provide a standardized, replicable framework for stratification by fracture complexity and operative technique. Cases were excluded if operative records, implant cost data, or minimum demographic information were unavailable. A total of 422 patients met inclusion criteria. Of these, 411 had complete CPT code documentation and formed the primary analytic cohort for CPT-stratified operative time and cost analyses. Remaining demographic and complication analyses used all available data.

Table 1: Patient Demographics by Surgeon Fellowship Training

Variable	Hand (n=156)	Trauma (n=255)	Total (N=411)	p-value
Age (median, IQR)	58 [35–69]	52 [23–66]	—	0.007*
Female sex, n (%)	111 (69.8%)	187 (71.6%)	298 (71.0%)	0.69
Diabetes, n (%)	8 (5.0%)	10 (3.8%)	18 (4.3%)	0.56
Smoking, n (%)	11 (6.9%)	21 (8.0%)	32 (7.6%)	0.48
ASA 1/2/3, n (%)	33/104/21 (21/66/13%)	76/136/43 (30/53/17%)	109/240/64 (26/58/16%)	0.042*
Follow-up (median days, IQR)	74 [45–131]	81 [44–111]	—	0.474

*IQR = interquartile range; ASA = American Society of Anesthesiologists physical status classification. *Statistically significant (p<0.05). Denominators vary by variable due to missing data; percentages reflect available data for each reported variable.*

Data Collection

Patient demographic variables included age at surgery, sex, smoking status, diabetes mellitus history, and American Society of Anesthesiologists (ASA) physical status classification. Operating surgeon fellowship training was categorized as either hand surgery or orthopaedic trauma surgery.

Given well-documented limitations in inter-observer and intra-observer reliability of radiographic distal radius fracture classification systems (including the AO/OTA classification), independent retrospective radiographic review by study investigators was not performed.[10,11] Multiple studies have demonstrated that even experienced orthopedic surgeons demonstrate only slight to fair agreement when classifying distal radius fractures radiographically, with kappa values ranging from 0.14 to 0.45 for the AO/OTA system.[10,11] Therefore, the CPT code assigned intraoperatively by the treating surgeon was used as the primary surrogate for fracture complexity, as it reflects real-time operative assessment of articular involvement and is a validated, consistently applied classification in the surgical and billing literature.

Operative data included surgery date, surgeon fellowship designation, total implant costs (USD), total OR supply costs (USD), and operative time (incision to closure, minutes). Medical chart review documented length of follow-up and complications including nonunion, infection requiring intervention, tendon rupture, reoperation, unplanned hardware removal, and complex regional pain syndrome (CRPS).

Statistical Analysis

Statistical analyses were performed using complete case data; data imputation was not performed. Frequency and descriptive statistics were used to characterize the demographic and clinical variables of the sample. Continuous variables were checked for normality using Shapiro-Wilk tests, histograms, and Q-Q plots. Non-normal variables were analyzed using medians (Mdn) and interquartile ranges (IQR), and normal variables were summarized using means (M) and standard deviations (SD). Baseline characteristics between the independent groups were compared using independent t-tests or Mann-Whitney U tests, depending upon statistical assumptions, and with Chi-square or Fisher's Exact tests for categorical variables. The primary outcomes of operative time and total direct costs were tested using two-way analysis of covariance (ANCOVA), and the interaction effect between surgeon type and CPT code was considered the primary finding. Marginal means with 95% confidence intervals (95% CI) were reported for the interaction effects. Effect sizes were reported using partial eta-squared. Post hoc analyses using Bonferroni adjustments were performed when significant main effects were detected. Complication rates between the surgery groups were analyzed using Chi-square or Fisher's Exact test. Statistical significance was assumed at a two-sided alpha

Table 3: Operative Time by Operative Code and Surgeon Fellowship Training

CPT Code	Hand Mean (95% CI)	Trauma Mean (95% CI)	p-value
25609 (intra-articular, 3+ fragments)	58.4 min (54.5–62.4)	42.3 min (38.5–46.0)	<0.001*
25608 (intra-articular, 2 fragments)	43.3 min (37.3–49.3)	41.3 min (35.9–46.7)	0.620
25607 (extra-articular ORIF)	36.6 min (21.7–51.5)	37.4 min (32.3–42.4)	0.922
25606 (percutaneous fixation)	14.9 min (−1.2–30.9)	14.5 min (6.7–22.4)	0.972
Overall (median, IQR)	43.5 min (33.0–63.3)	36.5 min (27.0–46.1)	<0.001*

