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The cardiothoracic surgery trainee experience during the coronavirus disease 2019 (COVID-19) pandemic: Global insights and opportunities for ongoing engagement



Jacqueline K. Olive, BA,^a Jessica G. Y. Luc, MD,^b Rui J. Cerqueira, MD, MSc,^c Jaime-Jürgen Eulert-Grehn, MD,^d Jason J. Han, MD,^e Kevin Phan, MD,^f and Ourania Preventza, MD, MBA^{g,h}

From the ^aBaylor College of Medicine, Houston, Tex; ^bDivision of Cardiovascular Surgery, Department of Surgery, University of British Columbia, Vancouver, British Columbia, Canada; ^cCardiovascular Research and Development Unit, University of Porto, and Department of Cardiothoracic Surgery, University Hospital Center of São João, Porto, Portugal; ^dDepartment of Cardiothoracic and Vascular Surgery, German Heart Center Berlin, Berlin, Germany; ^eDivision of Cardiothoracic Surgery, Department of Surgery, Hospital of the University of Pennsylvania, Philadelphia, Pa; ^fPrince of Wales Private Hospital, Sydney, Australia; ^gDivision of Cardiothoracic Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, Tex; and ^hDepartment of Cardiovascular Surgery, Texas Heart Institute, Houston, Tex.

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Address for reprints: Ourania Preventza, MD, MBA, BCM 390, One Baylor Plaza, Houston, TX 77030 (E-mail: preventz@bcm.edu).

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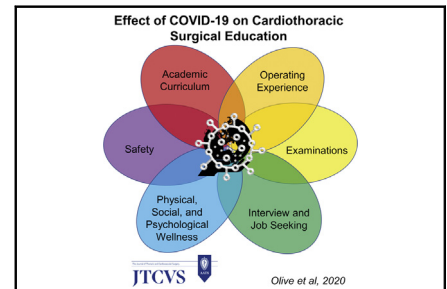
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The coronavirus disease 2019 (COVID-19) pandemic has posed unprecedented challenges to the world's health care systems and society at large. In addition, the cardiothoracic surgical community faces the challenge of upholding its educational imperative to provide learning for trainees during the pandemic even as the scope of clinical experiences has changed. Here, we discuss relevant concerns of cardiothoracic surgery trainees during the COVID-19 pandemic, the potential downstream consequences of altered curricula, and ongoing methods and opportunities for trainees to maximize their education and involvement during this pandemic (Table 1). In times of public health emergency, the trainee's voice may too often be unheard, and a series of relevant interconnected elements of the cardiothoracic surgery trainee experience should be addressed (Figure 1). In this Young Surgeon's Note, we provide a global perspective to better understand the scope of the pandemic's effect on cardiothoracic surgery learners and prepare their educators during the evolving crisis and for the specialty's future.

EFFECT OF COVID-19 ON THE TRAINEE EXPERIENCE

Academic Curriculum

Medical students and general surgery residents. The COVID-19 pandemic predominantly affects clinical experiences in subinternships and elective rotations, during which early surgical learners gain formal exposure to the cardiothoracic subspecialty. In the future, medical students and



Interconnected elements of cardiothoracic surgery trainee experience during the pandemic.

CENTRAL MESSAGE

The COVID-19 era presents unique challenges and clear opportunities for trainees in cardiothoracic surgery.

PERSPECTIVE

Cardiothoracic surgery training is demanding of time and commitment. The escalation of the COVID-19 pandemic poses additional challenges to trainees' education and potential risks to their health, safety, and overall wellness. This has led to postponement of exams and licensure, and to more widespread use of virtual platforms in place of in-person interaction and other traditional educational methods.

See Commentaries on pages 184 and 185.

general surgery residents might consider pursuing shadowing opportunities and mentors during the first 2 years of their respective programs in anticipation of unforeseen barriers to adequate formal clinical elective time.

Cardiothoracic surgery residents. With the international surge in patients with COVID-19, many programs have reallocated their cardiothoracic surgery house staff from surgical rotations to other areas of need, such as intensive care units (ICUs) and emergency departments. A recent international survey of cardiac surgery centers participating in the Randomization of Single vs Multiple Arterial Grafts (ROMA) trial reported that during locally advanced phases

TABLE 1. Issues and potential action items for cardiothoracic surgery trainees during the COVID-19 era

