

Decrease in Resident Arthroscopic Case Volume After 2013 Implementation of Minimum Case Requirements



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Purpose: To analyze graduating U.S. orthopaedic resident case logs to determine temporal trends in knee and shoulder arthroscopic case volumes, as well as changes in the variability of caseload volumes since the implementation of Accreditation Council for Graduate Medical Education (ACGME) minimum case requirements (“case minimums”) in 2013. **Methods:** We abstracted ACGME-published case log data for all U.S. orthopaedic surgery residents who graduated from 2007 to 2013 (before implementation of case minimums) and from 2014 to 2019 (after implementation). Using a case–control study design, we compared mean numbers of arthroscopic knee and shoulder cases reported per resident between the 2 time periods by using unpaired 2-tailed *t* tests. *P* values < .05 were considered significant. **Results:** The mean number of arthroscopy knee cases reported by residents decreased from 164 before implementation of case minimums to 107 after implementation (*P* < .001). The mean number of shoulder cases decreased similarly from 98 to 66 (*P* < .001). Among residents with caseload volumes in the 90th percentile (“high-volume caseloads”) the decrease was greatest, with 38% fewer knee cases and 41% fewer shoulder cases logged. The ratio of the number of cases in the 90th percentile of caseload to the number in the 10th percentile decreased significantly after implementation of case minimums (*P* < .001). **Conclusions:** After implementation of ACGME case minimums in 2013, the numbers of arthroscopic knee and shoulder cases reported by graduating U.S. orthopaedic surgery residents decreased significantly. The disparity between the number of cases that constitutes a high-volume caseload and the number that constitutes a low-volume caseload narrowed, suggesting greater uniformity in resident exposure to these procedures across training programs. **Level of Evidence:** Level III, retrospective comparative study.

Gaining proficiency in arthroscopic surgical procedures is a fundamental goal of orthopaedic residency training. Knee and shoulder arthroscopy are among 15 procedural categories with minimum requirements for resident caseloads (herein, “case minimums”) instituted in 2013 by the Accreditation Council of Graduate Medical Education (ACGME). According to these case minimums, residents are

required to log at least 30 arthroscopic knee procedures and 20 arthroscopic shoulder procedures before graduation. A previous study showed that the volume of arthroscopic procedures performed by orthopaedic surgery residents increased from 2007 to 2013; the number of logged arthroscopy cases during this period far exceeded the minimum numbers later established by the ACGME.¹ However, despite this overall increase, caseload volume varies widely among orthopaedic residents.¹⁻⁴

Case minimums were established because operative experience is considered one of the most critical factors for achieving competence in trainees.^{5,6} In a survey of recent orthopaedic surgery residency graduates, 96% of respondents felt comfortable performing knee arthroscopy independently, and 90% felt comfortable performing shoulder arthroscopy independently.⁷ The median case numbers recommended by these respondents for achieving independent proficiency in knee and shoulder arthroscopy were 25 and 28 cases, respectively.

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The purpose of this investigation was to analyze graduating U.S. orthopaedic resident case logs to determine temporal trends in knee and shoulder arthroscopic case volumes as well as changes in the variability of caseload volumes since the implementation of ACGME minimum case requirements (“case minimums”) in 2013. We hypothesized that, after implementation of ACGME case minimums, more emphasis would be placed on underrepresented procedure types to satisfy ACGME case minimums, resulting in a decrease in arthroscopic case volume and the variability of arthroscopic case volume.

Methods

We used ACGME case log data from 2007 to 2019 to determine the mean number of cases reported by graduating U.S. orthopaedic residents each year. The ACGME prospectively collects resident case logs from each year of residency, which are self-reported by residents as cases are performed. Upon graduation, a resident’s yearly case logs are aggregated, and the cumulative total is reported for the graduating academic year. ACGME case logs record all procedures reported by residents (in a primary or secondary role) using Current Procedural Terminology (CPT) codes.⁸ Our analysis consisted of 2 of the most common orthopaedic procedures: arthroscopic knee procedures (comprising 13 CPT codes) and arthroscopic shoulder procedures (comprising 23 CPT codes). We analyzed the per-resident means for such procedures, as well as the national 10th, 50th, and 90th percentiles for both procedure types.

We then compared case volumes between 2 groups: orthopaedic residents who graduated from 2007 to 2013 (before the implementation of case minimums) and residents who graduated from 2014 to 2019 (after the implementation of case minimums). The mean case

numbers reported per resident were compared between the 2 groups using unpaired 2-tailed *t* tests, with *P* values < .05 considered significant.

Residents whose case volumes were at or above the 90th percentile considered to have “high-volume caseloads” and those whose volumes were at or below the 10th percentile considered to have “low-volume caseloads.” We compared the ratio of mean number of procedures for residents with high-volume caseloads to mean number of procedures for residents with low-volume caseloads during each study period. We used Excel software, version 16.0 (Microsoft Corp., Redmond, WA) for data input and statistical tests.

