

The Impact of COVID-19 on the Sports Medicine Fellowship Class of 2020

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Background: In response to the COVID-19 pandemic, many US health systems suspended elective surgery at the recommendation of the US Surgeon General. This dramatically decreased case volumes for orthopaedic sports medicine fellows at academic institutions.

Purpose: To describe how the COVID-19 pandemic has affected the education of the sports medicine fellowship class of 2020 as well as the subsequent effects on their career plans and psychological well-being.

Study Design: Cross-sectional study.

Methods: A 33-item survey was distributed via email to all American Orthopaedic Society for Sports Medicine (AOSSM) 2020 fellow members on April 22, 2020. Frequencies are presented as raw totals and percentages of respondents. The Fisher exact test was used to determine statistical significance between nominal variables, with significance set at $P < .05$.

Results: Of 210 registered fellows, 101 (48.1%) responded. Before the COVID-19 outbreak, the typical case volume per week for most fellows (47.5%) was 11 to 15 cases. From the enactment of COVID-19 mitigation policies to the date of survey completion, 90.1% of fellows had performed fewer than 20 cases. A total of 32 fellows were presented with redeployment options by their fellowship program, with 10 redeployed mandatorily to other hospital departments. Fellows reported that web-based didactics ($n = 100$) and web-based journal clubs ($n = 72$) were utilized as alternative supplements in the absence of clinical education. There were 8 respondents who had either their prior contract or job offer rescinded, while 1 had a signed contract voided. As a result, 6 fellows now plan to matriculate into a previously unplanned fellowship. Also, 10 respondents' intended practice start date was being delayed by their employer. Respondents whose postfellowship plans were affected were statistically more likely to experience doubts about readiness for practice (58.8% vs 20.3%, respectively; $P = .005$), anxiety about future career plans (94.4% vs 63.8%, respectively; $P = .01$), anxiety about their financial situation (86.7% vs 50.8%, respectively; $P = .018$), stress in personal relationships (58.8% vs 29.9%, respectively; $P = .045$), and signs or symptoms of depression (41.2% vs 11.1%, respectively; $P = .007$) compared with those whose plans were not affected.

Conclusion: This survey illustrates that during the early stages of the COVID-19 pandemic and the subsequent suspension of elective surgery, there have been downstream effects to this group's education, careers, board certification timeline, and potentially their social and/or emotional well-being.

Keywords: epidemiology; fellowship; education; COVID-19; coronavirus; pandemic

With greater than 2 million cases and over 100,000 deaths in the United States as of mid-June 2020,⁷ the coronavirus disease 2019 (COVID-19) is the worst the United States has faced since the 1918 Spanish flu, bringing about economic contraction that is projected to approach Great Depression-era levels.²⁵ The rapid increase in patients presenting to health care facilities with flu-like symptoms, along with the frequency of those requiring ventilator support, has overwhelmed emergency departments and intensive care units in certain areas.

The US Surgeon General, in response to significant staffing and equipment shortages in many areas of the country, recommended in March 2020 the delay of all elective and nonessential medical and surgical procedures in an effort to minimize the spread of the disease and to ensure that medical supplies and personal protective equipment were available for the critically ill. In turn, numerous organizations, including the Centers for Medicare & Medicaid Services, American College of Surgeons, and American Academy of Orthopaedic Surgeons (AAOS), released guidelines for the management and triage of elective, nonemergent surgical procedures.^{8,13,19}

In the world of orthopaedic sports medicine, this had a direct and dramatic effect on case volumes in which the majority of surgical procedures falls under the elective

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umbrella.^{13,23} This has presented a unique obstacle for the education of fellows, who rely on repetitive exposure to surgical procedures to hone their skills in preparation for independent practice. Combined with 94% of the US population being under stay-at-home orders, as well as the postponement of athletics at every level, opportunities for patient interaction and assessment in clinics in addition to training rooms were also severely limited.¹⁸

There has been interest in the effects that this current pandemic has had on postgraduate medical and surgical education, with speculation as to what the future may hold in a post-COVID-19 landscape.^{17,20,27} However, there has yet to be any literature published as to the impact this pandemic is having on current fellows, whose training may have been compromised.

