

Sports Medicine Fellowship Training Significantly Increases Sports Case Volume: An Analysis of ACGME Case Log Data from 2006 to 2019



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Purpose: The purpose of this study was to determine the experiential benefit of completing a sports medicine fellowship for orthopaedic surgeons specializing in the treatment of sports injuries. **Methods:** Accreditation Council for Graduate Medical Education case logs were examined for sports medicine cases performed by orthopaedic surgery residents from 2006 to 2019 and for orthopaedic sports medicine fellows from 2010 to 2019. The average number of arthroscopic cases was evaluated for residents and fellows according to each body group. Additional data based on subcategorization of arthroscopic cases was analyzed as well. A Student *t*-test was conducted to compare the means between the groups. **Results:** Orthopaedic sports medicine fellows reported 274.9% more shoulder (260.6 ± 77.31 vs 94.8 ± 23.7 , $P < .0001$), 685.6% more humerus/elbow (17.1 ± 6.14 vs $2.5 \pm .508$, $P < .0001$), 596.7% more pelvis/hip (41.4 ± 25.40 vs 6.9 ± 2.97 , $P < .0001$), 188.1% more femur/knee (281.4 ± 57.85 vs 149.6 ± 34.09 , $P < .0001$), and 264.1% more foot/ankle (16.9 ± 5.58 vs $6.4 \pm .600$, $P < .0001$) sports cases compared to orthopaedic surgery residents. Orthopaedic sports medicine fellows performed significantly more shoulder arthroscopy cases (126.8 ± 3.96 vs 86.0 ± 22.26 , $P = .032$) and knee arthroscopy cases (179.4 ± 8.98 vs 101.75 ± 33.51 , $P = .015$) than residents over a 5-year period. **Conclusions:** On average, orthopaedic sports medicine fellowships significantly increase sports case volume of orthopaedic trainees, especially in the upper extremity. Notable increases were in the shoulder, femur/knee, and pelvis/hip. We have demonstrated that orthopaedic sports medicine fellowships significantly increase exposure to sports medicine related cases. **Clinical Relevance:** It is important for case volume to be evaluated across orthopaedic sports medicine fellowships because they must ensure that fellows receive adequate training in orthopaedic sports medicine.

Orthopaedic surgery residency provides a broad exposure to the various subspecialties of orthopaedics. Sufficient case volume is necessary for surgical competency.¹ Since the 2012–2013 academic year, the Accreditation Council for Graduate Medical Education (ACGME) has mandated minimums for all orthopaedic

subspecialties, including sports medicine.² As part of this mandate, residents must complete a minimum of 10 anterior cruciate ligament (ACL) reconstructions and 20 arthroscopic shoulder cases before graduation.

Orthopaedic surgery fellowship provides a focused, year-long experience with all the facets of a specific subspecialty. During this fellowship, the trainee performs a greater number of cases that he or she intends to perform upon entering independent practice. Sports medicine fellowships are an established route to increase a surgeon's exposure to sports cases. In 2015, Yin et al.³ conducted a survey of recent graduates of sports medicine fellowships to examine the perceived value of the fellowship. The authors found that experience gained during sports medicine fellowships had a strong influence on treatment of the knee and shoulder. Fellowship training was valuable for nonoperative treatment of the shoulder and for developing physical therapy regimens for knee injuries. It also had a greater impact on preferred surgical instrumentation and bracing equipment than residency training.³

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AVERAGE SPORTS MEDICINE CASES LOGGED BY ORTHOPAEDIC RESIDENTS AND ORTHOPAEDIC SPORTS MEDICINE FELLOWS

