



Trends in open shoulder surgery among early career orthopedic surgeons: who is doing what?

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Background: The incidence of various open shoulder procedures has changed over time. In addition, various fellowships provide overlapping training in open shoulder surgery. There is a lack of information regarding the relationship between surgeon training and open shoulder procedure type and incidence in early career orthopedic surgeons.

Methods: The American Board of Orthopaedic Surgery Part-II database was queried from 2002 to 2016 for reported open shoulder procedures. The procedures were categorized as follows: arthroplasty, revision arthroplasty, open instability, trauma, and open rotator cuff. We evaluated procedure trends as well as their relationship to surgeon fellowship categorized by Sports, Shoulder/Elbow, Hand, Trauma, and “Other” fellowship as well as no fellowship training. We additionally evaluated complication data as it related to procedure, fellowship category, and volume.

Results: Over the 2002-2016 study period, there were increasing cases of arthroplasty, revision arthroplasty, and trauma ($P < .001$). There were decreasing cases in open instability and open rotator cuff ($P < .001$). Those with Sports training reported the largest overall share of open shoulder cases. Those with Shoulder/Elbow training reported an increasing overall share of arthroplasty cases and higher per candidate case numbers. The percentage of early career orthopedic surgeons reporting 5 or more arthroplasty cases was highest among Shoulder/Elbow candidates ($P < .001$). Across all procedures, those without fellowship training were least likely to report a complication (odds ratio [OR], 0.76; 95% confidence interval, 0.67-0.86; $P < .001$). Shoulder/Elbow candidates were least likely to report an arthroplasty complication (OR, 0.84, $P = .03$) as was any surgeon reporting 5 or more arthroplasty cases (OR, 0.81; 95% confidence interval, 0.70-0.94; $P = .006$).

Conclusion: The type and incidence of open shoulder surgery procedures continues to change. Among early career surgeons, those with more specific shoulder training are now performing the majority of arthroplasty-related procedures, and early career volume inversely correlates with complications.

Level of evidence: Epidemiology Study; Large Database Analysis

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Keywords: ABOS; fellowship; training; complications; shoulder; open; trends

This study was deemed to be institutional review board exempt after review by the board given the nature of the study and entirely deidentified database.

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As the field of orthopedics has evolved, there have been significant changes in the type and incidence of various surgical procedures. In the field of shoulder surgery, trends in the type and incidence of certain procedures continue to change as some open procedures have largely been replaced by arthroscopic or minimally invasive procedures, whereas other open procedures such as arthroplasty are increasingly used.²⁸ Simultaneously, the ever-increasing subspecialization within orthopedics has changed the practice patterns of early career orthopedic surgeons performing open shoulder cases.^{14,22,27} Although orthopedic surgeons with various subspecialty trainings perform open shoulder cases, the most significant overlap is likely between those with Sports training and those with Shoulder/Elbow training. Further analysis of open shoulder cases as it relates to fellowship training will be useful for guiding graduating residents' expectations as well as providing orthopedic fellowships with useful information to further optimize and tailor fellowship training. Finally, this information can add more to the growing conversation correlating surgeon volume, surgeon training, and outcomes.^{7,15,25,26}

The purpose of this study is to evaluate trends in open shoulder procedures among early career orthopedic surgeons and to evaluate the relationship of case type and incidence to surgeon fellowship training.

We first hypothesized that there would be increasing case numbers of shoulder arthroplasty and decreasing numbers of open rotator cuff surgery and open instability surgery. Secondly, we hypothesized that an increasing share of open shoulder cases would be performed by orthopedic surgeons with more specific shoulder fellowship training.

We review the American Board of Orthopaedic Surgery (ABOS) Part-II database for evaluation of these trends. After passing written Part-I board examination, candidates eligible for full board certification submit all cases during a 6-month period within their first 2 years of active practice. The candidate-reported data are maintained by the ABOS and consist of the Current Procedural Terminology (CPT) code, International Classification of Diseases code, year of procedure performed, patient age/sex, surgeon's fellowship training (when applicable), and surgeon-reported complications.

Methods and materials

Institutional review board approval was obtained and a research proposal was submitted to the ABOS. We queried the database initially from 2002 to 2016 by CPT codes related to open shoulder procedures. We provided general procedure trends for open shoulder cases for this time period. For specific analysis with regard to fellowship training, we evaluated surgical cases performed from 2009 to 2016 as there was no specific designation for Shoulder/Elbow fellowship before 2009, and therefore a large number of procedures fell into the "no fellowship category." This

study will thus primarily focus on the 2009-2016 data. We specifically identified common CPT codes representing "open" shoulder procedures and placed them into the following 5 categories: arthroplasty, revision arthroplasty, open instability, trauma, and open rotator cuff repair (Table I). When 2 or more "open" shoulder CPT codes were reported in a case, we grouped based on the primary procedure code.