This study aimed to assess the effects, if any, that the COVID-19 pandemic has had on the sports medicine fellowship class of 2020. Of particular focus are (1) the effect on case volumes, (2) the redeployment of fellows to assist in the care of COVID-19 patients, (3) the effect on fellows' future career plans, and (4) the psychological impact that the aforementioned effects may have caused.

METHODS

A 33-item survey was created with the use of REDCap,²² a secure web application for building and managing online surveys and databases. The study was approved by the institutional review board of Cedars-Sinai Kerlan-Jobe Institute and endorsed by the research director of the American Orthopaedic Society for Sports Medicine (AOSSM). On April 22, 2020, it was distributed by email to all AOSSM members enrolled in an orthopaedic sports medicine fellowship for the 2019-2020 academic year. The AOSSM also advertised and posted a survey link during its weekly "Sports Medicine Fellows Webinar Series."²⁶ A total of 2 reminder emails were sent during the enrollment period, which closed on April 29, 2020. Each respondent was able to complete the survey only once.

The survey questions were categorized into 4 sections: fellow demographics, effects on fellowship program, effects on postfellowship plans, and psychological impact. The former 3 sections were made up of multiple choice or checkbox questions, while the fourth section consisted of questions on a typical 5-point Likert scale.²¹

Frequencies are presented as raw totals and percentages of respondents. Continuous variables are presented as the mean and standard deviation. To boost power and simplify statistical analysis, those categorical variables recorded

using a 5-point Likert scale were converted to dichotomous variables. Participants who responded with "strongly disagree" or "disagree" were grouped into the "disagree" category, while those who responded with "agree" or "strongly agree" were grouped into the "agree" category. Participants who responded with "neutral" were left in the "neutral" category and excluded from statistical analysis. The Fisher exact test was used to determine statistical significance between nominal variables, with significance set at $P < .05$.

RESULTS

Demographics

Of the 220 AOSSM 2019-2020 fellows, 210 had subscribed to receive marketing emails at the time of study initiation. Of those 210 members, 101 (48.1%) completed the survey. There were 83 (82.2%) who were aged between 31 and 35 years, with 84 (83.2%) completing residency in 2019. The majority of respondents described their main clinical setting as either an academic teaching hospital (35.6%) or ambulatory surgery center (36.6%). The largest group of respondents' fellowship programs had ≥ 5 fellows (31.7%). Also, 11 (10.9%) had completed a previous fellowship before the current academic year. Of the 32 states with orthopaedic sports medicine fellowship programs, 24 were represented by our respondents. A total of 48 respondents were from 5 of the 6 states with the most reported cases: New York ($n = 9$), Massachusetts ($n = 6$), Illinois ($n = 7$), California ($n = 20$), and Pennsylvania ($n = 6$) (Table 1).⁷

Effects on Fellowship Training

Before the COVID-19 outbreak, in a typical week, 48 (47.5%) respondents were performing 11 to 15 cases, with 25 (24.8%) performing more than 15 cases. All but 3 respondents reported that their fellowship programs enacted policies to limit case and/or clinic volumes, with 72.3% reporting implementation between March 11 and 20. Only 20 (19.8%) respondents stated that they did not perform any surgical procedures since the implementation of COVID-19 policies, while 76.2% reported performing urgent or emergent cases in which the patients' outcomes would have been adversely affected by a delay. Most respondents (90.1%) performed fewer than 20 cases in the period between the implementation of COVID-19 policies and completion of the survey, with 26.7% performing fewer than 5 cases. A total of 56 (55.4%) respondents were involved in the care of patients in the clinical setting in

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Ethical approval for this study was waived by Cedars-Sinai Medical Center (study No. 00000697).

TABLE 1
Demographic Information of All Respondents^a

	n (%)
Age, y	
25-30	1 (1.0)
31-35	83 (82.2)
36-40	13 (12.9)
≥40	4 (4.0)
ACGME accreditation status	
No	2 (2.0)
Yes	99 (98.0)
State	
California	20 (19.8)
New York	9 (8.9)
Illinois	7 (6.9)
Massachusetts	6 (5.9)
Pennsylvania	6 (5.9)
Other	53 (52.5)
Primary facility	
Ambulatory surgery center	37 (36.6)
Academic teaching hospital	36 (35.6)
Private teaching hospital	23 (22.8)
Other	5 (5.0)
Completed a fellowship previously	
No	90 (89.1)
Yes	11 (10.9)
Total No. of fellows in program	
1	18 (17.8)
2	22 (21.8)
3	14 (13.9)
4	15 (14.9)
≥5	32 (31.7)

^aACGME, Accreditation Council for Graduate Medical Education.

some capacity, with 15 interacting with patients via telemedicine platforms (Table 2).

