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Original Research

The Impact of Coronavirus Disease 2019 Restrictions on an Academic Hand Surgery Practice

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Purpose: The impact of the severe acute respiratory syndrome coronavirus 2 (coronavirus disease 2019) has been felt worldwide. We examined the quantitative impact during the first 4 weeks of hospital system and state-mandated restrictions on an academic, urban hand surgery practice. We hypothesized that the volume of clinic encounters, office procedures, and surgical cases would decrease and that the volume of nonelective care would remain unchanged.

Methods: We retrospectively reviewed all encounters at a hand surgery practice from March 16, 2020, through April 12, 2020 and compared those to two 4-week control time periods. Weekly encounter volumes and work relative value units (RVUs) were obtained for clinic encounters, office procedures, and surgical cases. The type of ambulatory visit was also identified. Surgical cases were categorized into 4 types (fracture or dislocation, acute soft tissue or nerve injury, infection, or elective/nonurgent) for the most recent time periods. We performed *t* tests to compare weekly volumes and RVUs between time periods.

Results: After the implementation of mandated restrictions on elective health care, ambulatory hand surgery clinic encounters decreased 72% to 73%, clinic procedures decreased by 87% to 90%, and surgical cases decreased by 87% to 88%. The percentage of ambulatory visits performed via telemedicine increased from 0.06% to 74%. Similar impacts on RVUs were seen. Surgeries for fractures and dislocations declined by 58% and those for acute soft tissue or nerve injury declined by 40%; the number of surgical procedures for infection remained unchanged.

Conclusions: The coronavirus restrictions on elective healthcare led to an immediate, substantial impact on hand surgery practice. There were significant decreases in the volumes of ambulatory encounters, office procedures, and surgical cases. The long-term financial impact of this change in practice is still to be determined but, based on the quantitative impacts seen, is likely to be significant.

Type of study/level of evidence: Economic/Decision Analysis IV.

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The severe acute respiratory syndrome coronavirus 2 (coronavirus disease 2019 [COVID-19]) pandemic has created considerable strain on the United States health care system, as rapid disease transmission through a disease-naïve population has led to a public health crisis. In some areas of the country, the needs of the infected population exceed the normal capacity of the system to care for

these patients. Efforts have been made to decrease disease transmission by using “social distancing” and personal protective equipment (PPE). Other policies have attempted to increase available resources of ventilators, hospital beds, and personnel by decreasing their use in other areas: namely, elective health care. Federal and state regulatory authorities and professional societies have issued orders and offered guidance and recommendations in this domain.^{1–3}

On March 15, 2020, the Commonwealth of Massachusetts Department of Public Health issued an order that required the deferral of nonessential elective procedures as part of a governmental effort to address the COVID-19 pandemic.⁴ Some of the expected benefits of this policy were to limit the exposure of

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patients who would otherwise come to the hospital, to limit the exposure of health care workers to those patients, to preserve the supply of PPE, and to create hospital capacity in terms of physical resources and personnel in order to accommodate the expected increased need to treat patients infected with COVID-19. The state also mandated that insurers compensate providers for performing medically necessary telehealth visits, which had not been mandatory prior to that time.⁵

On the following day, March 16, 2020, our hospital system enacted the state policy and extended the restrictions to also include ambulatory clinic patient encounters and office procedures. Providers were required to immediately postpone nonurgent clinic visits and surgical procedures. Urgent clinic visits for issues which could not be addressed remotely by a video and/or audio visit were allowed. Urgent and emergent surgical procedures were not restricted. The guidelines allowed for individual practitioners to determine the urgency of ambulatory visits but required divisional or departmental review and approval of all surgical cases to ensure compliance.

The objective of this study was to determine the impact of these elective health care restrictions on an academic orthopedic hand surgery practice based at an urban, level 1 trauma center. Our practice incorporates most elements of orthopedic practice, including inpatient and outpatient surgery, a high volume of office visits, and office procedures for a combination of traumatic/urgent and elective diagnoses. We hypothesized that the overall volumes of ambulatory clinic encounters, office procedures, and surgical cases would dramatically decrease during this time and that the volume of nonelective care would remain unchanged.