Fellowship training of candidates was grouped into the following training categories: Sports, Shoulder/Elbow, Hand, Trauma, Other, and no fellowship. For those reporting 2 or more fellowships, we grouped into the fellowship category seemingly most specific to shoulder training (Shoulder/Elbow > Sports > Hand > Trauma > Other). For the category of "open rotator cuff," any case that also contained an arthroscopic code was excluded. The specific revision arthroplasty codes were not widely used before 2013; thus arthroplasty codes *plus* hardware removal codes were additionally used to define revision arthroplasty cases before this. We included the number of candidates who reported *at least* 1 open shoulder procedure but also included the *total* number of candidates from each fellowship category (Table II). The percentages of procedures in this study are based on the number of orthopedic surgeons reporting at least 1 open shoulder case. In addition, the "cases per year" as reported in this study represent all cases collected over the 6-month board collection period. Finally, we evaluated surgeon-reported complications as it related to procedure type and fellowship training across all procedure categories. For arthroplasty, we also assessed complication rates respective to surgeon volume.

Statistical methods

Testing for proportion differences was performed using the χ^2 test and, where appropriate, the χ^2 test for trend in proportions. Odds ratios (OR) for complications were estimated using a logistic regression model. Changes in the average number of procedures per surgical candidate over time were assessed using a Poisson regression model including year as a categorical covariate. Statistical analysis was performed in SAS version 9.4 and R version 3.6.0.

Results

From 2002 to 2016, we identified 41,497 total open shoulder cases, and these procedure trends are reported in Figure 1. From our period of primary interest 2009-2016, we identified 21,166 cases from 3467 candidates. Post-residency fellowship training was undertaken in 2941 (84.6%) of the candidates who reported at least 1 open shoulder case. The number of candidates reporting at least 1 open shoulder case is reported in Table II. From 2002 to 2016, there were significant increases in arthroplasty ($P < .001$), revision arthroplasty ($P < .001$), and trauma ($P < .001$) and decreases in open instability ($P < .001$) and open rotator cuff ($P < .001$) cases. The only trend difference in the focused 2009-2016 period was no significant change in trauma cases ($P = .088$) or open instability cases ($P = .085$).

Table I Five procedure categories with associated CPT (Current Procedural Terminology) (American Medical Association, Chicago, IL, USA) codes used for case identification

Arthroplasty	
23470	Arthroplasty, glenohumeral joint; hemiarthroplasty
23472	Arthroplasty, glenohumeral joint; total shoulder (glenoid and proximal humeral replacement)
Revision arthroplasty	
23473	Revision of total shoulder arthroplasty, including allograft when performed; humeral or glenoid component
23474	Revision of total shoulder arthroplasty, including allograft when performed; humeral and glenoid component
23470, 23472	+ one of the following:
23334	Removal of prosthesis, includes humeral or glenoid component
23335	Removal of prosthesis, humeral and glenoid components (eg, total shoulder)
20680	Removal of implant; deep (eg, buried wire, pin, screw, metal band, nail, rod, or plate)
Open instability	
<i>Soft tissue procedures</i>	
23450	Capsulorrhaphy, anterior; Putti-Platt procedure or Magnuson-type operation
23455	Capsulorrhaphy, anterior; with labral repair (eg, Bankart procedure)
23465	Capsulorrhaphy, glenohumeral joint, posterior
23466	Capsulorrhaphy, glenohumeral joint, any type multidirectional instability
<i>Bone augmentation procedures</i>	
23460	Capsulorrhaphy, anterior, any type; with bone block
23462	Capsulorrhaphy, anterior, any type; with coracoid process transfer
Trauma	
23485	Osteotomy, clavicle, with or without internal fixation
23515	Open treatment of clavicular fracture, with or without internal or external fixation
23550	Open treatment of acromioclavicular dislocation, acute or chronic
23552	Open treatment of acromioclavicular dislocation, acute or chronic; with fascial graft
23585	Open treatment of scapular fracture (body, glenoid, or acromion), includes internal fixation when performed
23615	Open treatment of proximal humeral (surgical or anatomical neck) fracture
23616	Open treatment of proximal humeral fracture; with proximal humeral prosthetic replacement
23630	Open treatment of greater humeral tuberosity fracture, includes internal fixation when performed
23660	Open treatment of acute shoulder dislocation
23670	Open treatment of shoulder dislocation, with fracture of greater humeral tuberosity
Open rotator cuff	
23410	Repair of ruptured musculotendinous cuff (eg, rotator cuff) open; acute
23412	Repair of ruptured musculotendinous cuff (eg, rotator cuff) open; chronic
23420	Reconstruction of complete shoulder (rotator) cuff avulsion, chronic (includes acromioplasty)

(Fig. 1). The trends in the average number of open shoulder cases reported *per candidate* by fellowship trainings are shown in Figure 2. Over the study period, there was an increase in the proportion of cases reported by Shoulder/

Elbow ($P < .001$), Hand ($P = .003$), Trauma ($P < .001$), and “Other” ($P = .003$) candidates as well as a decrease in the number of cases reported by Sports ($P < .001$) candidates and those without fellowship ($P < .001$).