Regarding the redeployment of fellows to assist in the treatment of non-orthopaedic sports medicine patients, 32 (31.7%) respondents were presented with redeployment options by their fellowship program, with 10 redeployed nonvoluntarily; 1 respondent's fellowship was terminated in favor of COVID-19 patient care. None of the fellows who were offered voluntary redeployment were reassigned. Of the 10 fellows who were redeployed, 5 were involved in the care of COVID-19 patients, while the others cared for COVID-19-negative and nonsurgical patients.

While withstanding the period of diminished case and clinical volumes, fellowship programs and their fellows were forced to rely on patient care-unrelated forms of education. Table 3 shows a breakdown of the number of respondents who participated in web-based didactics (n = 100), surgical skills laboratories (n = 17), web-based journal article reviews (ie, "journal clubs"; n = 72), and traditional in-person conferences (n = 7). Several fellows sought temporary paid employment in the form of orthopaedic call shifts (n = 9) or telemedicine (n = 2). Considering the disruption to their fellowship education, 11 respondents reported that their programs had offered to graduate them

TABLE 2
Information Regarding the Effect of COVID-19 on Respondents' Fellowship

	n (%)
Cases performed in a typical week before the outbreak of COVID-19	
≤5	5 (5.0)
6-10	23 (22.8)
11-15	48 (47.5)
16-20	21 (20.8)
>20	4 (4.0)
Total cases performed since the implementation of COVID-19 policies	
0	20 (19.8)
1-5	27 (26.7)
6-10	25 (24.8)
11-19	19 (18.8)
20-29	5 (5.0)
30-39	4 (4.0)
≥40	1 (1.0)
Redeployment	
Offered redeployment by the fellowship program	32 (31.7)
Redeployed to health care activities outside the scope of the fellowship	10 (9.9)
State	
New York	5 (5.0)
Massachusetts	3 (3.0)
Illinois	1 (1.0)
Minnesota	1 (1.0)
Redeployment area ^a	
Emergency department (nonorthopaedic)	3 (3.0)
Intensive care unit	3 (3.0)
COVID-19 medical ward	3 (3.0)
Non-COVID-19 medical ward	2 (2.0)
Surgical service (nonorthopaedic)	1 (1.0)
Overflow/surge/field hospital	3 (3.0)

^aSome respondents were involved in multiple efforts as a result of COVID-19 redeployment.

early, while 25 were presented with the possibility of having their fellowships extended.

Effects on Postfellowship Plans

At the beginning of their fellowships, 89 (88.1%) respondents reported that they anticipated transitioning into civilian or military practice, with 12 (11.9%) already enrolled in another fellowship for the following academic year. Immediately before the COVID-19 outbreak, 59 (58.4%) had signed a contract or letter of intent for an orthopaedic surgery position, while 30 (29.7%) were either interviewing or considering offers. The most commonly reported anticipated practice start date was between August 1 and October 31, 2020 (90.1%).

Since the outbreak, 8 respondents had their prior contract (n = 7) or job offer (n = 1) rescinded, while 1 had their signed contract voided. There were 10 respondents who reported that while their future employment was retained, their intended start date was being delayed by their employer. Of the 31 respondents whose original plans were

TABLE 3
Educational Event Participation by Fellows
During COVID-19 Pandemic

	n (%)
Web-based	100 (99.0) ^a
Fellowship-sponsored didactics	87 (86.1)
Industry-sponsored didactics	83 (82.2)
Journal club	72 (71.3)
Multi-institution didactics	54 (53.5)
In-person	21 (20.8) ^b
Laboratory	17 (16.8)
Journal club	4 (4.0)
Didactics	3 (3.0)
Other	5 (5.0)

^aSum of all respondents who selected at least 1 web-based learning choice.

