



# Perceptions and reality: surgical critical care training in the time of COVID-19

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## Abstract

**Purpose** The COVID-19 pandemic is known to have disrupted educational experiences for surgical trainees. In surgical critical care (SCC) fellowships, trainees encountered changes in rotations, procedure volume, didactic education, and patient population. Effects of the pandemic on SCC training have not been well described. The purpose of this study was to evaluate trainee perceptions of these changes on educational experience and preparation for the American Board of Surgery (ABS) SCC Certifying Exam (CE). We theorized that, although the pandemic caused challenges to training, trainees' overall experience and CE performance would be unaffected.

**Methods** A 10-question survey was administered electronically to candidates completing the 2020 (CE-20) and 2021(CE-21) exams, regarding the effects of COVID-19 on SCC education and CE preparation. Responses were analyzed with descriptive statistics.

**Results** Response rate to the survey was 100%. Most CE-20 candidates stated that core (66%) and elective (51%) rotations were modified due to the pandemic. For CE-21 candidates, a minority experienced changes to rotations (41% for both rotation types). Most reported caring for COVID-19 patients < 25% of the time during fellowship. Over 70% cared for nonsurgical patients, and a majority of trainees responded that this improved their education. Procedure volumes were decreased overall (most notably for airway procedures) but rebounded between CE-20 and CE-21. At least 95% of respondents reported meeting case minimums in bronchoscopy, endotracheal intubation, and cardiac ultrasonography. For both groups, most candidates reported feeling less prepared for the CE (CE-20 65%, CE-21 59%). CE-20 and CE-21 passing rates were 89% and 84%, similar to prior years. Pass rates for the following year (CE-22) were unchanged at 85%.

**Conclusions** Despite alterations to rotation schedules and exam preparation, SCC trainees benefited from exposure to both COVID-19 and nonsurgical patients. Even with decreased procedure availability, almost all had adequate exposure. Performance on the SCC CE examination was similar to prior CE-22 results, indicating that the report of feeling less prepared did not correlate with exam outcome. Continued exposure to nonsurgical patients during training may be desirable for SCC fellows beyond the pandemic.

**Keywords** COVID-19 · Surgical education · Surgical critical care · Fellowship education

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## Introduction

On March 11, 2020, the outbreak of coronavirus disease 19 (COVID-19) was officially declared a pandemic by the World Health Organization [1], ultimately resulting in millions of infections and over 1 million deaths in the United States alone. During the height of the pandemic, many facilities were forced to shift care away from surgical patients to care for the critically ill, resulting in substantial disruption to surgical educational experiences. Healthcare providers including surgical critical care trainees in 2020 and 2021 were on the front lines of these disruptions in many institutions, as they cared for critically ill patients with COVID-19 while elective operations were canceled, decreasing the volume of surgical patient exposure. Additionally, safety concerns led to changes in (particularly airway-related) procedural exposure during this time.

The COVID-19 pandemic was known to have had significant decremental effects on graduate medical education training programs. General surgery resident training programs reported declines in numbers of cases performed, pauses in didactic educational curricula or shifts to online formats [2], and challenges to well-being including inadequate access to personal protective equipment, depression, and burnout [3]. Increases in ICU rotations were reported, and significant adaptations were needed to support trainee well-being [4]. A global survey of the effect of COVID-19 on nonsurgical critical care trainees found reductions in formal didactics, frequent rotation reassignment, inadequate supervision, and decreased participation in ICU procedures [5]. However, little data are available on the pandemic's effects on surgical fellowship trainees, especially in the field of surgical critical care (SCC).

Considering these gaps, our goal was to evaluate SCC fellowship graduates' perceptions of educational experiences and examination preparation during the pandemic to inform training modifications and future training paradigms. Through a voluntary survey associated with the American Board of Surgery (ABS) surgical critical care certifying examination (SCC CE) for the graduating fellows of 2020 and 2021, we evaluated trainee perceptions of changes to rotations, patient population, procedure exposure, and examination preparation. We hypothesized that, despite pandemic-related challenges, the overall experience of fellowship and examination preparation would be preserved.

