

Decreased Case Volume for Orthopaedic Sports Medicine Fellows During the Early Stages of the Coronavirus Disease 2019 Pandemic



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Purpose: To compare the surgical case volume for orthopaedic sports medicine fellows in the most recent classes with one another and in years preceding the pandemic. **Methods:** The Accreditation Council for Graduate Medical Education case log reports of key procedures for orthopaedic sports medicine fellows during academic years 2018-2019, 2019-2020, and 2020-2021 were extracted. Comparisons between these years in adult, pediatric, and total case volumes were performed using a 2-sample *t*-test to detect significant changes in the average number of key procedures completed between consecutive years. **Results:** There was a significant decrease in the total number of cases completed by fellows during the 2020 academic year ($P = .043$) compared with 2019, immediately followed by a significant increase in case volume in 2021 ($P < .001$) (2019, 339 ± 123 ; 2020, 316.2 ± 108 ; 2021, 356.5 ± 117). There was a significant increase in adult case volume from 2020 to 2021 (2020, 295.7 ± 106 ; 2021, 332.9 ± 117 ; $P < .001$), whereas no trends were noted in pediatric case volume. Between the prepandemic year of 2019 and the first year of the pandemic, significant decreases were noted in case volume for several procedures, including multiligamentous knee injuries, knee instability and pediatric hip arthroscopy. From the first to the second years of the pandemic (2019-2020 to 2020-2021), significant increases were observed in case volume for rotator cuff, acromioclavicular instability, elbow instability, knee cartilage, and meniscal surgeries. **Conclusions:** Orthopaedic sports medicine fellows experienced significant decreases in volume for several key case categories between the year preceding the coronavirus disease 2019 pandemic and the first academic year during the pandemic. There were subsequent increases in cases between the first year of the pandemic and the second year, which may be associated with resuming elective surgical cases. **Level of Evidence:** IV, retrospective database analysis.

At the onset of the coronavirus disease 2019 (COVID-19) pandemic in mid-March of 2020, elective procedures were brought to a halt by the U.S.

Surgeon General's recommendations in hopes to mitigate spread of the virus as well as conserve the dwindling supply of protective equipment. Orthopaedic surgery was one of the many specialties that this notably impacted, as several of its subspecialties involve primarily elective procedures. Moreover, orthopaedic surgery residencies have been altered by increased work-hour restrictions and operative supervision, and therefore the vast majority of residents participate in a postgraduate fellowship year to enhance their technical skills and experience.¹ Thus, COVID-19-related operating room shutdowns were a specific concern for orthopaedic fellowship training programs, as these are only 1 year in length and the class of 2019-2020 was only two-thirds of the way through their program when the pandemic began. Orthopaedic sports medicine is a field with a particularly high elective caseload and had potential to be markedly affected by the canceling of elective cases. In addition, cancellations and postponements of athletic events and even full

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sporting seasons could lead to even further decreases in operative case volumes for fellows during this remarkable time period.

In addition to the decrease in surgical volume, the fellowship training programs themselves also were impacted by COVID-19. Liles et al.² observed a significant increase in virtual didactic and surgical education, rather than the hands-on operative experience of pre-COVID-19 times in orthopaedic sports medicine training. They also found that 21% of programs studied had to help triage and assist in off-service needs in the hospital. Perrone et al.³ showed similar results in the increase of virtual learning, as well as 31% of their respondents being asked to work in a different specialty. Both studies demonstrated that orthopaedic surgery fellows experienced an overall decrease in exposure to operative orthopaedics during their fellowship year. The importance of high case volume in orthopaedic surgical practice is well-described. For example, early-career surgeons performing greater volumes of total shoulder arthroplasty had a lower complication rate than those who perform lower volumes.⁴ Moreover, the decision to choose one fellowship program over another is often dictated by the case volume and diversity of cases, which was certainly at risk due to the COVID-19 pandemic operating room shutdowns.⁵

While the COVID-19 pandemic resulted in a broad impact to orthopaedic surgical training programs during its March 2020 peak, the specific effects of operative volume during fellowship training of various orthopaedic subspecialties is unclear. Thus, the purpose of the current study was to compare the surgical case volume for orthopaedic sports medicine fellows in the most recent classes to one another and in years preceding the pandemic. Our hypothesis was that the class of 2019-2020 (who were fellows in the second quarter of 2020 during the peak of the pandemic and operating room shutdowns) would perform significantly fewer cases than either pre-pandemic years, or the 2020-2021 class. We also hypothesized that the 2020-2021 class would perform significantly more cases than the 2019-2020 class as operating rooms reopened and elective cases resumed.