^bSum of all respondents who selected at least 1 in-person learning choice.

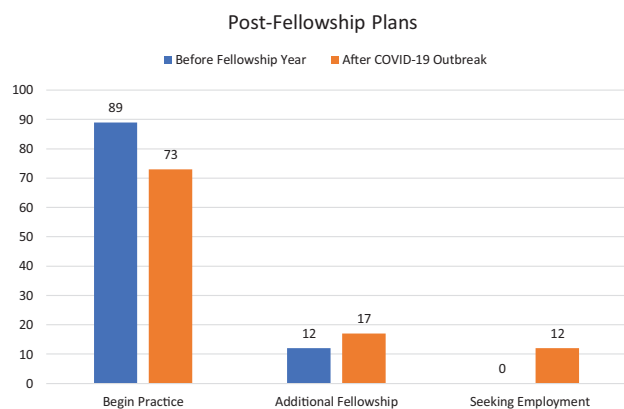


Figure 1. Respondents' anticipated postfellowship plans at different time points.

changed as a result of the pandemic, 13 anticipated that they would begin permanent employment upon completion of their fellowship, while 12 thought that they would still be seeking permanent employment. Also, 6 expected to matriculate into a previously unplanned fellowship or observership (Figure 1). The number of fellows whose anticipated practice start date was between August and October 2020 decreased to 76 as a result of the COVID-19 outbreak. Using the median date within each range, the mean delay in the practice start date for those whose employment was delayed, whether by their future employer or because of other unplanned events, was 127 days.

Psychological Impact

Most respondents either agreed ($n = 56$) or strongly agreed ($n = 32$) that their fellowship education had been negatively affected by COVID-19. However, only 23 agreed ($n = 17$) or strongly agreed ($n = 6$) that they had been experiencing doubts about their readiness to practice independently. Also, 60.4% of respondents either agreed ($n = 37$) or

strongly agreed ($n = 25$) that they were experiencing anxiety about their future career plans, with 45.5% reporting some level of anxiety about their financial situation. A total of 15 (14.9%) respondents reported that they have experienced signs of depression since the outbreak of COVID-19.

When comparing those respondents who reported that their postfellowship plans were affected by the COVID-19 pandemic with those whose plans were unchanged, the group whose plans were affected was more likely to agree with the statements that described a negative impact to their education, career plans, and social and mental well-being. This group was significantly more likely to be experiencing doubts about readiness for practice (58.8% vs 20.3%, respectively; $P = .005$), anxiety about future career plans (94.4% vs 63.8%, respectively; $P = .01$), anxiety about their financial situation (86.7% vs 50.8%, respectively; $P = .018$), stress in personal relationships (58.8% vs 29.9%, respectively; $P = .045$), and signs or symptoms of depression (41.2% vs 11.1%, respectively; $P = .007$) (Table 4).

DISCUSSION

The impact of the COVID-19 pandemic has been broad and far-reaching. With efforts to flatten the curve including social distancing and the suspension of elective surgery, there has been an immediate downstream effect on the education of orthopaedic sports medicine fellows.

The most obvious effect is the dramatic decrease in case volumes since the implementation of COVID-19 mitigation policies by health systems. Most fellows, who were performing, on average, 11 to 15 cases per week before the outbreak, saw their total cases decrease to fewer than 1 per week. Additionally, while many states began relaxing social distancing orders on May 1, and surgery centers began a phased resumption of elective procedures, some models have projected that it will take 7 to 16 months for case volumes to return to pre-COVID-19 levels.¹⁴

Of note, only 19.8% of fellows reported a complete suspension of surgical procedures, whereas 76.2% of respondents were still assisting in urgent or emergent cases, and another 4.0% reported performing elective surgery. In the AAOS tiered framework for triaging surgical procedures, outlining common orthopaedic procedures, most sports-related injuries were classified as "elective" or "urgent/somewhat elective," with a recommendation that these procedures still be performed, preferably in the outpatient setting if possible, to minimize the utilization of resources.¹³ These injuries included anterior cruciate ligament tears, locked menisci or bucket-handle meniscal tears, acute traumatic rotator cuff tears, biceps injuries, and most fractures best treated by an operative intervention. However, the classification of surgery as elective versus urgent or emergent was not provided with examples in our survey, with the interpretation left to the discretion of the respondent.