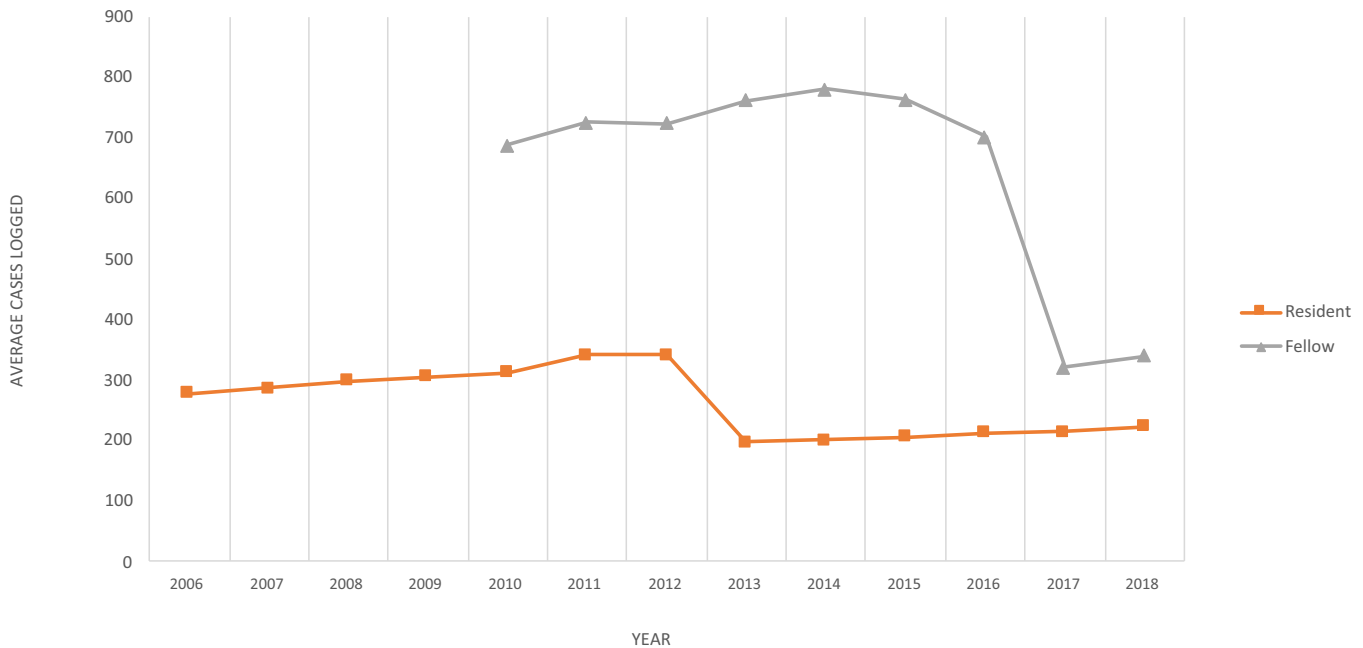


Fig 1. Average sports medicine cases logged by orthopaedic surgery residents and orthopaedic sports medicine fellows. There was a decrease in the number of cases performed by fellows between 2016 (701.3 cases) and 2017 (320.3 cases), largely due to missing ACGME case log data for forearm/wrist, hand, and pelvis/hip for 2017. There was also a decrease in the number of cases performed by residents between 2012 (725.5 cases) and 2013 (723 cases), but neither of these drops were statistically significant.

Arthroscopy, a major component of orthopaedic sports medicine training, is a difficult procedure to learn because it requires the development of 2-handed dexterity and visuospatial skills different from those gained from practicing open surgery.⁴ Additionally, O'Neill et al.⁴ found that sports medicine fellowship program directors believed ACL reconstructions require the highest number of repetitions for proficiency, compared to other arthroscopic procedures. In a study surveying fifth-year orthopaedic surgery residents, Hall et al.⁵ reported a 34% confidence level in arthroscopic procedures as compared to open procedures. Kohring et al.⁶ surveyed recent orthopaedic surgery residency graduates to assess their confidence in performing common orthopaedic cases independently. The authors found that 56.5% of recently graduated orthopaedic surgery residents rated their confidence level with arthroscopic ACL reconstructions as "able to perform independently." For open procedures, such as total hip replacements, open reduction internal fixation of intra-articular distal radius fractures, and total knee arthroplasties, 79.8%, 88.7%, and 89% of residents reported the same confidence level, respectively.⁶

The purpose of this study was to determine the experiential benefit of completing a sports medicine fellowship for orthopaedic surgeons specializing in the

treatment of sports injuries. We hypothesized that orthopaedic sports medicine fellows would perform significantly more sports medicine and arthroscopic cases than orthopaedic surgery residents.

Methods

Data Collection

ACGME case logs for sports medicine cases completed by residents between 2006 to 2019 were accessed from the Case Log Graduate Statistics page on acgme.org.² Similar data were accessed for fellows from 2010 to 2019. The ACGME began collecting data for medicine fellows during the 2010–2011 academic year. For both residents and fellows, we examined all of the cases falling under the "arthroscopy" category and defined all of those cases as sports medicine cases. The average number of cases completed by residents and fellows was gathered for individual body groups ("shoulder," "humerus/elbow," "forearm/wrist," "pelvis/hip," "femur/knee," and "foot/ankle"). Cases classified as foot/toes were consolidated into the "foot/ankle" category. Data for hand cases performed by residents were unavailable and thus were excluded from analysis.