Materials and Methods

This study was performed with institutional review board approval by the Partners Institutional Review Board and conducted under protocol #2010P002462. From our billing database, we retrospectively reviewed all patient encounters from the first 4 weeks postmandate (PostM; March 16, 2020, through April 12, 2020) for an academic orthopedic hand surgery practice. We similarly identified encounters from 2 control time periods: the 4 weeks immediately premandate (IPreM; February 17, 2020, through March 15, 2020) and the same dates 1 year prior to the PostM period (OYPreM; March 16, 2019, through April 12, 2019). The time frame of 4 weeks was chosen to have a uniform number of weekdays and weekends during the 3 study periods.

All ambulatory clinic visits and office procedures were included. We recorded surgical procedures based on Current Procedural Terminology codes and operative cases. Using information from institutional billing databases, the weekly and total encounter volumes and work relative value units (RVUs) were obtained. The numbers of providers in the ambulatory setting and for office and operating room procedures remained constant throughout all study periods.

The type of ambulatory visit was also recorded for the most recent 2 time periods. The types of visits were in-person, telephone or telemedicine, and video telemedicine. During the OYPreM time period, our group only performed in-person visits. Surgical cases for the IPreM and PostM time periods were categorized into 4 types: fracture or dislocation, acute soft tissue or nerve injury, infection, and elective/nonurgent. This allowed us to evaluate whether there were changes in the numbers and proportions of operative case types.

Descriptive statistics were calculated for volumes and RVUs during the study time periods. Comparisons of average weekly volumes and RVUs were performed using *t* tests. A convenience

sample was used. The standard significance criterion of an α of 0.05 was used.

Results

Ambulatory clinic encounters

During the 4-week time period PostM, 441 ambulatory clinic encounters were performed, compared with 1,623 during IPreM and 1,555 during OYPreM. The mean weekly ambulatory encounter volume was 110.2 during PostM, which constituted a 72% to 73% decrease from the mean weekly volumes of 405.8 during IPreM ($P = .0008$) and 388.8 during OYPreM ($P < .0001$; Fig. 1A). The mean weekly work RVUs also significantly decreased, from 384.5 during IPreM and 357.3 during OYPreM to 51.7 during PostM ($P = .0002$ and $P < .0001$, respectively; Fig. 1B).

The utilization of telemedicine as a modality for completing these visits increased dramatically. During the IPreM period, only 1 video telemedicine encounter and no telephone telemedicine encounters were performed out of 1,623 total encounters (0.06%). In the PostM period, telemedicine visits accounted for 74% of the visits (of which 39% were telephone and 61% were video; Table 1).

Office-based procedures

During PostM, 26 office procedures were performed, compared with 261 during IPreM and 195 during OYPreM. The mean weekly office procedure volume was 6.5 during PostM, a significant decrease by 87% to 90% from 65.2 during IPreM ($P < .0001$) and 48.8 during OYPreM ($P < .0001$; Fig. 2A). The mean weekly work RVUs also significantly decreased, from 61.1 during IPreM and 74.8 during OYPreM to 18.6 during PostM ($P < .0001$ for both; Fig. 2B).

Surgical procedures

During PostM, 40 surgical procedures (Current Procedural Terminology codes) were performed, compared to 339 during IPreM and 319 during OYPreM. The mean weekly surgical procedure volume decreased 87% to 88%, from 339 during IPreM ($P = .002$) and 319 during OYPreM ($P < .0001$) to 40 during PostM (Fig. 3A). The weekly volume of surgical cases (individual encounters) performed also showed a statistically significant decrease (Fig. 3B). The average weekly work RVU's significantly decreased, from 609.8 during IPreM and 586.7 during OYPreM to 97.7 during PostM ($P = .006$ and $P = .0004$, respectively; Fig. 3C).

The surgical case volume decreased week over week during the PostM time period, with 9 surgeries performed during the first week of restrictions on elective surgery and 2 surgeries performed in week 4 (Fig. 4).