## Methods

We performed a cross-sectional study of United States SCC trainees who took part in a voluntary survey immediately following the 2020 and 2021 administration of the SCC CE. All candidates taking the exam were included, and all data were managed by ABS staff and de-identified prior to transfer for analysis. Because all responses were de-identified, the survey was deemed Institutional Review Board (IRB) exempt by the Atrium Health Wake Forest Baptist Medical Center IRB.

### Survey design

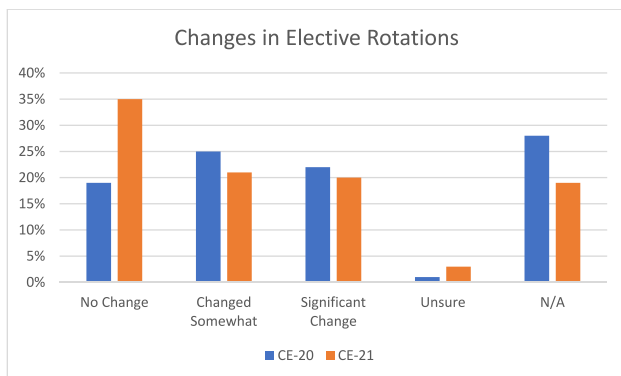
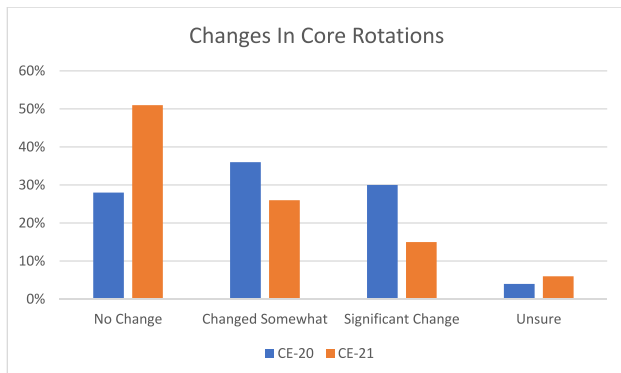
The survey was designed by the Trauma, Burns, and Surgical Critical Care Board (TBSCCB) to determine the effects of the COVID-19 pandemic on the experiences of SCC trainees to inform further decisions about testing and certification requirements during the pandemic. The survey was developed in consultation with ABS psychometricians and was informed by a contemporaneous unpublished survey of SCC program directors about the effects of the pandemic on their training programs. The ten-question survey was optional and included questions about perceptions of changes to fellowship experience due to the pandemic including rotation, patient care, and procedural experiences (Appendix 1). Candidates were also queried about perceived exam preparedness. There were minor differences between the 2020 and 2021 surveys that reflected the different timing of administration with respect to the beginning of the pandemic. Because of the COVID-19 pandemic, the September 2020 SCC CE was postponed until April of 2021 (CE-20). The 2021 exam (CE-21) was administered on schedule in September of 2021. Therefore, survey data were collected at different time intervals following training for the two groups. The ABS collected data related to demographics, international medical graduate (IMG) status. SCC CE pass rates were obtained from the ABS website [6].

### Statistical analysis

Demographics and de-identified survey results were used for analysis. Descriptive statistics were reported, and Fisher's Exact and Chi-square tests were used to compare results between groups where appropriate, with significance set at  $p < 0.05$ .

**Table 1** Demographics of survey respondents

	CE-20 (n=291)	CE-21 (n=328)	p value
Gender n (%)			0.474
Male	176 (60.5%)	188 (57.3%)	
Female	115 (39.5%)	140 (43.7%)	
Race n (%)			0.285
White	195 (67.0%)	224 (68.3%)	
Asian	39 (13.4%)	44 (13.4%)	
URM	16 (5.5%)	27 (8.2%)	
Unknown/prefer not to answer	41 (14.1%)	33 (10.1%)	
Ethnicity n (%)			0.576
Hispanic	20 (6.9%)	27 (8.2%)	
Non-Hispanic	242 (83.1%)	275 (83.8%)	
Unknown/prefer not to answer	29 (10.0%)	26 (8.0%)	
Medical training n (%)			0.494
IMG	39 (13.4%)	49 (14.9%)	
Non-IMG	251 (86.3%)	279 (85.1%)	
Unknown	1 (0.3%)	0 (0%)	