Table II Number of candidates reporting a minimum of one open shoulder case and number of candidates () from respective fellowship taking ABOS Part II same year*

Fellowship	2009	2010	2011	2012	2013	2014	2015	2016	Total
Shoulder/Elbow	20 (22)	20 (23)	24 (29)	29 (34)	30 (36)	38 (38)	32 (39)	30 (40)	223 (276)
Sports	160 (185)	179 (204)	174 (199)	151 (180)	166 (194)	173 (198)	181 (199)	141 (167)	1325 (1526)
Hand	50 (90)	46 (74)	50 (102)	43 (89)	68 (115)	58 (108)	58 (108)	71 (134)	444 (820)
Trauma	37 (41)	35 (41)	53 (57)	63 (73)	59 (79)	63 (73)	50 (59)	61 (68)	421 (491)
Other†	62 (225)	65 (219)	63 (236)	68 (234)	68 (269)	69 (254)	69 (248)	64 (284)	528 (1969)
None	82 (122)	77 (97)	71 (101)	64 (83)	70 (90)	56 (75)	67 (86)	48 (70)	535 (724)

ABOS, American Board of Orthopaedic Surgery.

* Candidates categorized into group most specific for shoulder training if reported 2 or more fellowships (Shoulder/Elbow > Sports > Hand > Trauma > Other).

† Other category includes Foot/Ankle, Adult Reconstruction, Spine, Pediatrics, and Oncology.

2002-2016 Case Trends

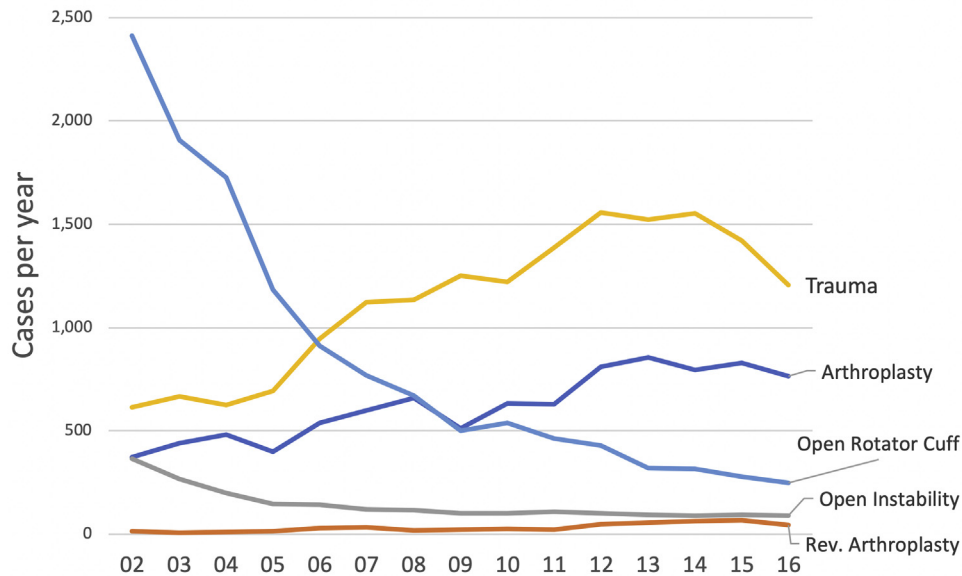


Figure 1 Case trends from 2002 to 2016 for general procedure categories for open shoulder surgery among early career orthopedic surgeons.

Arthroplasty

A total of 5832 shoulder arthroplasty cases were reported from 2009 to 2016 with a yearly mean of 729 (range, 531-895), and this increased across years ($P \leq .001$). The trends in overall *share* of arthroplasty procedures from each fellowship category are reported in [Figure 3](#). Across all years combined, those with Sports fellowship training reported the largest overall share of the arthroplasty procedures (36%) followed by those with Shoulder/Elbow training (34%). The per candidate arthroplasty numbers were highest across all years for Shoulder/Elbow candidates and increased across the study period ($P < .001$) ([Fig. 4](#)). The following are the percentages of candidates from each fellowship reporting 5 or more arthroplasty cases: Shoulder/Elbow 66% (range, 55%-78%), Sports 11% (range, 9%-14%), Hand 10% (range, 6%-15%), “Other” 4% (range, 0%-6%), Trauma 1.2% (range, 0%-3%), and no fellowship 11% (range, 9%-14%).

Revision arthroplasty

A total of 350 revision arthroplasty cases were identified during the 2009-2016 study period. There was an overall increase in revision arthroplasty cases during the time period, with 21 cases identified in 2006 and more than double of them (45 cases) reported in 2016 (mean, 43.75; range, 21-67) ($P < .001$). The majority share of revision arthroplasty cases was reported from those with Shoulder/Elbow training (49.4%) and those with Sports fellowship

training (28.2%). The remainder of cases were reported by those with Hand training (10.2%) and those with no fellowship training, Trauma training, and “Other” fellowship training (12% combined).