On March 13, 2020, the Accreditation Council for Graduate Medical Education (ACGME) released guidelines pertaining to disruptions to resident and fellow education as well as considerations for the redeployment of trainees for the treatment of COVID-19 patients.² A total of 32 fellows

TABLE 4
Impact of COVID-19 on Respondents' Beliefs and Mental Health^a

	Postfellowship Plans Affected		Postfellowship Plans Unchanged		P Value
	Disagree	Agree	Disagree	Agree	
Fellowship education negatively affected	0 (0.0)	17 (100.0)	5 (6.6)	71 (93.4)	.58
Having doubts about readiness to practice independently	7 (41.2)	10 (58.8)	51 (79.7)	13 (20.3)	.005 ^b
Experiencing anxiety about future career plans	1 (5.6)	17 (94.4)	25 (36.2)	44 (63.8)	.01 ^b
Experiencing anxiety about financial situation	2 (13.3)	13 (86.7)	32 (49.2)	33 (50.8)	.018 ^b
Increased stress in personal relationships	7 (41.2)	10 (58.8)	47 (70.1)	20 (29.9)	.045 ^b
Increased stress in professional relationships	12 (70.6)	5 (29.4)	55 (84.6)	10 (15.4)	.287
Experiencing signs/symptoms of depression	10 (58.8)	7 (41.2)	64 (88.9)	8 (11.1)	.007 ^b

^aValues are expressed as n (%). Respondents who selected "neutral" were excluded from this analysis.

^bStatistically significant result ($P < .05$).

were presented with the opportunity to be redeployed (either voluntary or mandatory) to assist in the care of COVID-19 patients or to other health care activities beyond the traditional scope of practice of their fellowships. There were 10 of these fellows who were mandatorily redeployed, with half involved in the direct care of COVID-19 patients.

Responding to the need for alternative methods to educate fellows outside of the clinical setting, many fellowship programs adopted previously underutilized resources to supplement fellowship education. Most notably was the emergence of web-based platforms as a vehicle to broadcast didactic lectures and host collaborative panel discussions. Nearly every fellow (99.0%) reported participating in web-based didactics (fellowship or industry sponsored). Traditional literature reviews (ie, journal clubs) saw a transition to web-based platforms for 71.3% of respondents. Additionally, 16.8% of fellows reported that their programs were able to run surgical skills laboratories to maintain some form of technical training. Plancher et al²⁰ and Stambough et al²⁷ have predicted that the future of postgraduate medical education will involve a greater utilization of web-based didactics and conferences in addition to virtual or augmented reality surgical skills laboratories, and this current pandemic may serve as the catalyst for mass adoption.^{3,4,5,11,12}

Of particular concern to the current fellowship class are the effects that this pandemic has had on the hiring of new surgeons. According to an April 2020 survey by the Medical Group Management Association, practices had seen a 55% decrease in revenue, on average, since the outbreak, with patient volumes down 60%.⁶ A significant number of practices in the orthopaedic sector have been forced to lay off or furlough employees to navigate the economic challenges posed by the pandemic. These challenges may make employers hesitant to invest in hiring young surgeons, who often require time to build their practice before they become profitable for their groups. Overall, 29.7% of respondents were still seeking employment before the outbreak. Regrettably, 9 fellows reported that their job offers were either rescinded or their contracts voided since the outbreak. Also, 6 fellows who originally anticipated beginning practice at the conclusion of their fellowship will now

spend the 2020-2021 academic year obtaining further training.

It still remains to be determined what effect that this will have on the fellowship graduation and board certification timeline for the 2020 fellowship class. The AOSSM, in a communication to fellowship programs, has asked fellowship directors to assess the competence of each individual fellow as 1 part of the determination of whether that person is prepared to enter the unsupervised practice of medicine. The ACGME, in a similar communication, has expressed support for those programs that find it necessary to extend the period of fellowship for some trainees.