Methods

The Accreditation Council for Graduate Medical Education (ACGME) publicly reports case logs each year for accredited surgical fellowship programs. This study used the combined ACGME case log for all 92 accredited orthopaedic sports medicine fellowships within the United States. This case log report provides descriptive characteristics for the key procedures performed by fellows subcategorized by patient type (adult, pediatric, and combined). The key procedures included were glenohumeral instability, rotator cuff,

acromioclavicular instability, elbow arthroscopy, elbow instability, hip arthroscopy, knee instability, knee multiligament repair and reconstruction, knee osteotomy, patellofemoral instability, knee articular cartilage, meniscus, and foot and ankle.

ACGME reports for academic years 2018-2019, 2019-2020, and 2020-2021 were extracted and herein will be referred to as the 2019, 2020, and 2021 academic years. The Student *t* test was used to compare adult, pediatric, and combined mean caseloads of both total and individual key procedures. Comparisons were designed to detect significant change in the average number of key procedures completed between consecutive years and between the 2019 and 2021 academic years. A *P* value $<.05$ was considered statistically significant. Analyses were performed using Stata (Version 15.1; StataCorp LLC, College Station, TX).

Results

There were 206 fellows in the 2019 graduating class, 216 in the 2020 graduating class, and 215 fellows in 2021 graduating class. The mean number of key procedures completed by sports medicine fellows can be visualized in [Table 1](#). During the 2019 academic year, orthopaedic sports medicine fellows completed 339 ± 123 (mean \pm standard deviation) total key procedures compared with 316.2 ± 108 in 2020 and 356.5 ± 117 in 2021. These data demonstrate a significant decrease in the number of cases completed by fellows during the 2020 academic year ($P = .043$) compared with 2019, immediately followed by a significant increase in case volume in 2021 ($P < .001$). While there was an average increase in case volume by 17.5 key procedures between 2019 and 2021, this increase did not reach the level of statistical significance ($P = .135$). From 2019 to 2020, individual key procedures for knee instability ($P = .008$) and knee multiligament repair and reconstruction ($P = .046$) significantly decreased. Key procedures including rotator cuff ($P = .024$), acromioclavicular instability ($P = .001$), elbow instability ($P = .004$), knee articular cartilage ($P = .007$), and meniscus ($P = .001$) all increased significantly from 2020 to 2021. No key procedures decreased in 2021 compared with 2019, and the caseloads for acromioclavicular instability ($P = .002$), elbow instability ($P = .028$), and knee osteotomy ($P = .025$) performed in 2021 were significantly greater than that of the pre-pandemic year, 2019 ([Table 1](#)).

Stratifying the total case volume into adult ([Table 2](#)) and pediatric ([Table 3](#)) groups elucidated similar fluctuation in case load over the study period. Although not statistically significant, sports medicine fellows in 2020 performed 20.4 fewer total adult cases than in 2019 ($P = .066$), whereas fellows in 2021 significantly exceeded their 2020 graduating class by 32.7 total adult cases ($P = .001$). Similar to the overall caseload trends,