Open instability

The entire data set from 2002 to 2016 was used to evaluate broad trends between arthroscopic instability and open instability procedures. There was a decrease in both open and arthroscopic instability cases reported ($P < .001$). From 2002 to 2016, within open instability, there was a decrease in open soft tissue procedures ($P < .001$) and an increase in bone block/Laterjet procedures ($P < .001$). During the focused study period from 2009 to 2016, 778 cases were identified as open instability surgeries, but there were no significant changes across this time period in overall case numbers or between subcategories of soft tissue or bone block/Laterjet procedures ($P = .064$) ([Fig. 5](#)). For open soft tissue only procedures, sports-trained candidates reported the highest share (45.5%) of cases followed by those with no fellowship training (31.05%). Of all open shoulder categories, this was the highest share of cases reported by those with no fellowship training. For bone block/Laterjet procedures, Sports trained candidates reported a 50% share and Shoulder/Elbow reported a 35.3% share of the procedures. On a per candidate basis, Shoulder/Elbow candidates were 4 times more likely than the next highest (Sports) to report a bone block/Laterjet procedure ($P < .001$).

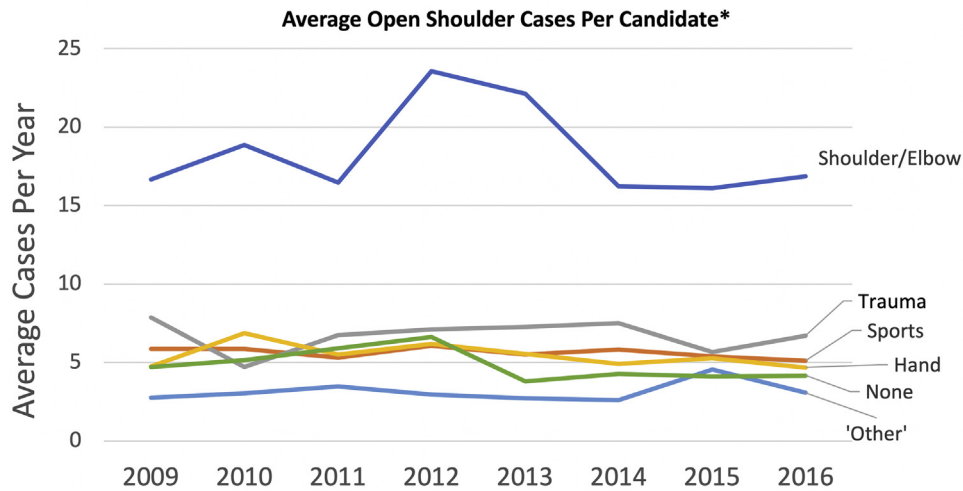


Figure 2 Average number of open shoulder cases reported during the 2009-2016 study period by fellowship type. *Per candidate average is among those reporting at least 1 open shoulder procedure.

Trauma

A total of 11,115 open shoulder trauma cases were identified during the 2009-2016 study period. From 2002 to 2016, there was a significant increase in trauma cases ($P < .001$) but no significant change from 2009 to 2016 ($P = .088$). The most commonly reported procedures were open treatment of a clavicle fracture with 5682 cases and open treatment of a proximal humeral fracture with 3950 cases. From the total shoulder trauma volume, Sports candidates reported 35.5% (3946) of cases, Trauma candidates reported 22.9% (2550) of cases, Shoulder/Elbow candidates reported 12.2% (1360) of cases, and the remaining 29.3% of cases were fairly evenly distributed between Hand candidates (1150), "Other" candidates (908), and those with

no fellowship training (1201) (Fig. 6). On a per candidate basis, Shoulder/Elbow performed an average of 6.1 cases, Trauma performed 6.1 cases, Sports performed 3 cases, and Hand performed 2.6 cases. Over the time period, there was an increase in number of cases performed by those with fellowship training in Trauma (258-333, $P < .001$) and "Other" (81-117, $P = .005$) categories and a decrease in Trauma cases reported by those with no fellowship (189-89, $P < .001$) and Sports fellowship (461-370, $P = .011$). On subgroup analysis of cases types, there was a sharp decline in CPT 23616 (hemiarthroplasty for fracture) from 137 cases reported to 28 cases reported. There were no significant trends in subgroups including open treatment proximal humerus fracture, open treatment clavicle fracture, and acromioclavicular reconstruction.

