

## The Effects of COVID-19 on General Surgery Residency Programs in the United States

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### ABSTRACT

**Introduction.** The COVID-19 pandemic impacted multiple aspects of surgical education. This survey delineates steps taken by general surgery residency programs to meet changing patient-care needs while continuing to provide adequate education.

**Methods.** A survey was administered to program directors and coordinators of all United States general surgery residency programs to assess the early effects of the pandemic on residents from March 1 through May 31, 2020.

**Results.** Of 303 programs contacted, 132 (43.6%) completed the survey. Residents were asked to work in areas outside of their specialty at 27.3% of programs. Residency curriculum was changed in 35.6% of programs, and 76.5% of programs changed their academic conferences. Resident schedules were altered at a majority of programs to limit resident-patient exposure, increase ICU coverage, or improve resident utilization. Surgical caseloads decreased at 93.8% of programs; 31.8% of those programs reported concerns regarding residents' achieving the minimum case numbers required to graduate.

**Conclusions.** These results provided insight into the restructuring of general surgery residency programs during a pandemic and may be used to establish future pandemic response plans.

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### INTRODUCTION

The ongoing COVID-19 pandemic has posed a unique challenge for residency programs, impacting case volumes, duty hours, and a shift in resident responsibilities to meet patient care needs. Early in the pandemic, in a statement published to their website on March 13, 2020, the Accreditation Council for Graduate Medical Education (ACGME) stated that the standard work hour requirements still apply.<sup>1</sup> However, they also acknowledged that resident rotations may be affected as new patient care needs arise, and that these changes to the rotation schedules have the possibility of affecting Board eligibility. Later that month, the American Board of Surgery announced that it would accept a 10% decrease in both total cases and clinical time for graduating residents.<sup>2</sup>

To date, there have been over 643 million reported cases of COVID-19 with over 98 million cases in the U.S.,<sup>3</sup> which have affected the medical community in unprecedented ways. Concerns have been raised

by general surgery residents over the decline in operative volumes affecting their ability to meet ACGME graduation requirements, as well as the effect of the pandemic on their overall readiness to enter practice as attending physicians.<sup>4</sup> Additional concerns were raised over the possibility of contracting COVID and spreading the infection among their patients, families, and colleagues.<sup>5</sup> A review of case logs from 16 residency programs from 2017-2020 confirmed a decline in operative experience across all PGY years during the first four months of the pandemic.<sup>6</sup>

Though many individual residency programs have reported on their strategies for adapting their programs during this time period,<sup>7-10</sup> to our knowledge there has been one published nationwide survey study of surgical program directors.<sup>11</sup> Similarly, we present here the results of a survey of general surgery residency programs throughout the U.S., detailing the response of residency programs during the early weeks of the pandemic. The purpose of this study was to explore the efforts required of general surgery programs to meet patient-care needs while continuing to provide surgical education, taking into account program characteristics, the burden of COVID-19 at the program-affiliated hospitals, and the impact of COVID-19 on resident education.

### METHODS

A 21-question survey was constructed with questions assessing the demographics of each program, burden of COVID on each hospital, resident participation in the care of COVID patients, and changes made to resident education. Questions were designed with the intention of obtaining a comprehensive picture of how the pandemic has affected surgery residents, and specifically solicited information regarding the March 1 through May 31, 2020, date range.

ACGME-accredited general surgery residency programs in the U.S. were identified by the FREIDA Residency Database provided by the American Medical Association. A total of 303 programs were identified with contact information readily available. Program coordinators and directors initially were contacted by email in March-April of 2021. After three contact attempts were made via email spaced two weeks apart, 35 programs had completed the survey. Given the low response rate, communication was switched to telephone contact. Program coordinators and directors were contacted by phone and invited to participate in the study. Three phone calls were made to each program before the contact attempt was abandoned. Calls were made from September through December of 2021. Programs that chose to participate were given the option to either complete the survey over the phone with a study author or to complete the survey via the GoogleForms platform. This survey study received exemption from our hospital's Institutional Review Board.