*Values are estimated marginal means from two-way ANCOVA. 95% CI = 95% confidence interval; CPT = current procedural terminology; ORIF = open reduction and internal fixation; ANCOVA = analysis of covariance. *Statistically significant (p<0.05). Interaction term (surgeon type × CPT code): F=3.876, p=0.009.*

value of 0.05, and all analyses were performed using IBM SPSS Statistics (Version 31).

RESULTS

Patient Demographics and Cohort Characteristics

A total of 422 patients met inclusion criteria; 411 with complete CPT code documentation formed the primary analytic cohort: 156 treated by hand surgeons and 255 by orthopedic trauma surgeons. Demographic characteristics are presented in Table 1. Groups were comparable in sex distribution (hand 69.8% vs trauma 71.6% female; p=0.69), diabetes prevalence (5.0% vs 3.8%; p=0.56), and smoking status (6.9% vs 8.0% active smokers; p=0.48). Trauma surgeons treated a slightly younger cohort (median age 52, IQR 23–66 vs median 58, IQR 35–69; p=0.007). A significant difference in ASA distribution was present (p=0.042), with trauma surgeons treating proportionally more ASA 1 patients (29.8% vs 20.9%); however, ASA 3 proportions were comparable (16.9% vs 13.3%). Length of follow-up was equivalent between groups (trauma median 81 days vs hand median 74 days; p=0.474), with duration sufficient to capture clinically relevant complications such as nonunion and tendon rupture.

Fracture Complexity Distribution (CPT Code)

CPT code distribution differed significantly between groups (chi-square=34.3, df=3, p<0.001; Table 2). Hand surgeons managed a higher proportion of CPT 25609 cases (63.5% vs 44.7%), while trauma surgeons performed proportionally more extra-articular ORIF cases (CPT 25607: 23.9% vs 4.5%) and percutaneous fixations (CPT 25606: 10.2% vs 4.5%). Given this difference, all primary outcome analyses were stratified by CPT code using ANCOVA to account for fracture complexity as a confounding variable.

Table 2: Fracture Complexity Distribution by Operative Code and Surgeon Fellowship Training

Group	CPT 25609	CPT 25608	CPT 25607	CPT 25606	Total
Hand, n (%)	99 (63.5%)	43 (27.6%)	7 (4.5%)	7 (4.5%)	156
Trauma, n (%)	114 (44.7%)	54 (21.2%)	61 (23.9%)	26 (10.2%)	255
Total, n (%)	213 (51.8%)	97 (23.6%)	68 (16.5%)	33 (8.0%)	411

CPT = current procedural terminology; ORIF = open reduction and internal fixation. CPT 25609 = ORIF intra-articular, 3+ fragments; CPT 25608 = ORIF intra-articular, 2 fragments; CPT 25607 = ORIF extra-articular; CPT 25606 = percutaneous fixation. Chi-square test: p<0.001.

Primary Outcome: Operative Time

Overall, trauma surgeons had significantly shorter operative times (median 36.5 min, IQR 27.0–46.1) versus hand surgeons (median 43.5 min, IQR 33.0–63.3; p<0.001). The interaction between surgeon training and CPT code on operative time was significant (F[3,396]=3.876, p=0.009, partial η^2=0.029). Stratified results are shown in Table 3. The difference was significant only for CPT 25609: trauma mean 42.3 min (95% confidence interval [CI] 38.5–46.0) versus hand mean 58.4 min (95% CI 54.5–62.4), p<0.001; a mean savings of 16.1 minutes. No significant time differences were found for CPT 25608 (p=0.620), 25607 (p=0.922), or 25606 (p=0.972).