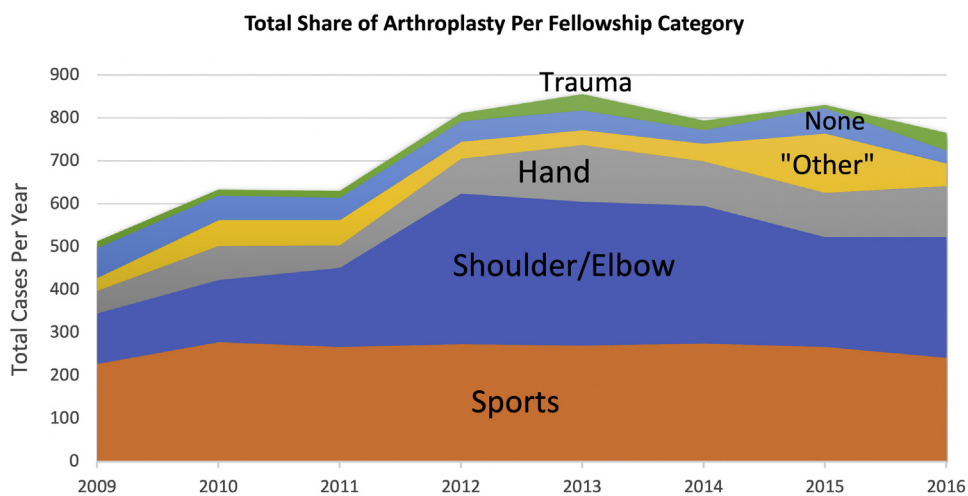


Figure 3 Total share of the arthroplasty procedure by fellowship type. Those with Sports training reported the largest share at the beginning of the study period and those with Shoulder/Elbow training reported the largest share at the end of the study period.

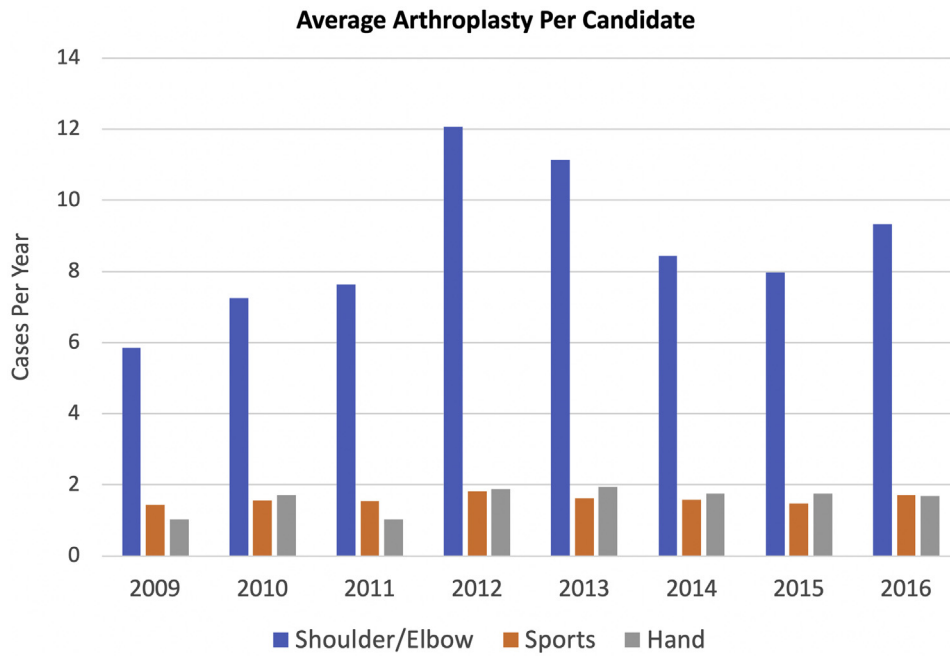


Figure 4 Average arthroplasty cases per candidate from the 3 fellowship categories reporting the highest share of arthroplasty cases (Shoulder/Elbow, Sports, and Hand). Shoulder/Elbow reported the highest per candidate across all years ($P < .001$), and increases were seen in both Shoulder/Elbow and Hand per candidate averages ($P < .001$) but no change in Sports ($P = .173$). These mean case numbers are for candidates reporting at least 1 case, not across the entire group of fellowship candidates.