The categorization of surgical cases was performed for the PostM and IPreM periods (Table 2). As elective surgery ceased, the mixture of case type changed to predominantly fractures and dislocations (58.3%, up from 16.8%). The total number of nonelective cases decreased by 47%. Cases for fractures and dislocations declined by 58% and cases for acute soft tissue or nerve injury declined by 40%; the total number of surgical procedures for infection remained unchanged.

Discussion

The severe acute respiratory syndrome coronavirus 2 (COVID-19) pandemic has had a global impact on health care. Within the United States, both government bodies and health care institutions have worked to rapidly adapt to meet the current and anticipated health care needs of their local communities and also to decrease

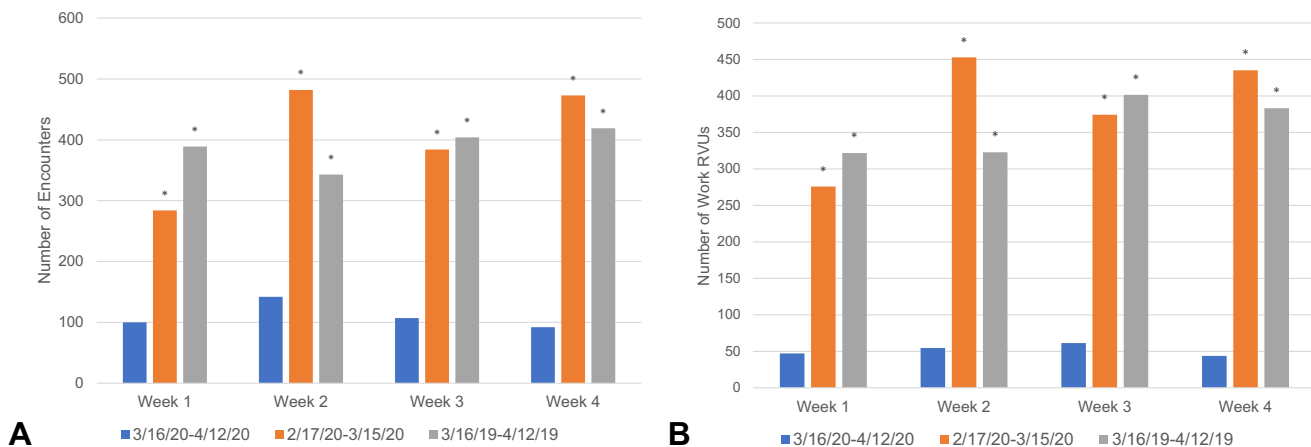


Figure 1. A Weekly ambulatory clinic encounter volume. B Weekly ambulatory clinic encounter work RVUs. *Denotes significance $P < .0001$.

Table 1
Categorization of Ambulatory Clinic Encounters

Encounter Category	2/17/20–3/15/20 (IPreM)	3/16/20–4/12/20 (PostM)
In-person encounter	1,622	113
Telephone telemedicine encounter	0	127
Video telemedicine encounter	1	201
Total	1,623	441

disease transmission. Limiting the spread of disease has centered around social distancing and the use of PPE.^{6–8} As part of this fluid process, state and federal agencies have variably issued recommendations and orders to limit elective surgical procedures.^{4,5,9,10} Professional societies have also published guidelines to aid in this process.^{2,3} Decreasing elective health care allows for fewer interactions between patients and providers and limits the patient “traffic” within hospital systems to only patients being evaluated and treated for nonelective conditions. By not performing elective surgeries, the limited resources—such as PPE, ventilators, hospital beds, and personnel—can be preserved and reallocated to prepare for and care for the current and expected requirements of patients infected with COVID-19.