Survey responses collected from participating programs were de-identified before analysis. All survey responses were included in the data analysis. Categorical and quantitative data were coded into categories and presented as frequencies and percentages. Quantitative data were summarized and presented as medians and interquartile ranges for non-parametric data or means and standard deviations for parametric data.

### RESULTS

**Program Demographics.** Of the 303 programs that were generated from the FREIDA database, 132 were willing to participate in our

survey, for a participation rate of 43.6%. Demographics of the responding programs are listed in Table 1. There was a relatively similar number among respondents from academic (38.6%), hybrid (31.1%), and community (28.0%) programs. The majority of programs surveyed (61.4%) represented five-year programs, without extra years dedicated to research. The median number of residents per program was 26.

**Table 1. Residency program characteristics.**

Parameter	Value
Number of respondents	100% (132)
Program type	
Academic	38.6% (51)
Hybrid	31.1% (41)
Community medical center	28.0% (37)
Military	0.8% (1)
Government hospital/county hospital	0.8% (1)
No response	0.8% (1)
Median number of residents per program	26 (18.3-35.0)
Residency has years dedicated to research	
Yes	37.9% (50)
No	61.4% (81)
No response	0.8% (1)

\*Presented as % (n) or median (IQR). ministrat

**Respondents' COVID-Specific Demographics.** COVID-specific demographics of participating programs are listed in Table 2. Only 7.6% of respondents said that they had residents who travelled to endemic areas within the first two months of the pandemic, and about half of those programs required their residents to quarantine for a period of time before returning to work. Of the respondents who reported on their hospital's COVID census, the majority reported over 150 in-patients (65.9%); however, 27.3% of programs did not disclose this information. To assist in caring for these patients, residents were asked to work in areas outside their specialty in 36 (27.3%) of the responding programs. Twenty-nine of those programs had residents working in a Critical Care Unit. Nine programs had residents working in Internal Medicine units. Four programs placed residents in the Emergency Department. Two programs placed residents in a Pulmonary unit. One program each reported placing residents in Trauma, Nephrology, specially-created wards, and the line team. Additionally, two programs reported being asked to cover the Medical intensive care unit but declined to do so.

Ninety-six programs (72.7%) reported having one or more residents test positive for COVID during the study time period (Table 3). Only 40.9% of programs reported a change in the amount of resident-patient contact when compared to the time prior to the pandemic, with the majority of this subset of programs (88.9%) reporting a decrease in resident-patient contact. However, 81.8% of the responding programs reported that residents routinely cared for COVID-positive patients.

**Table 2. COVID specific demographics.**

Parameter	Value
Residents travel to endemic areas (1/1-3/1/20)	
No	71.2% (94)
Unsure	21.2% (28)
Yes	7.6% (10)
Required to quarantine before returning to work.	60.0% (6/10)
Quarantine length (days)	9.3 ± 5.4
Number of COVID-19 patients treated at hospital	
26-50	1.5% (2)
51-75	2.3% (3)
76-100	0.8% (1)
101-125	2.3% (3)
151+	65.9% (87)
No response	27.3% (36)
Residents or attendings asked to work in areas outside of their specialty.	
Yes	27.3% (36)
No	71.2% (94)
No response	1.5% (2)

\*Presented as % (n) or mean ± standard deviation.

**Table 3. Impact of COVID on residents.**

Parameter	Percent (n)
Resident(s) tested positive during pandemic	
Yes	72.7% (96)
No	22.7% (30)
No response	4.5% (6)
Amount of resident-patient contact changed	
No	56.8% (75)
Unsure	2.3% (3)
Yes	40.9% (54)
Resident-patient contact	
Increased	11.1% (6)
Decreased	88.9% (48)
Residents routinely cared for COVID-19 patients	
Yes	81.8% (108)
No	15.2% (20)
No response	3.0% (4)

Responding programs were asked why their residents may or may not have cared for COVID-positive patients (Figure 1). Residents caring for COVID patients occurred for routine care, due to staffing needs, in the settings of resident redeployment strategies, and being consulted to perform procedures. Programs whose residents did not participate in the care of COVID patients cited lack of need, residency policy, and conservation of personal protective equipment as reasons for not involving residents in COVID-positive patient care.