Areas of impact	Potential solutions
Patient care	
Patient interactions (operating room, clinic, on call)	<ul style="list-style-type: none"> • Ensure that all cardiothoracic surgical learning hospitals are adequately staffed with trainees as essential personnel • Use advanced care practitioners or operating room assistants • Avoid multiple proceduralists for interventions • Postpone elective procedures to conserve hospital space, PPE, resources, and personnel • Create infrastructure for telehealth and remote rounds • Configure rotations for social distancing with flexibility and backup to conserve the surgical workforce
Clinical redeployment	<ul style="list-style-type: none"> • Seek volunteers for redeployment to direct patient care roles if needed but also consider drafting those most qualified • Reschedule junior residents with mandated intensive care, emergency department, or medical rotations to whichever of these areas need more clinical workers • Ensure appropriate orientation and supervision during redeployment • Consider redeployment an opportunity to learn from other specialties
Education	
Didactic learning	<ul style="list-style-type: none"> • Use virtual educational resources and curricula (eg, social media, CTSNet.org, National Thoracic Online Curriculum, Thoracic Surgery Directors and Residents Association resources, <i>Journal of Thoracic and Cardiovascular Surgery</i>, <i>Annals of Thoracic Surgery</i>, <i>Multimedia Manual of Cardiothoracic Surgery</i>) • Encourage sharing of resources between programs
Technical learning	<ul style="list-style-type: none"> • Use simulation where feasible • Seek educational opportunities for trainees (eg, trainees still learning critical care procedures can benefit from volunteering to be on the “procedure team” in the care of patients with COVID-19)
Research	<ul style="list-style-type: none"> • Participate in remotely accessible research opportunities • Encourage societies that have cancelled their academic conferences to resort to virtual modalities • Pursue alternative forms of academic enrichment (eg, advanced degrees, advanced coursework, research, career planning, financial literacy)

(Continued)

TABLE 1. Continued

Areas of impact	Potential solutions
Examinations and job-seeking	
Credentialing	<ul style="list-style-type: none"> • Encourage the use of e-technologies and teleconferencing for examinations • Reschedule examinations for the earliest date possible • Provide provisional licensing • Board flexibility as outlined regarding completing case-volume and all other requirements • Use nonvoluntary offsite time for clinical or educational purposes to meet specialty-specific requirements • Allow flexibility with fee waivers and extension of eligibility periods
Interviews	<ul style="list-style-type: none"> • Encourage the use of e-technologies and teleconferencing • Be flexible with trainee and faculty schedules
Personal wellness	
Safety	<ul style="list-style-type: none"> • Ensure training and fit-testing for PPE • Provide adequate supervision and backup • Provide adequate PPE • Provide accommodation and food as needed for trainees who are wary of going home because they fear infecting their families
Social	<ul style="list-style-type: none"> • Promote social media networking • Ensure excellent communication among team members
Psychological	<ul style="list-style-type: none"> • Have resources readily available for trainees in distress • Respect work-hour restrictions where possible
Financial	<ul style="list-style-type: none"> • Provide income support for trainees as needed • Offer loan-forgiveness

PPE, Personal protective equipment; COVID-19, coronavirus disease 2019.

of the pandemic, one half of centers have still permitted residents to participate in cardiac operations, 18% relocated fellows and residents from cardiac surgery to other departments, and one third relocated their personnel to other departments, chiefly to ICUs.¹ Although these results are potentially subject to selection bias, it is evident that educators and trainees face an increasing dilemma in preserving the integrity of surgery training versus meeting front-line clinical and service-oriented demands, all while protecting limited human resources. Fortunately, redeploying cardiothoracic surgery trainees to surgical ICUs and procedural teams can not only maximize their value in the greater health care system but also provide relevant learning experiences, given their unique interdisciplinary skill sets.

Effect of COVID-19 on Cardiothoracic Surgical Education

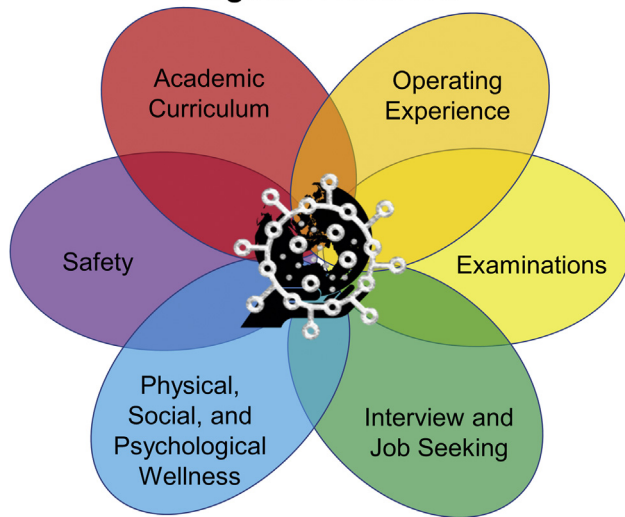


FIGURE 1. Interconnected elements of cardiothoracic surgery trainee experience during the pandemic.

Ultimately, residents may need additional time to log or double-scrub cases to gain adequate cardiothoracic surgery experience. In the United States, the impact may be greatest on traditional fellows with 2-year training periods, integrated program residents because of their condensed curricula, and residents who are currently in their dedicated research period or who desire to perform future uninterrupted research.² Once the pandemic subsides, the resulting backlog of elective cases, projected to be as much as 216% to 263% of monthly baseline cardiac surgery volume, may provide residents with greater opportunity.³

Examinations and Graduation

Medical students. The COVID-19 pandemic poses unique challenges to the safe administration of licensing examinations and in-person clinical skills assessments throughout the world. Therefore, applicants to integrated cardiothoracic surgery residency programs may need to submit their applications without these scores. Program directors and committees should be flexible in their initial review of applications, as options for remote or staged examinations may not be available in the immediate future. In addition, several medical schools around the world have offered early graduation to fourth-year students to provide additional support for the health care workforce, although these institutions recognize that this solution is controversial. These newly minted interns' work must be heavily supervised by experienced senior residents and surgeons.