The Commonwealth of Massachusetts issued a guidance on March 15, 2020, which required the postponement of nonessential elective procedures as part of a state governmental effort to address the COVID-19 pandemic.⁴ Anticipating this mandate and simultaneously working to address these public health issues, on March 16, 2020, our health care system initiated the restriction on not only elective surgical procedures but also ambulatory clinic patient encounters and office procedures. Providers immediately deferred all nonelective encounters. Our telemedicine ambulatory clinic system, which had been available but was infrequently used, was rapidly expanded to all providers, aided by a state mandate requiring insurers to compensate for telephone and video health visits.⁵

Our study reveals the rapidity with which compliance was achieved. The ambulatory clinic visit volume decreased dramatically and the relative proportion of telemedicine visits increased from 0.06% to 74% of visits. In-person ambulatory encounters fell to 7% of IPreM levels and were used for patients with clinical issues that could not be addressed remotely by a video and/or audio telemedicine visit. We noted similar findings with office procedures.

Our compliance with the restriction on curtailing elective surgery was immediate and complete. No elective surgeries were

performed during the PostM time period. Close monitoring of the operative schedule by the institution, with divisional oversight and vetting of all booked cases, resulted in 100% compliance. In our practice, nonelective surgery accounted for 22.8% of cases during the IPreM period, but 100% of the cases during the PostM period. The absolute numbers of nonelective surgeries for fracture or dislocation and acute soft tissue and nerve injuries decreased by 55.3%. Interestingly, the number of surgeries for infection remained constant, with 7 cases seen in both in IPreM and PostM. There was a decreasing trend in the number of nonelective cases over the 4 weeks. This may be due to fewer injuries sustained, secondary to changes in behaviors necessitated by social distancing requirements and stay-at-home orders, which limit riskier activities such as driving and participation in sports. Alternatively, as has been a concern in other areas of medicine, patients may be delaying seeking care of these injuries due to concerns about the COVID-19 infection risk incurred by presenting for emergency care.¹¹ Lastly, this decrease may represent an increased surgeon and/or patient willingness to choose nonsurgical treatment of certain traumatic injuries during the COVID-19 outbreak. The number of surgical cases for infection was unchanged, suggesting that causes for infection were independent of the COVID-19 pandemic and patients were still seeking care for infectious concerns.

While the immediate financial impact due to lost revenue from deferred ambulatory visits, procedures, and surgical cases is notable to hand surgeons, these reductions may have a substantial longer-term effect on hand surgery practices and associated providers. Many practices and hospital systems have implemented cost reduction methods through furloughs, salary modifications, and benefit reductions.¹² The longer the restrictions on elective health care continue, the larger the fiscal impact will be, despite the incorporation of telemedicine encounters as an alternate method to conduct ambulatory encounters. The ultimate financial and other practice effects of COVID-19 are still unknown, but the lasting impact on hand surgery providers, practices, and patients will be substantial.

There are several limitations to this study. First, there are many explanations for volume variations in clinical encounters, office procedures, and surgical procedures, and the differences could be in part due to reasons other than COVID-19 restrictions. We attempted to address this by using 2 control time periods: the immediate 4 weeks prior to the COVID-19 restrictions on elective care and the same dates 1 year prior. Second, the patient population of our subspecialty practice may not be representative of the wider hand surgery patient population. Hand specialists in different