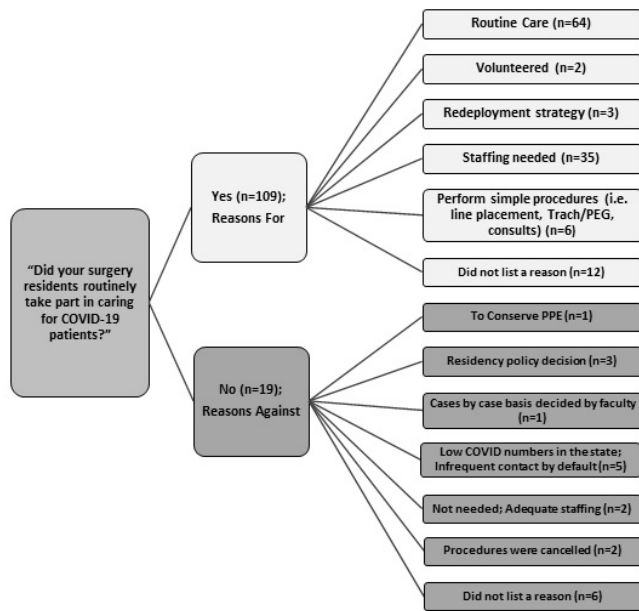


Figure 1. Diagrammatic depiction of reasons for or against residents participating in the care of COVID-19 patients, as reported by General Surgery residency programs. Results are reported as n for the number of programs reporting each reason.

The majority of respondents (95.5%) were able to provide their residents with N95 masks with varying degrees of frequency (Table 4). Just 16.7% of these residents were provided a new N95 for each use, while 21.2% received a new mask each shift, 19.7% were given N95s that were sanitized between shifts, and 27.3% of respondents had their residents reuse their N95 mask for multiple shifts without sanitizing. Other PPE, such as gowns and face shields, were readily available to the overwhelming majority of respondents.

**Table 4. COVID-19 impact on accessibility of personal protective equipment.**

Parameter	Percent (n)
Residents were provided with N95 masks.	
Yes	95.5% (126)
No	1.5% (2)
No response	3.0% (4)
Frequency N95 masks were provided to residents.	
A new N95 mask for each individual use.	16.7% (22)
A new N95 mask each shift but reused the mask throughout that shift.	21.2% (28)
An N95 mask which was sanitized between shifts.	19.7% (26)
Instructed to reuse their N95 mask for more than one shift.	27.3% (36)
Not provided with N95 masks.	1.5% (2)
No response	13.6% (18)
Access to other PPE (i.e. gowns, face shields)	
Yes	97.7% (129)
No response	2.3% (3)

**COVID-19 Impact on Curriculum and Schedule.** Another way in which residency programs changed as a result of COVID was through their curriculum (Table 5). About one-third of responding programs (35.6%) reported that their curriculum had changed in some way as a result of COVID. Major categories of curriculum impact included conference frequency and format, educational material, system changes, coping help, and schedule changes (Figure 2).