We also examined additional data provided by the ACGME wherever possible. For residents, the ACGME

Table 1. Orthopaedic Sports Medicine Cases Logged by Residents (5 Year Residency) Versus Fellows (1 Year Fellowship)

Body Region	Mean No. of Sports Medicine Cases Logged in 5 Years of Residency	Mean No. of Sports Medicine Cases Logged in 1 Year of Fellowship	<i>P</i> Value	Volume of Cases Logged by Fellows vs Volume of Cases Logged by Residents
Shoulder	94.8 ± 23.7	260.6 ± 77.31	<.0001	274.89%
Humerus/Elbow	2.5 ± .508	17.14 ± 6.14	<.0001	685.60%
Forearm/Wrist	5.15 ± .979	3.23 ± .795	<.0001	62.72%
Pelvis/Hip	6.94 ± 2.97	41.41 ± 25.40	<.0001	596.69%
Femur/Knee	149.63 ± 34.09	281.42 ± 57.85	<.0001	188.08%
Foot/Ankle	6.38 ± .600	16.85 ± 5.58	<.0001	264.11%
Total Cases	262.78 ± 55.41	644.66 ± 181.10	<.0001	245.32%

provided more specific subcategories defining the type of arthroscopic case (“ACL reconstruction,” “knee arthroscopy,” and “shoulder arthroscopy”) for the academic years 2010–2011, 2015–2016, 2016–2017, 2017–2018, and 2018–2019. For fellows, the ACGME data provided more specific subcategories defining the type of arthroscopic case (“glenohumeral instability,” “rotator cuff,” “meniscus,” etc.) for the academic years 2017–2018 and 2018–2019.

Analysis

ACGME case log data was inputted into SPSS Statistics 21 (IMB, Armonk, NY) for analysis. Continuous variables were reported as a mean and standard deviation. Group differences were analyzed using the Student *t*-test. A *P* value < .05 was considered statistically significant.

Results

The number of residents in the case log data increased from 616 in 2006–2007 to 725 in 2018–2019. The total number of fellows remained stable over time, from 208 fellows in 2010–2011 to 206 fellows in 2018–2019. Residents performed an average of 262.78 ± 55.41 arthroscopic cases over the 5-year residency period, while fellows performed an average of 644.66 ± 181.10 over a 1-year fellowship period (*P* < .0001). Fellows performed significantly more shoulder arthroscopy cases (126.80 ± 3.96, *P* = .032), as well as knee arthroscopy cases (179.35 ± 8.98, *P* = .015) than residents over a 5-year period, including data from 2010 to 2011 and 2015 to 2018 (Table 2). There was a decrease in the number of cases performed by fellows between 2016 (701.3 cases) and 2017 (320.3 cases), largely because of missing ACGME case log data for forearm/wrist, hand, and pelvis/hip for 2017. There was also a

decrease in the number of cases performed by residents between 2012 (725.5 cases) and 2013 (723 cases), but neither of these drops was statistically significant (Fig 1).

Experience Gained with an Orthopaedic Sports Medicine Fellowship

On average, fellows reported significantly more procedures for shoulder, humerus/elbow, pelvis/hip, femur/knee, and foot/ankle in their 1 year of fellowship training than residents reported in their 5 years of residency (*P* < .0001) (Table 1). Residents also reported significantly more forearm/wrist procedures in their 5 years of residency than fellows reported in their 1-year fellowship (*P* < .0001). The greatest difference in average case volume between fellows and residents was in the pelvis/hip, with fellows performing 596.7% more cases (41.41 cases vs 6.94 cases, *P* < .0001). The smallest difference in average case volume between fellows and residents was in the forearm/wrist, with fellows performing 62.7% fewer cases (3.23 cases vs 5.15 cases, *P* < .0001).