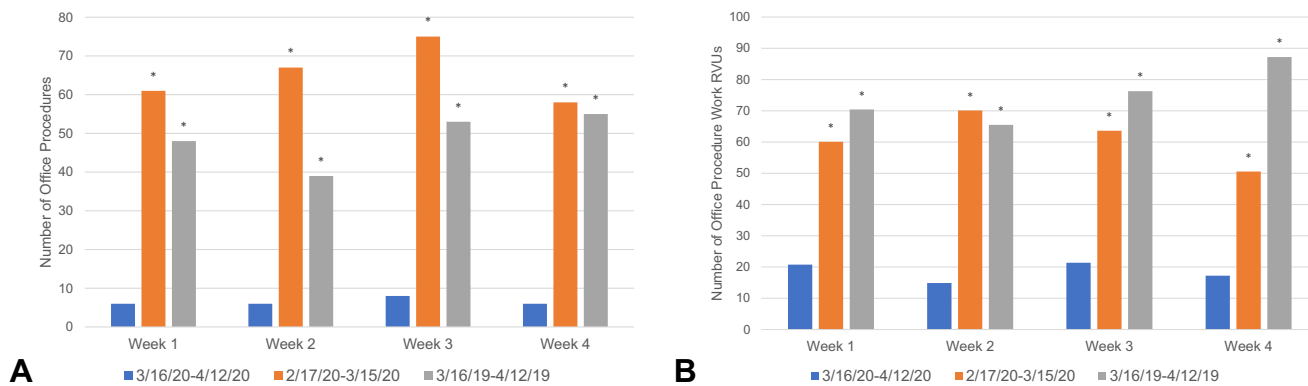


Figure 2. A Weekly office procedure volume. B Weekly office procedure work RVUs. *Denotes significance $P < .0001$.

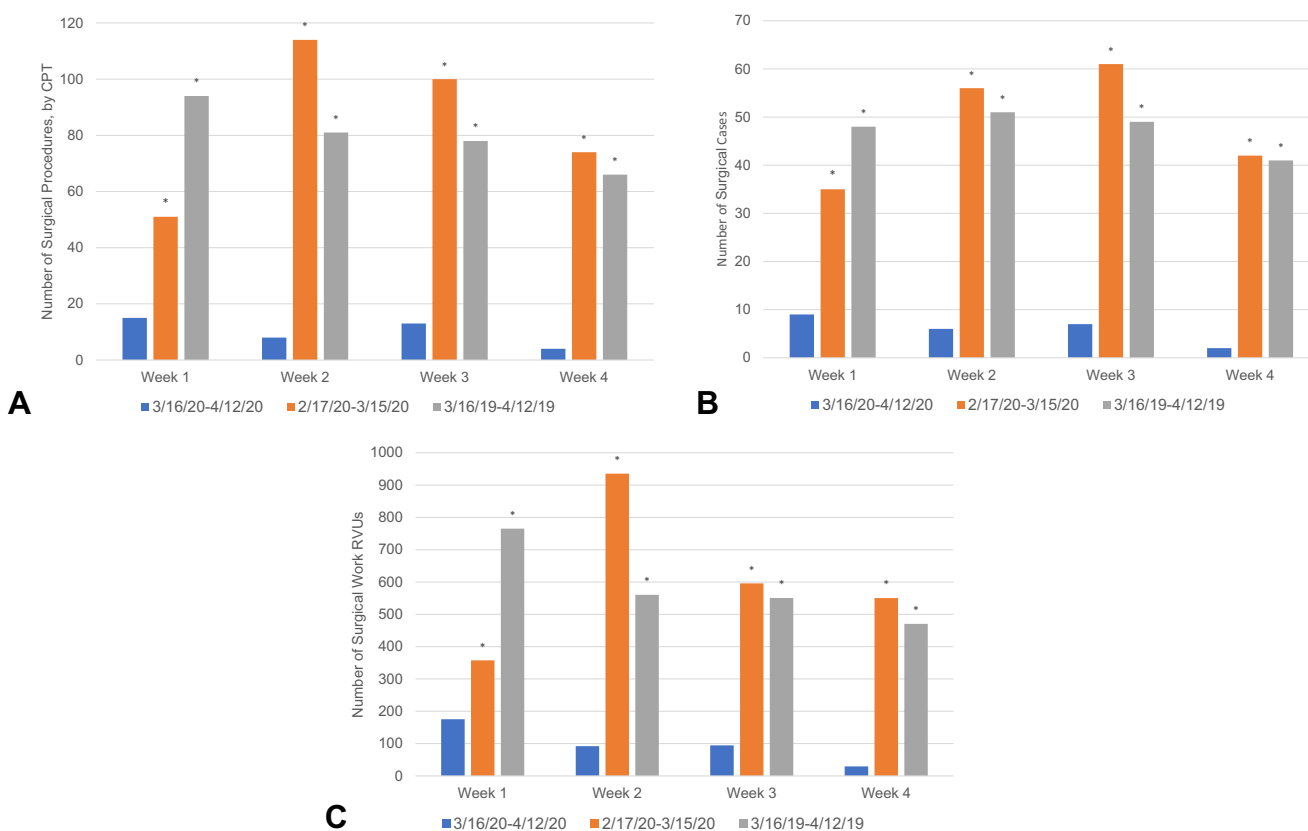


Figure 3. A Weekly surgical procedure volume by Current Procedural Terminology. B Weekly surgical case volume. C Weekly surgical work RVUs. *Denotes significance $P < .0001$.