Results

The mean number of arthroscopic knee cases reported by residents decreased from 164 before implementation of case minimums to 107 after implementation ($P < .001$). The mean number of shoulder cases decreased similarly from 98 to 66 ($P < .001$). The numbers of arthroscopic knee and shoulder procedures decreased for residents in the 10th, 50th, and 90th percentiles of case volume (Figs 1 and 2). The change was greatest for residents with high-volume caseloads, who reported 38% fewer knee procedures and 41% fewer shoulder procedures ($P < .001$; Table 1). Residents with low-volume caseloads reported 26% fewer knee procedures and 18% fewer shoulder procedures after implementation of case minimums ($P < .001$).

Accordingly, the ratio of the number of procedures reported by residents with high-volume caseloads to the number of procedures reported by residents with low-volume caseloads decreased significantly from 2014 to 2019 for both knee and shoulder procedures ($P < .001$; Table 2).

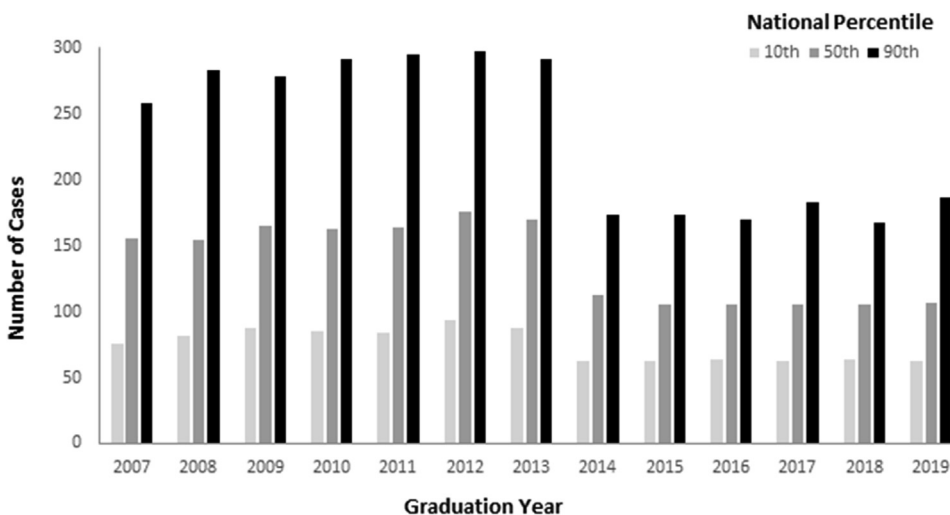
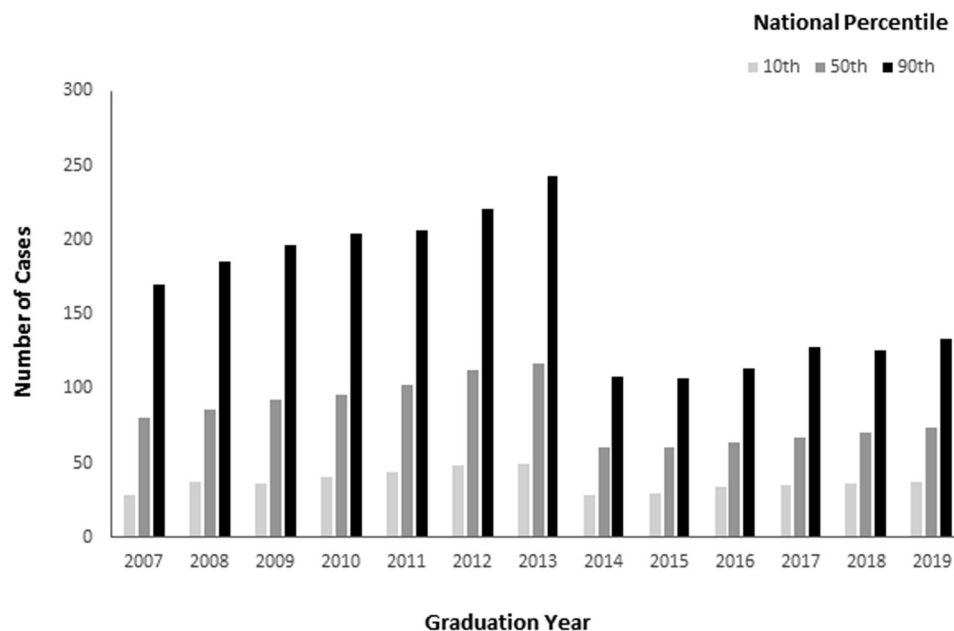


Fig 1. Knee arthroscopy case loads reported by graduating U.S. orthopaedic surgery residents from 2007 through 2019 (before and after implementation of the 2013 Accreditation Council for Graduate Medical Education minimum case requirements).

Fig 2. Shoulder arthroscopy caseloads reported by graduating U.S. orthopaedic surgery residents from 2007 through 2019 (before and after implementation of the 2013 Accreditation Council for Graduate Medical Education minimum case requirements)



Discussion

After implementation of the ACGME case minimums for knee and shoulder arthroscopy in 2013, the number of cases in these procedure categories logged by U.S. orthopaedic residents decreased significantly. The reason for this decrease is likely multifactorial.