**Fig. 1** Changes in core and elective rotations due to the COVID-19 pandemic

**Results**

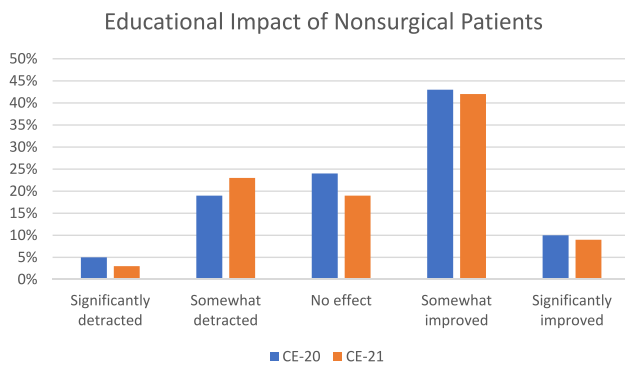
A total of 291 and 328 CE candidates in 2020 and 2021 participated in the examination. One hundred percent

**Table 2** Percent of time spent caring for COVID-19 patients for CE-20 and CE-21 candidates

	CE-20 (n=291) (%)	CE-21 (n=328) (%)
< 10%	31	31
10–25%	25	34
26–50%	16	20
51–75%	14	10
76–100%	11	4
No answer	2	1

of candidates completed a portion of the survey in both years. The nonresponse rate for each individual question was between 0 and 4%. Demographics for the candidates (Table 1) were similar between groups.

Disruptions to rotations were commonly reported by CE-20 candidates. Sixty-six percent reported changes to core rotations, and 51% reported changes to elective rotations. These disruptions were still present but less commonly reported by CE-21 candidates, with 41% reporting changes to both core and elective rotations (Fig. 1). During the pandemic, exposure to caring for patients with COVID-19 was highly variable. For CE-20 candidates, the reported percentage of time spent caring for these patients ranged from less than 10% to 75–100% of the time. A similar range of answers was noted in CE-21 candidates, with fewer reporting that more than half of their time was spent caring for COVID-19 patients (Table 2). During both years, the majority reported less than 25% of their time with this patient population.



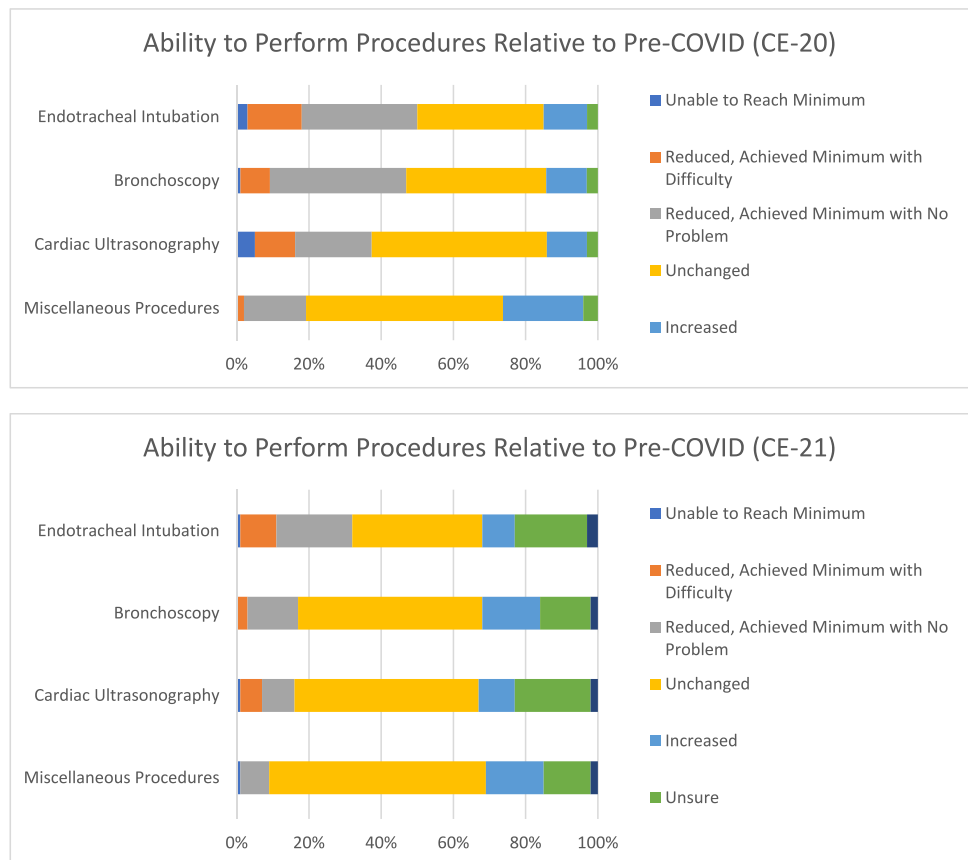
**Fig. 2** Educational impact of nonsurgical patients