practice settings may see a different mix of traumatic and elective diagnoses, which may have been affected differently by COVID-19. Third, our state’s regulatory mandates and hospital system’s response may be different from those in other areas of the country, leading to different practice effects. Fourth, with our limited data and time points, we cannot address the cause of the reduction in nonelective surgery. Finally, this study only evaluated the initial 4 weeks after COVID-19-related restrictions were enacted. Long-term effects, both on hospital system volumes and on patient outcomes, remain to be seen.

In conclusion, in a robust, academic orthopedic hand surgery practice, the impact of our health system’s response to COVID-19, including Massachusetts state-mandated restrictions on elective health care, was immediate and dramatic. Ambulatory clinic

encounters, office procedures, and surgical procedures and cases significantly decreased compared with 2 control time periods. Providers responded rapidly to increase the telemedicine opportunities to continue caring for their patients by telephone and video encounters. The nonelective surgical case volume also decreased by 47.7%, due to reductions in fractures and dislocations and in acute soft tissue and nerve injuries. The surgical case volume of infections was unchanged.

By deferring elective health care in Massachusetts in response to COVID-19, a statistically significant reduction in patient encounters for hand and upper extremity ambulatory clinics and surgeries was achieved, thus fulfilling the goals of decreasing the number of in-person interactions between patients and providers and reducing the associated needs for PPE, medications, equipment, and staffing.

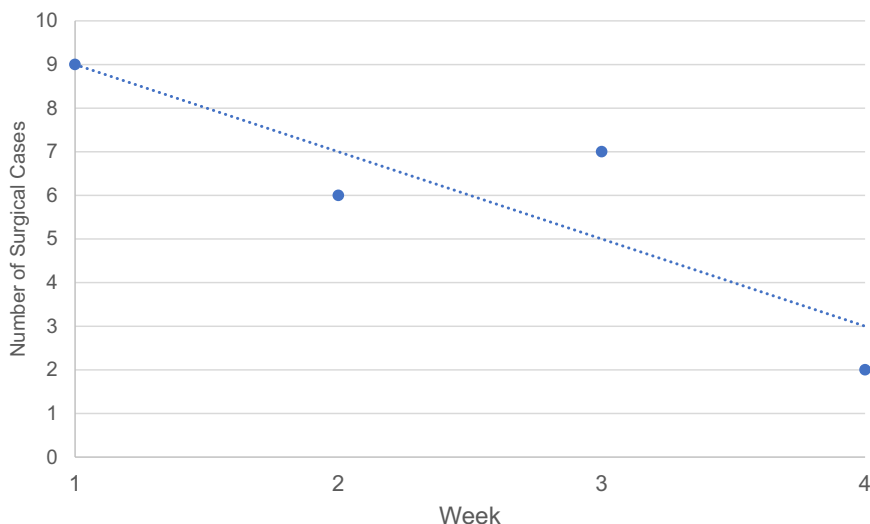


Figure 4. Surgical volume by cases per week during the PostM time period.

Table 2
Category of Surgical Cases During IPreM and PostM Time Periods

Category	2/17/20–3/15/20 (IPreM) n (%)	3/16/20–4/12/20 (PostM) n (%)
Fracture or dislocation	33 (16.8%)	14 (58.3%)
Acute soft tissue or nerve injury	5 (2.5%)	3 (12.5%)
Infection	7 (3.5%)	7 (29.2%)
Elective or nonurgent	152 (77.2%)	0 (0%)
Total	197	24

Longer-term effects on the patients, providers, departments, and the overall health care system are yet to be seen.

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