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Case-controlled Study

The impact of coronavirus 2019 on general surgery residency: A national survey of program directors

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\textbf{ARTICLE INFO}

Keywords:
Coronavirus 2019
Graduate medical education
Surgical education
Virtual learning

\textbf{ABSTRACT}

Background: Coronavirus disease 2019 (COVID-19) has had a widespread impact on graduate medical education. This survey aims to assess how general surgery residency programs adapted to the initial wave of the COVID-19 pandemic in the United States (US).

Materials and methods: General surgery program directors (PDs) in the US were invited to partake in a 16-question survey between April 17 and May 1, 2020. The survey included questions about basic program information, clinical practice changes, changes to education structure, surgery resident clinical duties, and perceived impact on resident operative experience and future career choices.

Results: Forty-eight PDs completed the survey in the designated two-week period. Almost all (44/48, 91.7%) programs changed their didactic education to an online video conference-based format. Thirteen programs (27.1%) decreased the amount/frequency of formal education, and 13 (27.1%) reported canceling didactic education for some period of time. The majority of PDs (26/48, 54.2%) felt these changes had no impact on resident didactic participation, 14 (29.2%) reported an increase in participation, and 8 (16.7%) reported decreased participation. Ten programs (20.8%) redeployed residents to non-surgical services at the time of this survey, 30 (62.5%) have not redeployed residents but plan to if needed, and 8 (16.7%) did not have any plans to redeploy residents.

Conclusions: The outbreak of COVID-19 has required general surgery residency PDs to change numerous aspects of resident education and clinical roles. Future inquiry is needed to assess if these changes lead to appreciable differences in resident preparedness and career selection.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has dramatically altered the world of healthcare and has had a particularly profound impact on the field of surgery. The widespread postponement of elective operations was aimed to minimize nosocomial spread and shift resources and personnel towards areas in dire need of support to combat this virus [1]. While necessary, this has had a significant impact on surgical residents’ education in various specialties. COVID-19’s strain on the healthcare system has required some surgical trainees to be reassigned to non-surgical services and have modified schedules to accommodate the low surgical volume. This disruption has been exacerbated by fewer opportunities to learn the technical and cerebral skills of surgery [2–6].

General surgery residency program leadership has been placed in an incredibly challenging position, accommodating the growing and complex needs of patient care in a pandemic while simultaneously educating future surgeons. Currently, the data available regarding the impact of COVID-19 on general surgery residency has come from trainees themselves [2,3]. In this analysis, we surveyed general surgery program
directors (PDs) to better understand how the COVID-19 pandemic impacted general surgery residency programs’ clinical and educational experience.

2. Methods

This study was approved by the Institutional Review Board of the University of Pittsburgh and has been submitted in line with the STROCSS criteria [7]. This study has been registered in the research registry (Unique Identifying Number: researchregistry6716), which can be viewed here.

General surgery PDs were identified using the Accreditation Council for Graduate Medical Education (ACGME) website and were sent an email invitation to complete the survey between April 17 and May 1, 2020. In the following two weeks, two reminder emails were sent to encourage completion of the survey. There was no incentive offered for the completion of the survey. All PDs took the survey voluntarily, and survey analysis included no identifying information. Only completed surveys were included in this analysis.

The survey consisted of 16 questions in total. The first three questions were about the program’s general characteristics (e.g., academic vs. community, size of the program). The remaining 13 questions were aimed to address any changes in resident schedule, education, and clinical assignments as a result of the COVID-19 pandemic. The survey was distributed internally to 5 faculty at our home institution to ensure clarity of the survey prompts and answers. The complete survey questionnaire can be found in the supplemental table. The survey was delivered using a secure electronic survey instrument via a validated commercial platform (Qualtrics, Raleigh, NC).

Data from the completed surveys were reported as number (%) for categorical variables and median (range) for continuous variables. No sub-analysis was performed due to the limited responses in the individual survey categories.

3. Results

3.1. Program and institutional characteristics

Three hundred and twenty general surgery PDs were emailed an invitation to complete the survey. Forty-eight (15.0%) PDs completed the survey in the designated two-week period. The respondents included programs in all regions of the continental United States. The type of medical center and geographic location of the programs are summarized in Fig. 1.