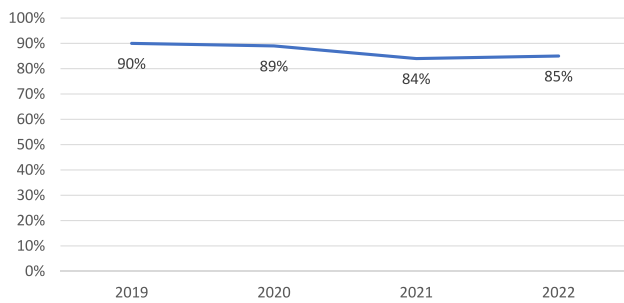
Caring for nonsurgical patients was common in both years. Seventy percent of CE-20 candidates and 77% of CE-21 candidates reported caring for these patients. Of those that cared for nonsurgical patients, the majority responded that this experience either somewhat or significantly improved their education (Fig. 2). Candidates perceived that procedure volumes were decreased overall. Airway procedures were most affected, with 50% reporting

at least some decrease in availability of endotracheal intubation and 46% reporting a decrease in availability of bronchoscopy on CE-20. The majority reported that access to cardiac ultrasonography and miscellaneous procedures were unchanged or increased. Very few were unable to meet requirements. Procedure exposure rebounded during the following year, as reported by CE-21 candidates, with 32% and 17% reporting a decrease in access to endotracheal intubation and bronchoscopy, respectively (Fig. 3).

Candidates reported effects of COVID-19 on exam preparedness. Very few reported increased preparedness due to the pandemic in each year (8% and 5% in CE-20 and 21, respectively). Twenty-six percent (CE-20) and 34% (CE-21) of candidates stated their preparation was unchanged due to the pandemic, and 66% and 59%, respectively, reported either somewhat or significantly less preparation. Exam pass rates for CE-20 and CE-21 were similar, 89% for CE-20 and 85% for CE-21 ( $p = 0.077$ ). Exam pass rates were also similar to those of pre-pandemic and subsequent years (Fig. 4). When evaluating answers associated with a failing test score on CE-20, those who failed were more likely to report somewhat or a great deal less preparedness than those who passed (84% vs. 63%,  $p < 0.05$ ). There were no significant differences in exam preparation in 2021.

**Fig. 3** Candidate ability to perform procedures relative to pre-COVID





**Fig. 4** Surgical critical care certifying exam pass rates, 2019–2022

## Discussion

Most candidates take the SCC CE immediately after completing fellowship. Since SCC is typically a 1-year fellowship, the CE-20 candidates had completed the majority of their fellowship year as the pandemic began in March 2020, while the CE-21 candidates experienced COVID-19 changes and restrictions for the entirety of fellowship. Our study was designed to evaluate trainee perceptions of SCC educational experience and examination preparation during the height of the pandemic. We found that core and elective rotation disruptions were common but decreased over the course of the pandemic. Time spent caring for COVID-19 patients was highly variable, but caring for any nonsurgical patients during the pandemic was common among trainees, resulting in a positive impact on their training experience. Although many perceived that procedural volume, especially in airway procedures, was decreased, it was rare that candidates reported difficulty with case minimums. Candidates reported that exam preparation was more difficult during the pandemic, but exam pass rates were similar to previous years. To our knowledge, this is the first study to specifically address educational experiences of SCC fellows during the pandemic.