**Table 5. COVID-19 impact on curriculum and schedule.**

Parameter	Percent (n)
Residency curriculum has changed.	
Yes	35.6% (47)
No	63.6% (84)
No response	0.8% (1)
The program has incorporated further epidemiologic education beyond the scope of COVID-19 into the curriculum.	
Yes	24.2% (32)
No	68.9% (91)
No response	6.8% (9)
The program has plans to incorporate further epidemiological education into future curriculums.	
Yes	26.5% (35)
No	67.4% (89)
No response	6.1% (8)
Morbidity and Mortality (M&M) and other academic conferences have changed.	
Yes	76.5% (101)
No	22.7% (30)
No response	0.8% (1)
Changes were made to the surgery residents' schedules.	
Yes	81.1% (107)
No	16.7% (22)
No response	2.3% (3)
Accommodations have been made for surgery residents.	
Yes	80.3% (106)
No	17.4% (23)
No response	2.3% (3)
Living accommodations were provided to surgery residents so as to allow self-quarantining away from their current residence/family.	
Yes	36.4% (48)
No	62.9% (83)
No response	0.8% (1)

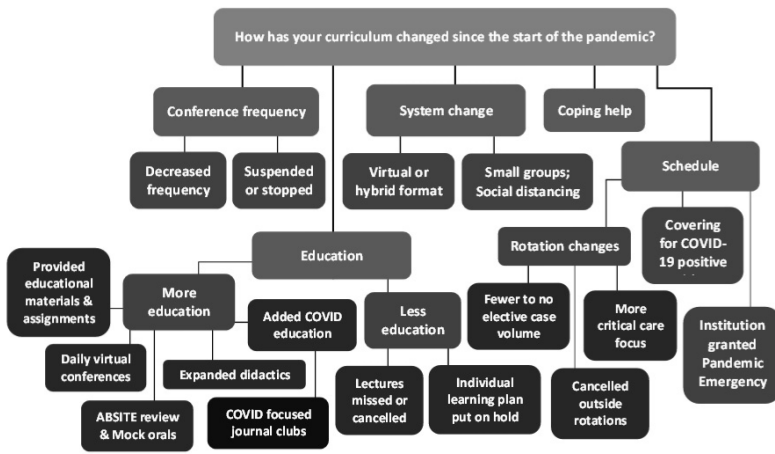


Figure 2. Diagrammatic depiction of curriculum changes reported by General Surgery residency programs, divided into categories and related subcategories.

About one-quarter of respondents (24.2%) reported already having incorporated epidemiologic education into the curriculum at the time of this survey, with 26.5% of programs reporting plans to incorporate further epidemiologic education in the future (Table 5). While 63.6% of programs had reported not changing their curriculum, 76.5% did report a change in their Morbidity and Mortality conference or other academic conferences. Additionally, 81.1% of respondents reported changes to the residents' schedules. The schedules were altered in a variety of ways (Figure 3). Many programs altered the schedules with the goals of limiting resident-patient exposure, increasing ICU coverage, or improving resident utilization.

Given the widespread schedule and curriculum changes faced by surgery residents, 80.3% of responding programs saw fit to provide certain accommodations to their residents (Table 5, Figure 4). About one-third of programs (36.4%) went so far as to provide living accommodations for their residents to allow for quarantining away from their families and other residents (Table 5). In addition to housing, other accommodations included revised leave policies, access to COVID testing, wellness programs, and workplace adjustments to allow for social distancing.

**COVID-19 Impact on Graduation Requirements.** In addition to impacting the schedule and curriculum of residents during the immediate timeframe, the COVID-19 pandemic also posed a challenge to the residents' ability to fulfill graduation requirements. The majority of programs (84.8%) reported that surgical caseloads had changed as a result of COVID-19, with 93.8% of those programs reporting a decrease in caseloads (Table 6). However, only 31.8% of programs reported that the residents' ability to achieve the required case numbers had been affected. While the majority of programs reported that no residents had dropped out of their programs due to COVID-19, one program did report losing a resident who dropped out after themselves or a family member were exposed to COVID-19 while traveling abroad.