Institutional changes implemented to accommodate for the COVID-19 pandemic are summarized in Fig. 2. Starting in the week of March 1st-7th, PDs reported limiting elective/non-urgent procedures, and by March 22nd-28th, all PDs reported limiting or delaying elective non-urgent procedures. The highest ACGME stage was stage I for 4 programs (8.5%), stage II for 28 programs (59.6%), and stage III for 15 programs (31.9%).

3.2. Changes to resident education and clinical assignments

All programs implemented some change to their didactic education format in response to COVID-19 (Fig. 3). When asked how these changes affected resident participation in didactic education, 26 (54.2%) reported no change in resident participation, 14 (29.2%) reported an increase in resident participation, and 8 (16.7%) reported decreased resident participation.

Changes in resident schedule or service coverage are summarized in Fig. 4. Only 10 programs (20.8%) reported redeploying residents to non-surgical services at the time of the survey. Thirty programs (62.5%) have not redeployed residents, but plan to if needed. Eight programs (16.7%) did not have any plans to redeploy residents. Most programs (23/44, 52.3%) with research residents did not plan on redeploying these residents to clinical duties at the time of this survey. Seventeen programs (38.6%) planned to deploy research residents if needed, and 4 programs (9.1%) had already redeployed research residents to clinical duties. When asked about additional/new responsibilities for residents, 7 (14.6%) programs reported residents becoming a part of a “line” or “procedural” team.

All PDs believed the pandemic would not affect their current chief residents from graduating on time. However, 22 PDs (45.8%) believed the pandemic would negatively affect graduating resident case volumes, 18 PDs (37.5%) believed the pandemic would have no effect on case volumes, and 8 PDs (16.7%) were unsure about COVID’s impact on case volumes. The vast majority of PDs (40/48, 83.3%) believed the pandemic would not affect graduating residents’ immediate career/fellowship positions. Twenty-four PDs (50.0%) believed the pandemic would not significantly impact their junior residents’ case volumes. Thirteen PDs (27.1%) believed the pandemic would impact their junior residents’ case volumes and 11 PDs (22.9%) were unsure.

4. Discussion

In order to preserve personal protective equipment, reallocate resources and staff, and minimize exposure to the patient and hospital employees, surgical interventions were limited to emergent and urgent cases during the initial surge of the pandemic [1]. Simultaneously, general surgery residents have a unique and broad skillset that encompasses in-depth knowledge of critical care and bedside procedures (e.g., central lines) that make them an invaluable resource during these demanding times [8]. As seen in the presented data, this led to dramatic changes in clinical assignments, operative experience, and the educational format for general surgery residents.

The most common change in the resident schedule was alternating blocks or “teams” of on- and off-service residents (48.9%). In our cohort, 20.8% of programs redeployed residents to non-surgical services, but in other analyses, up to 35% of residents were redeployed [3]. An interestingly common practice is the formation of “procedure/line teams” that comprised of surgical residents and/or faculty dedicated to placing arterial and central venous lines. In our cohort, 14.6% of programs

![Fig. 1. Characterization of surgery program directors program location (top) and program type (bottom).](image-url)
reported this as an added responsibility during the pandemic. Schulberg et al. described their institution’s experience with a line team and noted procedures were significantly more efficient and had a low complication rate (<1%) [9]. The University of Washington created a more dramatic reallocation of workflow by dividing residents into clinical, operative, and inpatient care teams that surgical residents rotated through weekly. This allowed for the physical distancing of residents and limiting the number of residents each patient interacts with [10].

While there is no replacing the hands-on teaching in the operating room, PDs in our cohort made a concerted effort to bolster their resident’s educational experience. Over 90% of the PDs in our cohort implemented video-based educational conferencing to maintain a socially distanced educational environment. Multiple PDs reported expanding didactic time and even adding self-paced study curriculums with assigned reading, practice problems, and operating videos to review, in addition to scheduled didactics. These efforts to make up for the scarce surgical experience during the pandemic’s peak were well-received by trainees and may have a role in surgical education beyond the pandemic [2,3,11]. Emphasizing didactic and simulation training when there are limited clinical opportunities may also help ease the growing concern for residents being unprepared for future practice [12]. In a survey of over 1000 general surgery residents, Aziz et al. found that 42.3% of residents reported lack of confidence in meeting all of their ACGME case requirements due to COVID-related restrictions [2]. As we are currently in the midst of the second wave, innovative educational strategies will continue to be necessary as clinical restrictions are re-introduced.