Many of the challenges demonstrated in this study have been reported in other trainee populations. A systematic review of the literature on COVID-19 impacts on residency training across the globe revealed that 96% of articles in all specialties reported a decrease in clinical experience and/or case volume [7]. However, as Nicholas and colleagues point out, fellows are in a more vulnerable position due to decreased training duration compared to residents in longer training programs [8]. In contrast to other surgical trainees, our survey results suggest that SCC candidates were less affected by changes in procedural volume than others. Despite reporting decreases in procedural volume, especially relative to airway procedures in 2020, <5% of CE-20 candidates and <1% of CE-21 candidates reported not being able to meet ACGME procedure minimums. In contrast, in a survey of general surgery educational leaders performed in a similar time period, Ellison and colleagues report that

the inability to meet minimum case numbers was a “major to severe” problem in trainees of varying levels, ranging from 8 to 12%, depending on postgraduate year of the trainee [9]. The trends reported by SCC CE candidates in decreased procedural exposure in CE-20 followed by a rebound on CE-21 parallel those reported the anesthesia literature, where airway procedures and case volume were reduced in the early pandemic but recovered after the first few months [10].

A striking finding of our study was the variability in the amount of time reported caring for COVID-19 patients. Although the majority reported spending less than 25% of their time with these patients, a significant proportion still reported that over half of their time during fellowship was spent on this patient population. Although there are reports of skill decay due to redeployment in general surgery trainees [11, 12], the unique nature of SCC training makes this decay less likely in our trainees. An interesting finding in our study was the unexpected benefit of caring for nonsurgical patients. Other studies of surgical trainees have likewise found benefits in the disruption. For example, potential benefits reported for breast surgical oncology fellowship trainees included scheduling flexibility, access to national conferences in virtual formats, and the adoption of virtual formats for didactic educational content [13].

Although the response rate was high, our study did have limitations due to the retrospective nature of the work. The candidates’ answers to our questions were subject to recall bias and any preconceived notions that the candidate held about what training would have been like if COVID-19 were not a factor. This factor was more pronounced for the CE-21 group, as they had no pre-COVID SCC training experience to which they could compare their experience. The timing of the postponed CE-20 exam meant that the timing of the survey with respect to finishing training was different for each group. Despite these limitations, this work serves as an important window into the experiences of SCC trainees during this time. The association with the exam allowed us to capture almost all candidates’ perceptions, and the very high response rate to each question avoided nonresponse bias.

Although substantial disruptions to the educational experience and to exam preparation were noted, there were signs that rotation experience and procedural volume were improving between the two surveys. Additionally, as trainees, programs, and hospitals adapted to the pandemic, there was evidence of educational benefit. Although CE candidates reported feeling less prepared for the CE examination because of the pandemic, it is encouraging that the pass rate did not substantially change. We attribute this stability to the fact that in surgical critical care, unlike more elective specialties, the patient population available for learning was not substantially decreased. SCC trainees that would not normally be exposed to nonsurgical patients found benefit in their experience. While it is too soon to determine long term

effects on the competence of the now SCC certified physicians, undoubtedly, they will have increased comfort with this patient population as they move forward in their careers. SCC fellowships were able to adapt and flex to accommodate changing clinical conditions during the pandemic. Future changes to SCC fellowship curricula should consider the unique benefits of caring for critically ill patients without underlying surgical pathology.

## Conclusions

Despite substantial alterations to rotation schedules, procedure availability, and exam preparation, programs and trainees adapted over time to the challenges of the COVID-19 pandemic. CE pass rates were not affected by SCC training during the pandemic. Providing care for nonsurgical and COVID-19 patients was reported to be beneficial to CE candidates' education. Future training requirements for SCC fellows should consider the benefit of incorporating diverse critical care experiences.

## Appendix 1: Survey Questions

Note: With slight variations in wording between 2020 and 2021.