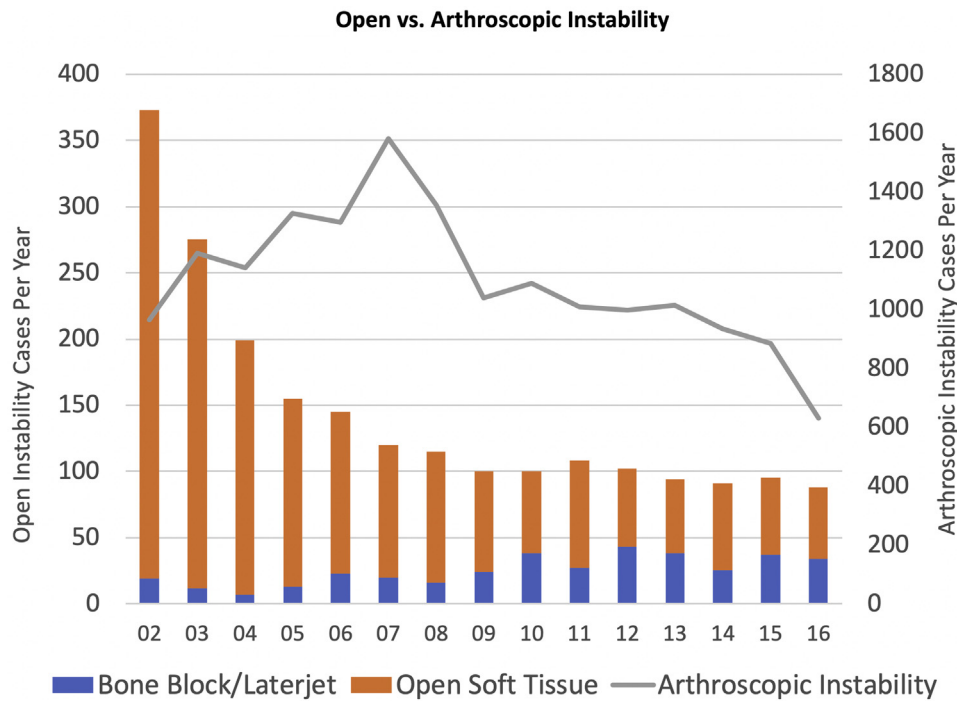


Figure 5 Trends from 2002 to 2016 comparing open vs. arthroscopic instability surgery. The open instability category is further stratified by bone block/Laterjet and open soft tissue procedures.

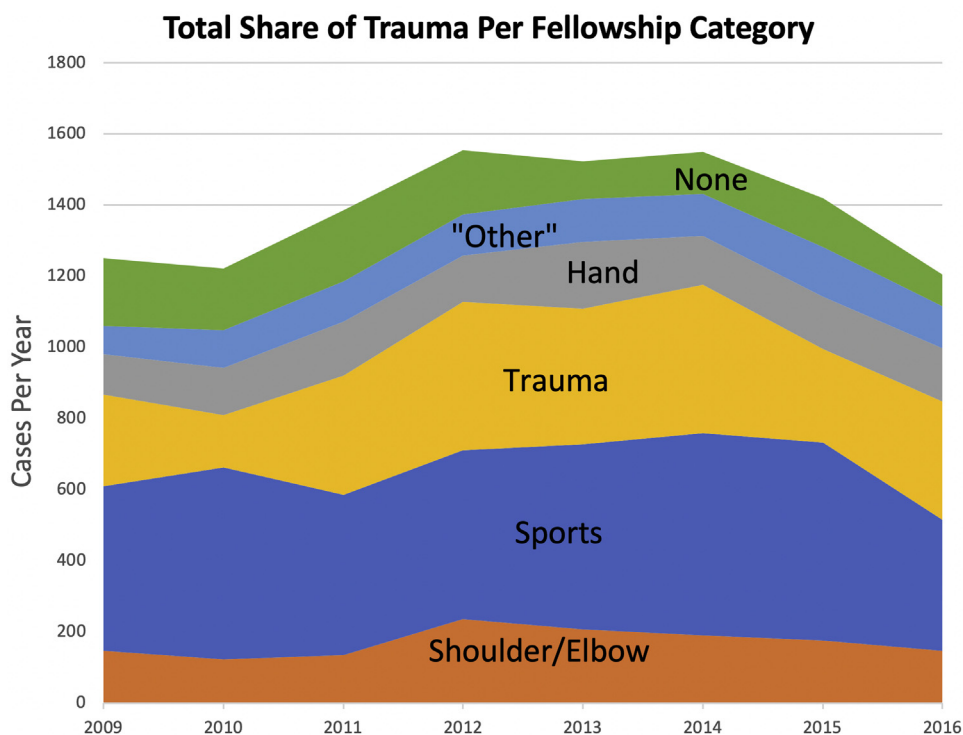


Figure 6 Total share of open shoulder trauma by the fellowship category.

Rotator cuff

From 2002 to 2016, there was a significant decrease in open rotator cuff repair and an increase in arthroscopic rotator cuff repair (Fig. 7). During the focused 2009-2016 study period, a total of 3091 open rotator cuff repairs and a total of 29,318 arthroscopic rotator cuff repairs were reported. The number of open rotator cuff repairs steadily decreased from 500 cases in 2009 to 246 cases in 2016. From the total open rotator cuff case volume, Sports candidates reported 31.5% (975), those with no fellowship reported 26.9% (833), Shoulder/Elbow candidates reported 16% (495), Hand candidates reported 14.2% (440), "Other fellowships" reported 7.89% (244), and Trauma candidates reported 3.4% (104) of cases. The per candidate numbers of open rotator cuff repairs decreased across all fellowship categories except those with no fellowship training ($P < .001$). The decreases were most significant in the "Other" fellowship category (72.1% decrease) and Shoulder/Elbow candidates (64.6% decrease).