Table 1. Total Sports Medicine Case Experience for Sports Medicine Fellows

Type of Case	Number of Cases by Year, Mean \pm SD			T Test Comparisons Between Years		
	2019	2020	2021	2019 to 2020	2020 to 2021	2019 to 2021
Glenohumeral instability	28.9 \pm 15	27.3 \pm 13	29.5 \pm 13	.242	.08	.661
Rotator cuff	98.8 \pm 54	93.6 \pm 50	105.1 \pm 55	.305	.024	.237
Acromioclavicular instability	1.9 \pm 2	2 \pm 2	2.5 \pm 2	.608	.001	.002
Elbow arthroscopy	3 \pm 4	2.5 \pm 3	3.1 \pm 4	.146	.079	.798
Elbow instability	3.3 \pm 6	3 \pm 5	4.7 \pm 7	.577	.004	.028
Hip arthroscopy	11.3 \pm 24	11.5 \pm 20	13.9 \pm 25	.926	.272	.277
Knee instability	70.3 \pm 33	62.3 \pm 29	66.9 \pm 27	.008	.089	.247
Knee multiligament repair and reconstruction	0.9 \pm 2	1.4 \pm 3	1.3 \pm 3	.046	.73	.11
Knee osteotomy	1.6 \pm 2	1.9 \pm 3	2.3 \pm 4	.23	.241	.025
Patellofemoral instability	7.2 \pm 8	7.3 \pm 9	7.2 \pm 9	.904	.908	1
Knee articular cartilage	18.3 \pm 13	17 \pm 13	20.5 \pm 14	.305	.007	.096
Meniscus	89 \pm 44	82.1 \pm 37	94.4 \pm 40	.082	.001	.188
Foot and ankle	4.7 \pm 7	4.3 \pm 6	5 \pm 7	.528	.266	.661
Total key procedures	339 \pm 123	316.2 \pm 108	356.5 \pm 117	.043	.0002	.135

NOTE. Bold values indicate statistical significant.
SD, standard deviation.

2020 fellows saw a significant decrease in the number of knee instability ($P = .007$) and knee multiligament repair and reconstruction ($P = .047$) cases, whereas the 2021 fellows saw a subsequent increase in rotator cuff ($P = .025$), acromioclavicular instability ($P = .001$), elbow instability ($P = .002$), knee osteotomy ($P = .042$), knee articular cartilage ($P = .007$), and meniscus ($P = .001$) cases.

Pediatric caseloads saw less variation over the study period (Table 3). There was no significant change from year to year of the total number of key procedures performed on pediatric patients. For individual procedures, there was a significant decrease in the average number of hip arthroscopies performed ($P = .033$) in 2020 from 2019, while 2021 saw a significant increase in the number of elbow instability procedures ($P = .039$) compared with 2020.

Discussion

The results of the current investigation demonstrate several ACGME-defined key sports medicine surgical procedures with significant decreases in case volumes between the pre-COVID-19 year and the first year of the COVID-19 pandemic, followed by increases in the most recent academic year (2020-2021). The COVID-19 pandemic has drawn into question the adequacy of recent surgical training. Variations in surgical volume and diversity during the suspension of elective surgery led to concern that orthopaedic residents and fellows may miss vital training opportunities during the pandemic. Notably, orthopaedic fellowships are most commonly only 1 year in duration, and therefore even a few weeks of alterations to an operative curriculum could represent a remarkable detrimental impact in the overall training experience. Given the largely elective nature of the field, orthopaedic sports medicine fellows

experienced a direct effect on their education as a result of the pandemic. Therefore, the goal of the current study was to evaluate changes in surgical case volume for orthopaedic sports medicine fellows over a 3-year period before and during the pandemic.

Dramatic decreases in surgical case volumes were appreciated at the start of the implementation of COVID-19 mitigation policies by health systems during spring of 2020. The results herein are consistent with those of previous studies that investigated the effects of the pandemic on surgical case volumes. Residents and fellows during the COVID-19 pandemic reported a 74% decrease in vascular surgery case volume,⁶ a reduction in case volume for interventional radiology residents,⁷ decreases in both didactical and practical training for plastic surgery residents,⁸ and reported decreases in clinical and surgical activities for urology residents.⁹ Most orthopaedic sports fellows experienced a steep decline in total cases at the outset of the pandemic in which average volume was 11 to 15 cases per week, but dropped to fewer than 1 per week.² Between the 2019 and 2020 academic years, our data demonstrated decreases in overall case volume of several case categories, including multiligamentous knee injuries, knee instability, pediatric hip arthroscopy, and total procedures performed (Tables 1-3). Such decreases may be explained by several factors. Primarily, the widespread cessation of elective cases near the end of the 2020 academic year may explain the significant decrease in overall orthopaedic sports medicine fellow case volume. In addition, decreases in categories such as multiligamentous knee injuries and knee instability also may be related to the discontinuation of sporting activities during the initial phases of the pandemic.¹⁰ This raised concern for trainees, as obtaining adequate case volumes during fellowship training is necessary to satisfy