1. Please choose the statement that best describes the impact of the COVID-19 pandemic on your core scheduled rotations during your critical care training year.
  - A. My core scheduled rotations did not change.
  - B. My core scheduled rotations changed somewhat.
  - C. My core scheduled rotations changed significantly.
  - D. I am not sure if my core scheduled rotations changed.
2. Please choose the statement that best describes the impact of the COVID-19 pandemic on your elective rotations during your critical care training year.
  - A. My elective rotations did not change.
  - B. My elective rotations changed somewhat.
  - C. My elective rotations changed significantly.
  - D. I am not sure if my elective rotations changed.
  - E. Not applicable.
3. How did the COVID-19 pandemic affect your ability to prepare for the Surgical Critical Care Certifying Examination?
  - A. I was a great deal more prepared because of the pandemic.
  - B. I was somewhat more prepared because of the pandemic.
  - C. No effect.
  - D. I was somewhat less prepared because of the pandemic.
  - E. I was a great deal less prepared because of the pandemic.
4. During your critical care training year, did you care for critically ill patients with COVID-19?
  - A. Less than 10% of the time, when a COVID-19-positive patient was on my service.
  - B. 10% to 25% of the time.
  - C. 26% to 50% of the time.
  - D. 51% to 75% of the time.
  - E. 76% to 100% of the time.
5. During your critical care training year, did you provide care for non-surgical patients (for instance, covering a COVID-19 unit or caring for medical boarders in a surgical intensive care unit)?
  - A. Yes.
  - B. No.
6. If you answered yes to question 5, what was the impact of caring for non-surgical patients on your education?
  - A. Significantly detracted from my education.
  - B. Somewhat detracted from my education.
  - C. No effect on my education.
  - D. Somewhat improved my education.
  - E. Significantly improved my education.
7. Was your ability to perform endotracheal intubation changed during the COVID-19 pandemic (by report from faculty or previous fellows)?
  - A. The number of procedures was unchanged from the pre-pandemic volume.
  - B. The number of procedures was increased from the pre-pandemic volume.
  - C. The number of procedures was reduced from the pre-pandemic volume, but I had no problem reaching the ACGME minimum number.
  - D. Access to procedures was reduced, and I had to work very hard to reach the ACGME minimum number.
  - E. I was unable to reach the ACGME minimum number.

- F. I am uncertain whether or not my ability to perform the procedure was changed.
8. Was your ability to perform bronchoscopy changed during the COVID-19 pandemic (by report from faculty or previous fellows)?
- A. The number of procedures was unchanged from the pre-pandemic volume.
- B. The number of procedures was increased from the pre-pandemic volume.
- C. The number of procedures was reduced from the pre-pandemic volume, but I had no problem reaching the ACGME minimum number.
- D. Access to procedures was reduced, and I had to work very hard to reach the ACGME minimum number.
- E. I was unable to reach the ACGME minimum number.
- F. I am uncertain whether or not my ability to perform the procedure was changed.
9. Was your ability to perform transthoracic and transesophageal cardiac ultrasonography changed during the COVID-19 pandemic (by report from faculty or previous fellows)?
- A. The number of procedures was unchanged from the pre-pandemic volume.
- B. The number of procedures was increased from the pre-pandemic volume.
- C. The number of procedures was reduced from the pre-pandemic volume, but I had no problem reaching the ACGME minimum number.
- D. Access to procedures was reduced, and I had to work very hard to reach the ACGME minimum number.
- E. I was unable to reach the ACGME minimum number.
- F. I am uncertain whether or not my ability to perform the procedure was changed.
10. Was your ability to perform miscellaneous procedures (e.g., tube thoracostomy and central line placement) changed during the COVID-19 pandemic (by report from faculty or previous fellows)?
- A. The number of procedures was unchanged from the pre-pandemic volume.
- B. The number of procedures was increased from the pre-pandemic volume.
- C. The number of procedures was reduced from the pre-pandemic volume, but I had no problem reaching the ACGME minimum number.
- D. Access to procedures was reduced, and I had to work very hard to reach the ACGME minimum number.
- E. I was unable to reach the ACGME minimum number.
- F. I am uncertain whether or not my ability to perform the procedure was changed.

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## Declarations

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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