Complications

For the 21,166 cases reported across the data set, a total of 3293 surgical complications, 137 anesthetic complications, and 1233 medical complications were reported. The revision arthroplasty category had the highest complication rate (33%) followed by Trauma (16.7%) and arthroplasty (15%) categories. For all procedures combined, the fellowship

category most unlikely to report a surgical complication was "no fellowship" (OR, 0.76; 95% confidence interval [CI], 0.67-0.86; $P < .001$) and the one most likely to report a surgical complication was Trauma (OR, 1.15; 95% CI, 1.03-1.28; $P = .01$). In the arthroplasty category, Trauma (OR, 1.8; 95% CI, 1.27-2.60; $P < .001$) and Sports (OR, 1.17; 95% CI, 1.01-1.28; $P = .04$) candidates were most likely to report a complication and Shoulder/Elbow candidates (OR, 0.84; 95% CI, 0.72-0.99; $P = .03$) were least likely to report a complication. In addition, in the arthroplasty category, those reporting 5 or more arthroplasty cases were less likely to report a complication than those with less than 5 cases (OR, 0.81; 95% CI, 0.70-0.94; $P = .006$). In the open instability category, Shoulder/Elbow candidates were most likely to report a complication (OR, 2.16; 95% CI, 1.30-3.60; $P = .003$). In the trauma category, Trauma candidates were least likely to report a complication (OR, 0.88; 95% CI, 0.78-0.99; $P = .04$) and all other fellowships without statistical significance. Finally, in open rotator cuff, Trauma candidates were most likely to report a complication (OR, 2.19; 95% CI, 1.36-3.52; $P < .001$). See Table III for complete data.

Discussion

The first aim of this study was to evaluate the overall trends of open shoulder surgery performed by early career orthopedic surgeons over a 15-year period (2002-2016).

Open vs. Arthroscopic Rotator Cuff

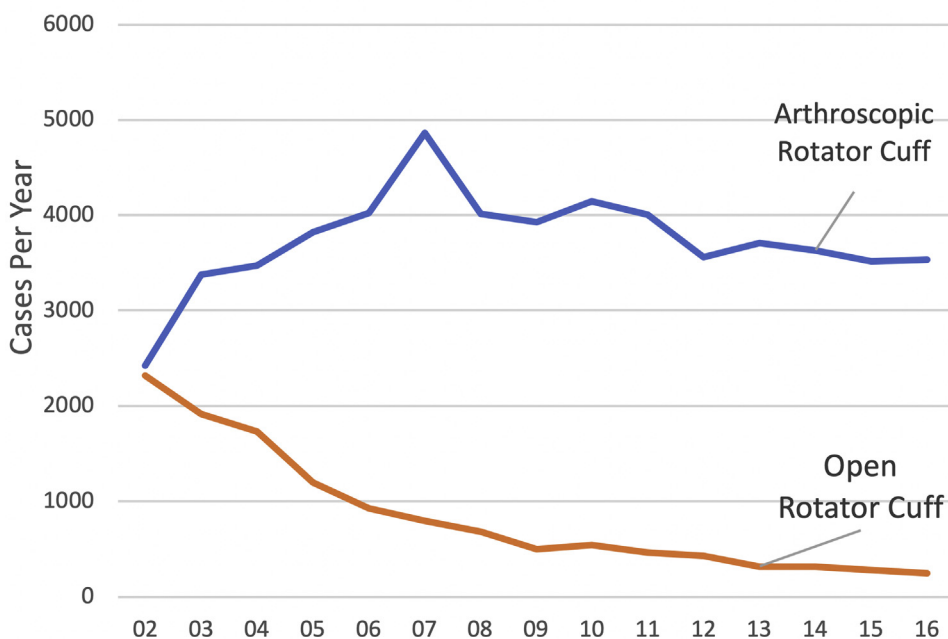


Figure 7 Trends from 2002 to 2016 comparing open vs. arthroscopic rotator cuff procedures.

Over this time period, we saw increasing numbers of arthroplasty, revision arthroplasty, and trauma cases. There was a simultaneous and somewhat predictable decrease in open rotator cuff surgery and open instability surgery that correlates with known trends.^{8,10,18,28} Specifically in the categories of arthroplasty and revision arthroplasty, we saw early career orthopedic surgeons reporting increasing numbers of cases, which mirrors national trends.⁹ The second and primary aim of the study was to specifically evaluate trends in these procedures as they relate to fellowship training over an 8-year period (2009-2016).

In the arthroplasty category, there was a significant trend for those with more specific shoulder training performing a larger share of cases. The reason for the small decline in share of arthroplasty being performed by Shoulder/Elbow candidates after 2013 is not entirely clear but could be related to a simultaneous increase in cases performed by Hand candidates. Despite the increase in arthroplasty cases

reported by Hand candidates, it should be noted that approximately half of Hand candidates report any open shoulder cases and even less report arthroplasty cases. Horst et al¹⁴ reported that over a 10-year period (2003-2013), the percentage of early career cases that fall within a candidate’s subspecialty fellowship training had risen to 81% and continues to increase. The trends seen in shoulder arthroplasty are similar as surgeons with more specific shoulder training are performing an increasing share of these cases.