Discussion

On average, fellows completed 145.3% more arthroscopic sports cases (644.7, *P* < .0001) than residents (262.8, *P* < 0.0001). Notably, the greatest increase was in humerus/elbow cases performed by fellows (685.6%, *P* < 0.0001). This may be attributed to a greater frequency of distal biceps repairs during fellowship. The next greatest increase was in pelvis/hip cases (596.7%, *P* < .0001). Hip arthroscopy has increased in popularity and has a significant learning curve.⁷ Accordingly, more attention would be given to hip arthroscopy during a sports fellowship. Other significant increases were in the shoulder (274.9%, *P* <

Table 2. Arthroscopic Shoulder and Knee Procedures Over 1 year (2018–2019)

Body Region	Mean No. of Sports Medicine Cases Logged in 5 Years of Residency	Mean No. of Sports Medicine Cases Logged in 1 Year of Fellowship	<i>P</i> Value	Volume of Cases Logged by Fellows vs Volume of Cases Logged by Residents
Shoulder	86.0 ± 22.26	126.80 ± 3.96	.032	147.44%
Knee	101.75 ± 33.51	179.4 ± 8.98	.015	176.31%

.0001), foot/ankle (264.1%, $P < .0001$), and femur/knee (188.1%, $P < .0001$). Fellows completed significantly more arthroscopic shoulder cases (126.80 ± 3.96 , $P = .032$) and arthroscopic knee cases (179.35 ± 8.98 , $P = .015$) than residents. These data were recorded over a 5-year period, including 2010–2011 and 2015–2018.

Previous studies have evaluated residency case volume in other orthopaedic subspecialties.^{8,9} In 2014, Daniels et al.⁸ found that orthopaedic surgery residents completed an average of 214.8 fewer spine cases compared to neurosurgical residents (160.2 vs 375.0, $P = .002$).⁸ There was also a significant difference in the average number of spinal deformity cases, with orthopaedic residents having completed 9.5 and neurosurgical residents having completed 2.0 ($P < .0001$). Hinds et al.⁹ examined ACGME case logs to determine trends in pediatric cases performed by orthopaedic residents. Between 2007 and 2013, the mean pediatric orthopaedic case volume per resident increased from 295.9 to 373.2. The greatest increase was in the upper extremity, with hand/finger, humerus/elbow, forearm/wrist, and shoulder case volumes increasing by 12.7%, 26.3%, 41.3%, and 52.1%, respectively.⁹ In 2018, Butler et al.¹⁰ compared the volume of orthopaedic trauma cases performed by orthopaedic residents to that of orthopaedic trauma fellows. The authors found that compared to the average resident, the average orthopaedic trauma fellow completed significantly more trauma cases in the pelvic/hip (91.7 vs 73.5, $P < .0001$), femur/knee (74.8 vs 61.9, $P < .0001$), and ankle/toes regions (25.5 vs 21.9, $P = .009$). Moreover, fellows completed significantly more open complex reductions ($N = 134$, $p < 0.01$) as compared to residents ($N = 47.5$, $P < .01$).¹⁰

In 2018, Butler et al.¹⁰ examined the benefits of completing an orthopaedic trauma fellowship. The authors found that fellows reported a significant increase in trauma cases as compared to residents. Moreover, they gained increased exposure to lower extremity cases and “open complex” cases.¹⁰ These findings further confirm the experience gained by completing an orthopaedic surgery fellowship. We found that fellows acquired more experience in a specific body region and in more technically difficult cases as compared to residents. In our study, fellows reported increased exposure to upper extremity and arthroscopic cases.

There is inherent unreliability of self-reported case logging. Okike et al.¹¹ demonstrated that overall, trainees had an average case logging error rate of 35%, with 29% and 43% for residents and fellows, respectively. There also may be an underestimation of cases because of underreporting. According to the same study, there was a 24% failure to report rate overall, with 23% and 25% for residents and fellows,

respectively.¹¹ This may make it more difficult to draw conclusions from the data.

Limitations

There are several limitations to this study. For most academic years, there was a lack of specificity regarding the types of arthroscopic cases (e.g., rotator cuff repair). This was true for both the resident and fellow data. The combination of the leg/ankle category and the foot/toes category into the foot/ankle category resulted in less data available for analysis. We also did not have access to the entirety of the raw data to be able to do a complete analysis of all subcategories.

Conclusion

On average, orthopaedic sports medicine fellowships significantly increase sports case volume of orthopaedic trainees, especially in the upper extremity. Notable increases were in the shoulder, femur/knee, and pelvis/hip. We have demonstrated that orthopaedic sports medicine fellowships significantly increase exposure to sports medicine–related cases.

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