Primary Outcome: Total Costs

Total direct costs were significantly lower overall for trauma surgeons (median $1,011, IQR $845–$1,386) versus hand surgeons (median $2,347, IQR $1,496–$2,782; p<0.001). The surgeon type × CPT code interaction was highly significant (F[3,400]=9.225,

Table 4: Total Direct Costs by Operative Code and Surgeon Fellowship Training

CPT Code	Hand Mean (95% CI)	Trauma Mean (95% CI)	p-value
25609 (intra-articular, 3+ fragments)	$2,567 ($2,435–$2,700)	$1,339 ($1,216–$1,462)	<0.001*
25608 (intra-articular, 2 fragments)	$1,814 ($1,613–$2,015)	$1,282 ($1,101–$1,463)	<0.001*
25607 (extra-articular ORIF)	$2,114 ($1,616–$2,612)	$980 ($811–$1,149)	<0.001*
25606 (percutaneous fixation)	$154 (−$384–$693)	$113 (−$151–$377)	0.892
Overall (median, IQR)	$2,347 ($1,496–$2,782)	$1,011 ($845–$1,386)	<0.001*

*Values are estimated marginal means in USD from two-way ANCOVA. 95% CI = 95% confidence interval; CPT = current procedural terminology; ORIF = open reduction and internal fixation; ANCOVA = analysis of covariance. *Statistically significant (p<0.001). Interaction term (surgeon type × CPT code): F=9.225, p<0.001.*

p<0.001, partial η^2=0.065). Cost differences were significant for CPT 25609 ($1,339 vs $2,567; p<0.001), CPT 25608 ($1,282 vs $1,814; p<0.001), and CPT 25607 ($980 vs $2,114; p<0.001). No significant cost difference was observed for CPT 25606 (p=0.892), consistent with minimal implant use for percutaneous fixation. Results are summarized in Table 4.

Secondary Outcomes: Complications

Complication rates were low, with no statistically significant differences between groups across all endpoints (Table 5). Nonunion occurred in one hand surgery patient (0.6%) and zero trauma patients (p=0.38). Two tendon ruptures occurred in the trauma group (0.8%) and none in the hand group (p=0.53). Hardware removal rates were 5.7% (hand) and 5.3% (trauma; p=0.89). CRPS was diagnosed in 0.6% of hand and 2.3% of trauma patients (p=0.26). No infections requiring intervention were identified in either group.

Table 5: Complication Rates by Surgeon Fellowship Training

Complication	Hand, n (%)	Trauma, n (%)	p-value
Nonunion	1 (0.6%)	0 (0.0%)	0.38
Tendon rupture	0 (0.0%)	2 (0.8%)	0.53
Hardware removal	9 (5.7%)	14 (5.3%)	0.89
CRPS	1 (0.6%)	6 (2.3%)	0.26

All comparisons by Pearson chi-square or Fisher exact test. CRPS = complex regional pain syndrome. No significant differences (all p>0.05). Denominators reflect available complication data and may vary from the primary analytic cohort.

DISCUSSION

To our knowledge, this is the first study to directly compare orthopedic trauma and hand fellowship-trained surgeons with respect to operative efficiency and direct costs for distal radius ORIF at a physician-owned ASC. Our principal findings were: (1) orthopedic trauma surgeons performed distal radius ORIF significantly faster, particularly for complex intra-articular fractures, with a mean time savings of over 16 minutes per case for CPT 25609; (2) total direct costs were substantially and significantly lower for trauma surgeons across all articular fracture categories; and (3) complication rates were equivalent between groups, suggesting that the efficiency advantage of trauma-trained surgeons was not associated with compromised patient safety.