The reported cases of revision arthroplasty increased across the study period as would be an expected sequela of simultaneously increasing numbers of primary arthroplasty. Among all arthroplasty cases, revision cases accounted for 8.6% of cases that are similar to reported numbers.¹⁶ There were relatively few cases in the revision category, but the majority of these cases are being performed by those with more specific shoulder training. Based on trends in this

Table III Odds ratio (with *P* values) for reporting complications with respect to procedure category and fellowship

	Shoulder/Elbow	Sports	Hand	Trauma	Other	None
Arthroplasty	0.84 (.03)	1.17 (.04)	0.98 (.84)	1.8 (<.001)	0.97 (.81)	0.77 (.09)
Open instability	2.16 (<.003)	0.87 (.56)	0.63 (.41)	2.97 (.21)	0.95 (.94)	0.46 (.38)
Trauma	1.06 (.46)	1.07 (.2)	1.08 (.34)	0.88 (.04)	0.97 (.75)	0.95 (.52)
Open rotator cuff	1.67 (<.001)	1.09 (.47)	1.18 (.28)	2.19 (<.001)	0.32 (<.001)	0.63 (<.001)

Odds ratios <1.0 indicate lower likelihood to report complications and >1.0 indicate higher reporting of complications. Statistically significant values (*P* < .05) are noted in bold.

study, revision shoulder arthroplasty will continue to increase and those with more specific shoulder training will perform the majority of these cases.

In the open instability category, we report increasing arthroscopic instability and decreasing open instability treatment over the longer (2002-2016) period that has been previously reported.⁴ Of all procedure categories, those with no fellowship training reported their largest share of procedures in the open soft tissue instability category. The reason for this is uncertain though certainly could be related to lack of further arthroscopic training in this area. Open soft tissue instability cases have steadily decreased from 2002 to 2016, whereas bone augmentation cases have increased. This increase is potentially attributable to increased attention to bone loss in instability surgery as well as the advent and increasing use of procedures such as distal tibia allograft augmentation for glenoid bone loss.^{3,20,24}

In the open shoulder trauma category, there was no significant change in overall procedure volume over the 2009-2016 study period. The decrease seen in hemiarthroplasty for fracture is likely attributable to the increasing use of reverse shoulder arthroplasty over hemiarthroplasty for fracture over this same time period.^{11,23} This trend was most dramatic in those with Shoulder/Elbow training, and it is plausible that surgeons with more specific shoulder training are more responsive to evidence-based changes favoring reverse shoulder arthroplasty over hemiarthroplasty for older patients or those not amenable to fixation.⁵ The predictive factors for which candidates chose to participate in and/or have access to shoulder fracture care have yet to be defined though there are a relatively high number of reported cases across all fellowship categories as well as in those without fellowship training.

The final category of open rotator cuff surgery saw significant declines in case numbers across all fellowship categories, which correlates with well-known trends in this area.^{2,8,10} Those with any fellowship training reported the greatest decreases in these cases when compared with those without fellowship training. In a similar finding, Amirtharaj et al¹ reported that those without fellowship training were 35% more likely to report an open distal clavicle excision vs. arthroscopic compared with those with Sports fellowship training. Both such trends could be related to lack of further arthroscopic training potentially received in fellowship. Of note, some continued use of open rotator cuff repair coding could be related to the treatment of subscapularis tears that is routinely performed in both open and arthroscopic fashions.⁶ Nonetheless, it can be assumed that the open repair of rotator cuffs will continue to decrease, especially in early career, fellowship-trained orthopedic surgeons.

Across all procedures combined, those without fellowship training were least likely to report a surgical complication. This group also reported a higher proportion of “low risk” procedures such as instability and rotator cuff. These low rates of complications for those without

fellowship training did not bear out in higher risk categories such as arthroplasty and trauma. Lower complications were reported in the arthroplasty category by those with Shoulder/Elbow training, a similar trend to what has been reported by fellowship-trained hip and knee surgeons in the field of hip and knee arthroplasty.¹⁹ Fellowship type aside, among all candidates reporting arthroplasty cases, we found that those reporting at least 5 cases reported lower complication rates. Hasan et al¹³ first reported at that time in 2003 that less than 3% of orthopedic surgeons performing shoulder arthroplasty were performing at least 10 arthroplasties a year. Since that time, there has been much published correlating surgeon volume to patient outcomes not only in shoulder arthroplasty but across other fields of orthopedics.^{7,12,17,19,21,25,26}

Finally, as increasing numbers of residents continue to pursue postgraduate training through subspecialty fellowships, similar trends can be expected in the practice patterns of early career orthopedic surgeons. This information is useful for both future fellowship applicants seeking exposure to open shoulder surgery and those seeking to tailor fellowship training to meet population needs. Although much remains unknown in this area, this study further elucidates the relationship between fellowship training and early career practice patterns.

The primary limitation of this study is the potential variability in coding practices. We are also limited by the 6-month period of case collection in early career surgeons that might not accurately represent widespread trends and case distribution among later career surgeons. Furthermore, complication reporting is certainly limited by surgeon bias though to what degree this is affected by specialty training is unknown. Finally, the direct relationship and impact of cases performed in fellowship with respect to early practice patterns needs further research.

Conclusion

In the field of open shoulder surgery, we see changing trends with increasing numbers of shoulder arthroplasty and revision shoulder arthroplasty with decreasing numbers of open instability and open rotator cuff. In addition, arthroplasty-related procedures are being increasingly performed by those with Shoulder/Elbow fellowship training. Finally, decreased arthroplasty complications were reported in early career surgeons reporting higher case numbers in this category.

Disclaimer

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