SCHEDULING CHANGE CATEGORIES	SCHEDULING CHANGE SPECIFICS
Limited Patient Exposure (n=77)	Platooning; Cohorting strategy; Put in groups/teams; combined surgery resident groups
	Rotating basis
	Skeleton crew
	Clinic visits were curtailed/canceled
	Changed schedules so that fewer residents & faculty were in the hospital
	Reduced days in hospital
	Decreased call, call schedule lightened
	Consolidated some services/rotations for combined coverage
	Half duty
	No 24hr call for juniors during height of pandemic
	Increased educational/ research /administrative tasks; permitted to do educational things on some services
	More shifts; More shift work
Canceled (n=22)	Outside rotations

Figure 3. Specific scheduling changes reported by general surgery residency programs, grouped into overall categories.

ACCOMMODATIONS MADE FOR RESIDENTS DURING THE COVID-19 PANDEMIC	
COVID-19 Positive	Policy
<ul style="list-style-type: none"> <li>Made to quarantine if COVID positive, suspected positive, experiencing symptoms, caring for COVID positive family members or after travel</li> <li>Used a specific COVID leave rather than taking personal time</li> <li>Extended sick leave; sick leave utilized</li> <li>Didn't have to make up for lost time due to being COVID positive</li> <li>Schedule changes; "residents were placed on like a "jeopardy-like" call format to cover if residents were out. Residents in their research years would serve as back up"; emergency rotation</li> <li>Hotel/housing provided if the resident wanted to quarantine away from family; 8th floor available for quarantine</li> <li>Required 1-2 negative tests to go back to work</li> <li>Had to see employee health if sick &amp; had to be cleared by employee health before going back to work</li> <li>Additional research time and educational online activities during quarantine were provided so residents didn't have to lose hours</li> </ul>	<ul style="list-style-type: none"> <li>Differing policies between department of surgery and the university</li> <li>Furlough pay</li> <li>Frequent testing; mandatory testing</li> <li>Policy adjustments for time missed &amp; housing</li> <li>Adjustments made for social distancing (added computers)</li> </ul>
	<b>Distance From The Hospital</b> <ul style="list-style-type: none"> <li>"Home call"</li> <li>Mandatory time off</li> <li>Minimum "manning" tried to reduce resident exposure; schedules changes; increased rest periods and more days off when possible; "skeleton crew"</li> </ul>
	<b>Wellness</b> <ul style="list-style-type: none"> <li>Increased wellness programs; wellness days</li> <li>Provided a place for constant debriefs</li> <li>Able to be taken off service and go home for being particularly stressed or fatigued</li> <li>Recommended to stay home if sick from something other than COVID-19</li> <li>Had help in the hospital from other programs</li> <li>Daily food provided or provided if needed; including food delivery</li> </ul>
	<ul style="list-style-type: none"> <li>Telemedicine</li> <li>Hotel provided if residents didn't want to expose family; paid for taxis if residents were too tired to drive; call rooms for sleep</li> <li>Virtual academics</li> </ul>

Figure 4. List of accommodations provided to residents by residency programs, grouped into categories related to COVID-19 positive residents, wellness, policy, and distance from the hospital.

**Table 6. COVID-19 impact on graduation requirements.**

Parameter	Percent (n)
Surgical caseloads have changed as a result of COVID-19 or related restrictions placed on the hospitals.	
Yes	84.8% (112)
No	9.8% (13)
No response	5.3% (7)
Surgical caseloads have...	
Increased	5.4% (6)
Decreased	93.8% (105)
No response	0.9% (1)
The surgery residents' ability to achieve their required case numbers has been affected negatively by reduced caseloads related to COVID-19.	
Yes	31.8% (42)
No	67.4% (89)
No response	0.8% (1)
Surgery residents have dropped out of the residency program for reasons related to the COVID-19 pandemic.	
Yes	0.8% (1)
No	98.5% (130)
No response	0.8% (1)

## DISCUSSION

Based on the demographics of responding programs, our data seem to approximate a representative sample of general surgery residencies throughout the U.S. and likely give an accurate view of the responses of residency programs during this particular time period. However, as the burden of COVID-19 in specific geographic regions and individual hospitals changed throughout the pandemic, programs presumably continued to adapt their curriculum and patient care responsibilities. Therefore, survey responses likely would have changed based on the time period of interest. This survey was meant to gauge the initial response of residency programs in the early days of the pandemic and could act as a template for programs in the event of additional pandemics of similar or other causes in the future.