The long-term impact of COVID-19 on surgical residents’ education

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Fig. 2. Institutional changes implemented in response to the COVID-19 pandemic. Responses to: “What changes has your institution undergone to adjust to the current COVID-19 pandemic response?”

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Fig. 3. Reported changes implemented to the educational curriculum and conferences since the COVID-19 pandemic. Responses to: “What changes has your program implemented to your general surgery educational curriculum/conferences?”
and career choice is unknown. In this analysis, PDs believed COVID-19 would negatively impact graduating residents’ (45.8%) case volume more than junior residents’ (27.1%), but 83.3% believed COVID-19 would not affect future fellowship and career selection. As we are now in our second wave, it is essential to continuously monitor junior residents' operative experience. Restricting elective cases, small in-house surgical teams, and shifting cases to more senior residents are all policies that shrink the junior’s operative experience and eventually may harm their progression in the operating room. As far as fellowship and career selection, the cancellation of away rotations and in-person national conferences that serve as a fruitful networking space will likely impact fellowship placement for the next 2–3 years. Also, there is evidence that the pandemic has significantly affected the surgery job market [13–15]. Senior residents who are either applying for fellowship or looking for their first attending position would likely benefit from increased mentorship and guidance to navigate this challenging time.

This survey was distributed during the initial wave of the pandemic, and thus many of the PDs’ responses may have changed since that time. The limited number of responses to this survey also did not allow us to perform further sub-categorical comparisons, limiting the conclusions that can be ascertained from this analysis. The majority of the PDs in our cohort (52%) are from rural programs. As we know, COVID-19 has been especially crippling to urban medical centers. This may have led to an underestimation of the policies put in place on a national level.

5. Conclusion
The coronavirus 2019 pandemic has brought unprecedented changes to healthcare, and surgical education is no exception. As we are in the second wave of the virus, surgical restrictions are already in place in some areas and in the process of being implemented in others. The data presented here can provide insight into the general surgery residency response to the virus’ initial outbreak and help guide future decision-making. Although the recent approval of the coronavirus 2019 vaccine is an exemplary scientific achievement with tremendous potential, experts suggest the coronavirus 2019 pandemic will likely continue for the next 5–6 months. It is vital to the education of general surgery residents to implement an adaptive curriculum, maximize operative exposure whenever possible, and simultaneously prioritize the safety of these trainees. Future studies will need to assess the impact of decreased operative experience on long-term trainee performance.

Ethical Approval
This study did not include patients. General surgery program directors volunteered to answer the survey. This study was approved by the Institutional Review Board of the University of Pittsburgh.

Funding
None.

Provenance and peer review
Not commissioned, externally peer-reviewed.

Author contribution
Maxwell F. Kilcoyne – Assisted with data collecting, interpretation of findings, manuscript drafting, and implantation of edits
Garrett N. Coyan – Concept creation and design, assisted with data collecting, and implantation of edits
Edgar Aranda-Michel- Assisted with data collecting and manuscript drafting
Arman Kilic- Concept and study design and providing critical revisions
Victor O. Morell- Concept and study design and providing critical revisions
Ibrahim Sultan- Concept creation and design, providing critical revisions, final version approval

Registration of Research Studies
Not applicable
1.Name of the registry:
2.Unique Identifying number or registration ID:
3.Hyperlink to your specific registration (must be publicly accessible and will be checked):
Guarantor

Ibrahim Sultan MD

Consent

All program directors took the anonymous survey voluntarily, and survey results were reported in aggregate without identifying information.

Declaration of competing interest

Garrett Coyan is a shareholder and serves as the Chief Medical Officer of Neoolife, Inc. Arman Kilic receives consultancy fees from Medtronic. Ibrahim Sultan receives institutional research support from Medtronic and Atricure.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.102285.

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