The economic implications of these findings are substantial in the context of physician-owned ASC management. Published data confirm that OR time carries a direct and measurable cost, with one study at a Level II orthopedic trauma center documenting a per-minute cost of $16.21, excluding implants, soft goods, and professional fees.[8] At a physician-owned facility, a 16-minute reduction in operative time for the most common fracture category can translate directly to improved throughput capacity and per-case profitability. In addition, if time is saved over several cases, this allows for an additional surgery to be performed. This demonstrates potential lost-opportunity cost when hand surgeons treat distal radius fractures instead of trauma surgeons. When combined with a mean implant cost differential of over $1,200 for CPT 25609 cases, the aggregate financial advantage of trauma-trained surgeons across a high-volume distal radius practice becomes clinically and operationally significant.[6,7]

The cost differential likely reflects differences in implant selection philosophy and surgical behavior between the two subspecialties. Orthopedic trauma fellowship training emphasizes implant versatility, anatomical plating principles, and cost-conscious inventory stewardship—skills developed in the context of high-volume level I and II trauma center practice.[5,7] The role of value-based implant selection in orthopedic trauma has been specifically advocated as a means of delivering equivalent outcomes at lower cost.[12] Furthermore, formal implant report card systems have been shown to positively influence trauma surgeon implant stewardship behavior, suggesting that cost awareness is a trainable and modifiable competency within fellowship programs.[13] The observed cost differences may in part reflect implant selection differences between subspecialties, though the specific drivers of this variation were not directly assessed in this study.

A significant difference in CPT code distribution was observed between groups, with hand surgeons managing a higher proportion of the most complex intra-articular fractures (CPT 25609: 63.5% vs 44.7%). The mechanism underlying this distribution was not assessed in this study and may reflect surgeon availability, scheduling practices, or other institutional factors beyond the scope of this analysis. This distribution may also reflect differences in coding practices or in subjective assessment of fracture complexity between subspecialties. This case-mix difference was addressed through ANCOVA stratification, which demonstrated that the trauma surgeons' efficiency advantage persisted after controlling for fracture complexity. Importantly, even when comparing only CPT 25609 cases — the most complex intra-articular fracture category and the one performed more frequently by hand surgeons — trauma surgeons remained significantly faster and less costly. These findings suggest that the observed differences in operative time and cost are not solely attributable to fracture complexity. The difference in ASA classification distribution between groups is unlikely to have significantly confounded the primary outcomes, as ASA score was not independently associated with operative time or cost in this dataset.

Follow-up time was adequate in both groups to capture the most common complications of distal radius fracture surgery. Complication rates were low and equivalent across all measured endpoints. The hardware removal rate (5.7% hand, 5.3% trauma) and CRPS rates (0.6% hand, 2.3% trauma) are consistent with ranges reported in the literature for volar locking plate fixation.[14,15] These data are highly suggestive that outcomes are equivalent between hand and trauma surgeon treatment of these common injuries.

Limitations

This study has several limitations inherent to its retrospective design. Patient allocation between surgeons was not randomized and reflects practice patterns that may introduce selection bias. Independent radiographic fracture classification was not performed due to well-documented inter- and intra-observer reliability limitations of the AO/OTA and other classification systems for distal radius fractures.[10,11] Although CPT code serves as a clinically relevant proxy for fracture complexity, its use as the primary stratification variable remains a limitation. Patient-reported outcomes (PROMs such as PROMIS UE or QuickDASH), as well as range of motion, grip strength, and formal radiographic reduction parameters, were not systematically captured. Notably, the relationship between radiographic parameters and functional outcomes in distal radius fractures has itself been questioned in the literature, which partially mitigates this limitation.[16] Variability in individual surgeon practice patterns within each subspecialty was not independently analyzed and may contribute to observed differences beyond fellowship training designation alone. Finally, the single-center design limits generalizability, and future multi-center prospective studies incorporating standardized functional outcome measures are warranted.

CONCLUSION

At a physician-owned ambulatory surgery center, orthopedic trauma fellowship-trained surgeons performed distal radius ORIF in significantly less time and at substantially lower implant and supply costs compared to hand fellowship-trained surgeons, without any difference in complication rates or length of follow-up. The most impactful differences were observed for complex intra-articular fractures (CPT 25609). Trauma surgeons were on average 16 minutes faster and cost over $1,200 less per case, a difference driven largely by implant selection. These findings suggest the value proposition of orthopedic trauma surgeons in the ASC environment and may inform subspecialty triage decisions, case allocation protocols, and facility operational planning. As orthopaedic care continues to evolve toward value-based models, understanding the economic implications of fellowship training on routine fracture care is increasingly important.

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