While the American Board of Orthopaedic Surgery has made modifications for the 2021 Part II Oral Examination case list collection process to account for case volume disruptions,¹ there have thus far been no changes to the board certification timeline or process for the 2022 examination. According to current guidelines, "a Candidate must have started practice and been granted hospital admitting and surgical privileges on or before November 1 (2020) in order to qualify for the Part II examination two calendar years later (2022)."²⁴ Considering our calculation of an average 127-day delay in starting practice for those 31 respondents whose plans were changed as a result of COVID-19, nearly one third of 2020 fellows will not be on track to sit for the 2022 Part II Oral Examination, thus delaying their potential certification by a full calendar year.

Perhaps the most disturbing finding is the effect that this has had on the emotional well-being of our respondents. Overall, 87.1% of fellows felt that their education had been negatively affected, while 60.4% were experiencing anxiety about their future career plans. Those respondents whose postfellowship plans had been altered by the COVID-19 outbreak were more likely to have questioned their readiness for practice, experienced career and financial anxiety, suffered strained personal relationships, and experienced signs or symptoms of depression. Feelings of unpreparedness to begin clinical practice may not be a stressor unique to the times, negatively affecting physicians' mental health and possibly contributing to physician burnout. Regarding depression, while a 41.2% rate in this group falls within the range of 20.9% to 43.2% reported by Mata et al¹⁶ in their

systematic review and meta-analysis of the prevalence of depressive symptoms among surgical residents, when contrasted against only 11.1% of their colleagues whose plans were unchanged, this may highlight a disconcerting association.

A limitation of our study design, inherent to survey results, is respondent bias. Respondents who may have been more affected by the COVID-19 pandemic on both a professional and a personal level may have been more inclined to participate in our survey than nonrespondents. Furthermore, surveys dealing with sensitive topics may yield lower response rates, as demonstrated by Fan and Yan¹⁰ in a 2010 systematic review of factors affecting web-based survey response rates; questions pertaining to job loss, financial insecurity, and mental health may have deterred some fellows from responding. Additionally, the survey questions have not been validated for reproducibility and responsiveness. Our response rate of 48.1% is above the previously reported average of 35% for physician specialists,⁹ and given the very specific population of interest, method of distribution, and aggressive marketing campaign by the AOSSM, this may represent a best-case response rate. However, with more than half of current fellows abstaining, there is a nonresponse bias that may lead to an inaccurate representation of the landscape and feelings of the fellows in this class.

Another limitation due to the absence of any pre-pandemic baseline measurements was that our study was not designed to measure the magnitude of the effect that the COVID-19 pandemic had on the levels of career uncertainty, financial anxiety, or depression in the survey respondents. A study of 1257 doctors and nurses in China during that country's coronavirus peak found that half reported depression, 45% anxiety, and 34% insomnia.¹⁵ Extrapolating to the United States, it is certainly plausible, if not likely, with higher rates of domestic infections and mortality, along with Great Depression-era levels of economic contraction, that our study population would experience some heightened degree of anxiety and/or depressive symptoms from baseline. However, there was no a priori analysis to determine the number of respondents needed in the group whose plans were affected to be adequately powered that suggested such an association. Furthermore, by dichotomizing responses into "agree" and "disagree" categories, the psychological impact may be skewed toward those with feelings at the extremes of each sentiment. The inclusion of "neutral" respondents may have moved some associations away from statistical significance.

Moreover, our survey offers only a snapshot-in-time picture of the effects of the pandemic on this population. Unknown at this time is the effect that a second or third wave of cases will have on the country's health care system and future generations of surgical trainees. Longitudinal studies will need to be performed in the coming years to assess the true long-term effects of the pandemic.

Despite the limitations of our study design, these findings offer valuable insights on the impact of the COVID-19 pandemic on the current orthopaedic sports medicine fellowship class. This survey illustrates that during the early stages of the COVID-19 pandemic and the subsequent

suspension of elective surgery, there have been downstream effects to this group's education, careers, and potentially their social and/or emotional well-being. Furthermore, this crisis may act as a catalyst for us to consider the long-held practices within orthopaedic training, not only with regard to educational models and methods but also investigating the very reasons why residents elect to pursue sports medicine fellowships in the first place and whether residency programs have sufficiently prepared graduates not pursuing fellowships for competent, independent practice. Follow-up studies should be performed to assess the broader effects of this pandemic not only on this group of fellows but also on trainees at all levels as well as our industry as a whole.

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