The response of many residency programs to the pandemic was similar, to alter patient-care responsibilities to minimize resident exposure to COVID while adopting a virtual format for educational activities. A popular strategy reported both by our respondents and throughout the literature is the concept of platooning, in which residents are split into cohorts to minimize the number of residents at the hospital at any given time. This not only served to minimize resident exposure to patients, but also limited transmission of COVID between residents. Nearly 73% of participating programs had at least one resident test positive for COVID during the time period in question. This number presumably would have been higher had programs not altered their infrastructure, however, it is impossible to know for certain.

Many of the strategies reported by survey respondents have been described anecdotally in greater detail in publications from individual

programs. One program in New York City detailed the restructuring of their residents into two services with teams alternating weekly, stating how they relied upon the off-service residents when others were forced to quarantine after COVID exposure.<sup>7</sup> Additional reports from that program of transition to web-based educational conferences were also similar to what was reported by our respondents. Another program in Florida reported reducing their resident coverage by 50%, also with consolidated teams that alternated weeks.<sup>10</sup> In a similar survey study, program directors reported that the proportion of residents working in-hospital on a typical day dropped from 82.4% to 42.7% during the early months of the pandemic.<sup>11</sup> This drop was due to assignment of residents to only essential services and restructuring schedules such that residents were frequently able to be away from the hospitals.

Our data corroborated existing literature regarding changes to educational structure. White et al.<sup>11</sup> reported, from their program director survey, the cancellation of in-person didactics and the addition of virtual didactics and grand rounds. One New York program reported conversion of education conferences to an online format, as well as utilization of virtual grand rounds conferences as a time to present COVID-related updates and studies.<sup>8</sup> A survey of general surgery residents reported that 80% of respondents reported didactics being completely virtual, and 41.3% reported an increase in didactic content during the pandemic.<sup>4</sup> Our survey added to this information by finding that 26.5% of programs plan to incorporate epidemiologic education in the future, while 24.2% already had incorporated such topics into their curriculum.

We did not ask how quickly changes were made in each program, whether programs were restructured multiple times before settling on one strategy, or how programs determined it was safe to return to their usual rotations. Additionally, we did not ask whether any programs already had a plan in place that they were able to enact for such situations, rather than formulating a plan from scratch. In the event of a future pandemic, perhaps the strategies reported here can be employed again quickly, or perhaps programs will be encouraged to formulate a pandemic response plan that will allow for swift restructuring of a program. Future studies may explore whether virtual meeting platforms adopted for social distancing remain in use even after the height of the pandemic. Such virtual platforms seem to have become a mainstay of modern society and would be easy to utilize again in future pandemics.

Our data indicated that the majority of programs saw a decrease in their overall case numbers in the early months of the pandemic, likely due in part to the suspension of elective surgeries in many hospitals. Similarly, in a survey of general surgery residents, residents reported a significant decline in the number of operative cases performed per resident per week, with 42.3% of those residents concerned that they would not meet the ACGME's case requirements for graduation.<sup>4</sup> In contrast, only 31.8% of respondents to our survey reported that their residents' ability to achieve their required case numbers was affected by COVID. One other study presented data showing that residents from 16 programs experienced a significant decline in operative volume over the first four months of the pandemic.<sup>6</sup> It was unclear from our survey whether there was a compensatory increase in case numbers later in the pandemic when elective cases were able to be performed again. Future studies may explore graduates' perception of their surgical abili-

ties in their first years as an attending compared to that of graduates who did not train during the pandemic. Additionally, future surveys could explore both the case numbers and perceived competency in areas such as Critical Care that may have been impacted positively by the pandemic.