All residents, regardless of caseload percentile, consistently reported more than the required minimum number of arthroscopic procedures. The ACGME case minimums require residents to report 30 arthroscopic knee procedures and 20 arthroscopic shoulder procedures. Even with the decrease in volume we observed, orthopaedic residents who graduated from 2014 to 2019 reported a mean of 107 arthroscopic knee procedures and 66 arthroscopic shoulder procedures during residency, which are more than 3 times the ACGME requirements. The results of a survey of orthopaedic residents indicated the latter explanation, with only 17% of respondents suggesting that the shoulder arthroscopy case minimum should

be increased, and 14% suggesting that the knee arthroscopy case minimum should be increased.⁹ The decrease in volume after implementation of the 2013 requirements may represent shifting priorities favoring other procedures for which caseload volumes have historically been lower. However, knee and shoulder arthroscopy were the 2 most frequently performed procedure types by surgeons during their first 2 years of independent practice.⁵

Klimstra et al.¹⁰ determined that the number of closed manipulations of wrist and forearm fractures increased among orthopaedic residents since the implementation of case minimums. Compared with shoulder and knee arthroscopy, closed reduction of wrist and forearm fractures had been reported at lower volumes, closer to the expected minimum requirements.¹⁰ Since 2013, resident time has likely shifted from overrepresented procedure types to underrepresented procedure types in an effort to increase breadth of experience. Case minimums also may have different effects on operative

Table 1. Mean Numbers of Arthroscopic Knee and Shoulder Procedures Reported by Graduating U.S. Orthopaedic Residents, by Residents' Caseload Volume Percentile, Before and After Implementation of Case Minimums

Caseload Volume Percentile	Mean \pm Standard Deviation		Decrease, %	P Value
	Before Case Minimums (2007–2013)	After Case Minimums (2014–2019)		
Knee cases				
10th	85 \pm 5.7	63 \pm 1.0	26	<.001
50th	164 \pm 7.6	107 \pm 2.6	35	<.001
90th	285 \pm 14	176 \pm 7.5	38	<.001
Shoulder cases				
10th	40 \pm 7.1	33 \pm 3.6	18	.046
50th	98 \pm 14	66 \pm 5.8	33	<.001
90th	204 \pm 24	120 \pm 11	41	<.001

Table 2. Ratios of the Number of Arthroscopic Knee and Shoulder Procedures Reported by Graduating U.S. Orthopaedic Residents With High-Volume* And Low-Volume† Caseloads, Before and After Implementation of Case Minimums

Procedure Type	Before Case Minimums (2007-2013)	After Case Minimums (2014-2019)	P Value
Knee arthroscopy	3.4	2.8	<.001
Shoulder arthroscopy	5.1	3.6	<.001

*High-volume caseloads were those at or above the 90th percentile.

†Low-volume caseloads were those at or below the 10th percentile.

versus nonoperative procedures, and further research is needed to determine changes in caseload volumes for the other 12 procedure types identified by the ACGME since implementation of case minimums.

In addition, the decrease in arthroscopy caseload volume may be partly attributable to resident reporting practices. A 2011 survey of 298 orthopaedic residents noted a high level of variability in case logging practices.⁶ No follow-up study has determined whether consistency in reporting practices has improved since 2013. The decrease in reported case logs may represent artificially high caseloads from before the implementation of case minimums or incomplete reporting of caseloads after implementation of case minimums. If the implementation of case minimums caused a change in resident reporting behavior, we anticipate such differences would be present in other surgical specialties. However, decreases in logged cases after implementation of case minimums did not occur in plastic surgery or neurosurgery, among fields.⁸ In future research, case log data may be compared with billing records to determine the accuracy and completeness of resident reporting.

Finally, we found that variability in arthroscopy caseload volume among residents has decreased since 2013. Previous studies found a large disparity in caseload volume between residents in the 10th and 90th percentiles.^{1-4,11} Our data show a shrinking gap between the number of arthroscopy cases reported by residents with high-volume versus low-volume caseloads. This finding is consistent with one of the goals of implementing case minimums—to improve the uniformity of resident experience.¹²

Limitations

Our study is limited by self-reporting of case log data by residents, which may be inaccurate and inconsistent between residents and time periods. Furthermore, those graduating after the implementation of case minimums were still residents for several years before implementation of case minimums. The ACGME also makes no distinction regarding the level of a resident's involvement in logged cases. Therefore, despite uniform logging, the case numbers for knee and shoulder procedures represent varying degrees of resident autonomy during any given case.

Conclusions

After implementation of ACGME case minimums in 2013, the numbers of arthroscopic knee and shoulder cases reported by graduating U.S. orthopaedic surgery residents decreased significantly. The disparity between the number of cases that constitutes a high-volume caseload and the number that constitutes a low-volume caseload narrowed, suggesting greater uniformity in resident exposure to these procedures across training programs.

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