Table 2. Adult Sports Medicine Case Experience for Sports Medicine Fellows

Type of Case	Number of Cases by Year, Mean \pm SD			T Test Comparisons Between Years		
	2019	2020	2021	2019 to 2020	2020 to 2021	2019 to 2021
Glenohumeral instability	26.1 \pm 15	24.9 \pm 12	26.8 \pm 12	.364	.101	.597
Rotator cuff	98.4 \pm 54	93 \pm 50	104.4 \pm 55	.287	.025	.26
Acromioclavicular instability	1.8 \pm 2	2 \pm 2	2.5 \pm 2	.305	.001	.0004
Elbow arthroscopy	2.5 \pm 4	2.2 \pm 3	2.6 \pm 4	.383	.241	.798
Elbow instability	2.8 \pm 5	2.6 \pm 4	4.1 \pm 6	.65	.002	.016
Hip arthroscopy	10.3 \pm 22	10.8 \pm 19	13.1 \pm 24	.803	.271	.213
Knee instability	61 \pm 29	53.9 \pm 25	57.3 \pm 24	.007	.151	.154
Knee multiligament repair and reconstruction	0.8 \pm 2	1.3 \pm 3	1.2 \pm 3	.047	.73	.11
Knee osteotomy	1.5 \pm 2	1.7 \pm 2	2.2 \pm 3	.305	.042	.005
Patellofemoral instability	5.4 \pm 5	5.4 \pm 5	5.4 \pm 6	1	1	1
Knee articular cartilage	16.5 \pm 12	15.5 \pm 13	18.7 \pm 13	.413	.011	.072
Meniscus	84.7 \pm 44	78.5 \pm 36	90 \pm 39	.113	.002	.191
Foot and ankle	4.2 \pm 6	4 \pm 6	4.7 \pm 7	.732	.266	.433
Total key procedures	316.1 \pm 121	295.7 \pm 106	332.9 \pm 117	.066	.001	.148

NOTE. Bold values indicate statistical significant.
SD, standard deviation.

the previously-defined learning curves to achieve competency in ligamentous knee surgery.¹¹

It is important to note that certain categories, such as pediatric hip arthroscopy, were performed very infrequently (mean 1 case per fellow in 2019 vs 0.7 cases per fellow in 2020); therefore, the clinical significance of such trends are unclear, despite achieving statistical significance. Moreover, despite total sports medicine fellowship case volume decreasing from 339 cases to 316 cases between the academic year before the pandemic (2019) and the academic year most impacted by the pandemic (2020), the clinical importance of this has yet to be fully elucidated. Further research into confidence, competency, outcomes and complication rates of graduates of this fellowship class would be interesting to determine any clinical applicability of this significant alteration to this group's fellowship training.

The 2021 academic year showed a significant increase in overall case volume in rotator cuff, acromioclavicular (AC) joint instability, elbow instability, knee articular cartilage, and meniscus cases (Tables 1-3) compared with the 2020 academic year. These trends may reflect the resumption of elective cases that were backlogged as a result the American Academy of Orthopaedic Surgeons (AAOS) guidelines encouraging a shutdown of elective cases during the pandemic.¹² Another possible explanation is the return to activity following the relaxation of COVID-19 restrictions, which subsequently would increase the frequency of sports-related injuries such as AC joint dislocations from sports collisions.¹³ Meniscus tears are another common injury that occur with twisting motions in impact sports¹⁴ that contributed to the overall increase of total and adult surgical cases. This increase in fellow operative volume across several categories may be attributable not only to the return to baseline numbers of sporting participants,

but also a theoretic increased risk of sports-related injuries due to abrupt resumption of competition after a period of inactivity and deconditioning following an athletic hiatus. This explanation may also apply to the increases observed in the pediatric elbow instability case category and may also demonstrate the brisk return to activity in some children following periods of inactivity.

Interestingly, our study showed that several key case categories demonstrated significant increases in case volume between 2021 (postpandemic shutdown) compared with 2019 (prepandemic times). The total and adult volumes of AC joint instability, elbow instability, and knee osteotomy cases significantly increased from 2019 to 2021. Pediatric rotator cuff repairs were also performed more commonly in 2021; however, it is important to note that the low volume of such cases performed in either year (mean cases 2019, 0.5; 2021, 0.7) may preclude this from clinical relevance (Table 3). While many states began relaxing social distancing orders on May 1, 2020, and surgery centers began a phased resumption of elective procedures, some models projected that it would take 7 to 16 months for case volumes to return to pre-COVID-19 levels.³ While this projection may have held true for fellows in 2020, our data points to an increase in surgical case volume for the following year.