**Limitations.** Limitations of this study included recall bias. As this survey was conducted via email and telephone, respondents may have provided answers based on their personal recollection of events rather than based on objective data. Our survey only captured information regarding the March-May 2020 timeframe. As the pandemic extended well beyond this, it is conceivable that programs may have employed unique restructuring strategies after this timeframe that were not captured by our survey. Additionally, while 43% of programs responded, our overall findings may have been different if this response rate had been higher.

## CONCLUSIONS

The information provided by this survey was helpful in understanding the strategies utilized by general surgery residency programs to restructure their patient care and curriculum in the early months of the pandemic and was largely supportive of the existing literature. These findings potentially may be used by residency programs to establish plans to be prepared in the event of future pandemics. Additional information needs to be collected to understand the full spectrum of changes necessitated by the pandemic, as well as how these changes have impacted graduating residents.

## REFERENCES

- <sup>1</sup> Accreditation Council for Graduate Medical Education. ACGME Resident/Fellow Education and Training Considerations related to Coronavirus (COVID-19). March 13, 2020. <https://www.acgme.org/newsroom/2020/3/acgme-residentfellow-education-and-training-considerations-related-to-coronavirus-covid-19/>. Accessed December 6, 2022.
- <sup>2</sup> American Board of Surgery. Modifications to Training Requirements. March 26, 2020. [http://www.absurgery.org/default.jsp?news\\_covid19\\_trainingreq](http://www.absurgery.org/default.jsp?news_covid19_trainingreq). Accessed December 6, 2022.
- <sup>3</sup> Johns Hopkins University. COVID-19 Dashboard. <https://coronavirus.jhu.edu/map.html>. Accessed December 6, 2022.
- <sup>4</sup> Aziz H, James T, Remulla D, et al. Effect of COVID-19 on surgical training across the United States: A national survey of general surgery residents. *J Surg Educ* 2021; 78(2):431-439. PMID: 32798154.
- <sup>5</sup> He K, Stolarski A, Whang E, Kristo G. Addressing general surgery residents' concerns in the early phase of the COVID-19 pandemic. *J Surg Educ* 2020; 77(4):735-738. PMID: 32354684.
- <sup>6</sup> Purdy AC, de Virgilio C, Kaji AH, et al. Factors associated with general surgery residents' operative experience during the COVID-19 pandemic. *JAMA Surg* 2021; 156(8):767-774. PMID: 33929493.
- <sup>7</sup> Juprasert JM, Gray KD, Moore MD, et al. Restructuring of a general surgery residency program in an epicenter of the coronavirus disease 2019 pandemic: Lessons from New York City. *JAMA Surg* 2020; 155(9):870-875. PMID: 32936281.
- <sup>8</sup> Nobel TB, Marin M, Divino CM. Lessons in flexibility from a general surgery program at the epicenter of the pandemic in New York City. *Surgery* 2020; 168(1):11-13. PMID: 32473830.
- <sup>9</sup> Nassar AH, Zern NK, McIntyre LK, et al. Emergency restructuring of a general surgery residency program during the coronavirus disease 2019 pandemic: The University of Washington experience. *JAMA Surg* 2020; 155(7):624-627. PMID: 32250417.
- <sup>10</sup> Meneses E, McKenney M, Elkbuli A. Reforming our general surgery residency program at an urban level 1 Trauma Center during the COVID-19 pandemic: Towards maintaining resident safety and wellbeing. *Am J Surg* 2020; 220(4):847-849. PMID: 32586630.
- <sup>11</sup> White EM, Shaughnessy MP, Esposito AC, Slade MD, Korah M, Yoo PS. Surgical education in the time of COVID: Understanding the early response of surgical training programs to the novel coronavirus pandemic. *J Surg Educ* 2021; 78(2):412-421. PMID: 32768380.

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