Elective surgical case volume reductions have led to a shift in the focus of hospitals and specific departments. During the pandemic, the urgent preservation of personal protective equipment¹⁵ and scarcity of hospital beds carried its own challenges, leading to the conversion of other department wards or beds into surveillance beds for patients with possible COVID-19.¹⁶ Orthopaedic departments began to implement more web-based learning and offer new opportunities in education such as surgical simulation and virtual reality-training in lieu of time in the

Table 3. Pediatric Sports Medicine Case Experience for Sports Medicine Fellows

Type of Case	Number of Cases by Year, Mean \pm SD			T Test Comparisons Between Years		
	2019	2020	2021	2019 to 2020	2020 to 2021	2019 to 2021
Glenohumeral instability	2.8 \pm 4	2.4 \pm 4	2.8 \pm 4	.305	.3	1
Rotator cuff	0.5 \pm 1	0.5 \pm 1	0.7 \pm 2	1	.19	.041
Acromioclavicular instability	0 \pm 0	0 \pm 0	0.1 \pm 0	Null	Null	Null
Elbow arthroscopy	0.4 \pm 1	0.4 \pm 1	0.5 \pm 1	1	.3	.306
Elbow instability	0.5 \pm 1	0.4 \pm 1	0.6 \pm 1	.305	.039	.306
Hip arthroscopy	1 \pm 4	0.7 \pm 3	0.9 \pm 2	.033	.416	.744
Knee instability	9.3 \pm 15	8.4 \pm 12	9.5 \pm 13	.5	.362	.884
Knee multiligament repair and reconstruction	0.1 \pm 1	0.1 \pm 0	0.1 \pm 0	Null	1	Null
Knee osteotomy	0.1 \pm 0	0.2 \pm 1	0.1 \pm 0	Null	Null	Null
Patellofemoral instability	1.8 \pm 5	1.9 \pm 5	1.8 \pm 6	.837	.851	1
Knee articular cartilage	1.8 \pm 4	1.5 \pm 3	1.8 \pm 4	.383	.379	1
Meniscus	4.3 \pm 8	3.6 \pm 6	4.5 \pm 7	.308	.153	.785
Foot and ankle	0.5 \pm 2	0.3 \pm 1	0.3 \pm 1	.192	1	.192
Total key procedures	23 \pm 37	20.4 \pm 30	23.6 \pm 33	.427	.293	.861

NOTE. Bold values indicate statistical significant.
SD, standard deviation.

operating room.¹⁷ In response to concerns of reduced operative case volume for residents during the COVID-19 pandemic, the ACGME and American Board of Orthopaedic Surgery have relaxed certain graduation requirements, while asserting that resident competency is measured on a program-specific level.¹⁷ Continued attention to resident and fellow educational curriculums will be imperative during the continued effects of the COVID-19 pandemic on orthopaedic trainee education to ensure adequate didactic, clinical, and operative training.

Limitations

The current study is not without limitations. While our study assesses the volume of surgeries performed during a 1-year sports medicine fellowship after orthopaedic surgery residency, it does not include surgical volumes before 2017. This limited our ability to compare data to trends before the COVID-19 pandemic. Importantly, non-ACGME-accredited fellowship programs were not included in this study, which is a limitation inherent to the data source. The ACGME case logs are fellow-reported, and therefore are dependent on the accuracy of fellows reporting their case logs. These case logs do not report upon patient outcomes, or surgeon competence or confidence in the operating room. Moreover, the relevance of findings relating to changes in several case categories with low total case numbers during all years studied, such as multiligamentous knee, pediatric rotator cuff, knee osteotomy, and pediatric hip arthroscopy cases, is difficult to elucidate, given the low numbers, and may not represent clinically significant changes in case volume.

Conclusions

Orthopaedic sports medicine fellows experienced significant decreases in volume for several key case categories between the year preceding the COVID-19

pandemic and the first academic year during the pandemic. There were subsequent increases in cases between the first year of the pandemic and the second year, which may be associated with resuming elective surgical cases.

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