The Coalition for Physician Accountability, of which the Accreditation Council for Graduate Medical Education is a member, released the statement "Maintaining Quality and

Safety Standards Amid COVID-19," which offers recommendations and guidance to new and volunteer physicians.⁴

Graduating cardiothoracic surgery residents. For cardiothoracic surgery specialist certification examinations, most countries worldwide have tentatively rescheduled written and oral examinations to Fall 2020, if not Spring 2021. The European Board of Cardiothoracic Surgery has shown flexibility and understanding regarding the scheduling of Level One and Level Two examinations for their cardiothoracic surgeons, as has the American Board of Thoracic Surgery.⁵

In addition, while the decrease in elective surgical cases is allowing allocation of resources and residents to the emergency care of patients with COVID-19, understandably, there are concerns about whether trainees can meet minimum case-volume requirements for graduation, especially opportunities for direct observation and autonomy.⁶ Health education committees may be forced to extend training programs well beyond the end of the lockdown to give surgical trainees additional time for retraining after elective activity resumes. Alternatively, program directors may need to play a larger role in deciding the readiness of trainees for independent practice. It is critical to identify the specific requirements that a trainee may fall short of meeting, to develop individualized plans to address those requirements, and to monitor progress on a regular basis.⁶ The American Board of Thoracic Surgery, in conjunction with the Thoracic Surgery Directors Association (TSDA) and the Thoracic Surgery Residents Association, demonstrates flexibility and is proactive in ensuring that contingency plans are in place for senior cardiothoracic surgery residents should they not meet their operative experience requirements by the end of the academic year.⁵ Certainly, the directors of all programs worldwide are committed to ensuring that trainees meet all the requirements for proficiency and qualifying exams.

For trainees whose caseload does not meet the criteria to sit for the examination, board organizations and accredited programs may need to coordinate to develop a flexible but fair solution. For trainees who have not completed their required caseload because of the recent COVID-19 crisis but who have already accepted a job as an individual practitioner outside their current institution, they might be allowed a provisional period during which the cases they perform in their practice would count toward their required caseload until they qualify for the exam. In this case, the chief medical officer of the hospital where the trainee practices or a supervising board-certified thoracic surgeon would provide affirmation of the cases to the Board. For trainees who do not complete their required caseload by the end of their academic year but have accepted a faculty job at their current institution, their program may allow them to continue and extend their training by a few months to accumulate the rest of their cases; the trainees would

function at the instructor level without interfering with the training of incoming residents. Finally, depending on the extent to which the pandemic escalates, solutions may need to be considered such as provisional licensure to practice, subject to appropriate oversight and supervision to ensure patient and trainee safety.

Interviews and Job Applications for Residency and Fellowship

Shortened or repurposed elective clinical time poses a unique challenge to those whose interest in cardiothoracic surgery developed late, or who must obtain letters of recommendation and complete visiting rotations to be competitive for surgery residency programs.^{7,8} Fewer opportunities to rotate on a cardiothoracic surgery service could dampen prospective applicants' interest in the specialty and in specific training programs, as well as decrease the competitiveness of applicant pools for integrated residency and fellowship programs. To anticipate these changes, program directors and committees should support the recent postponement of application deadlines and provide alternative means for external trainee engagement, such as holding virtual resident didactics and hosting virtual tours and social gatherings.⁹ The Coalition for Physician Accountability recommends that all programs commit to online interviews and virtual visits for applicants.¹⁰

Candidates may feel at a disadvantage if they cannot participate in on-site interviews. Our pediatric surgery colleagues have reported that the virtual interview is an effective screening tool for their highly competitive fellowship match and has significant potential to modify rank lists.¹¹ Safety, financial, and logistical considerations may make virtual interviews more favorable in future application cycles.¹²

For residents and fellows seeking job opportunities, flexibility is needed regarding the job application process, with special attention to letters of intent and to any time-based conditions of contracts, given the pandemic's uncertain timeline. In addition, coordination is needed among regulatory bodies so as not to delay credentialing of cardiothoracic surgeons because of COVID-19.

Pursuing an Academic Career Without In-Person Conferences in the Near Future

Because of the risks associated with large gatherings, numerous cardiothoracic surgery conferences have been cancelled, and others have been reformatted. Many conferences scheduled for the rest of the year are in limbo, awaiting further clarity of circumstances. Because the prospects for rescheduling in-person conferences are unclear, we must innovate to continue to share scholarly work and provide trainees with alternative opportunities to build their résumés and applications. The American Association for Thoracic Surgery (AATS) adopted novel modalities and held its

conference virtually in both live and on-demand formats—AATS 100th Annual Meeting: A Virtual Learning Experience—thereby providing cardiothoracic surgery professionals around the world with complimentary access to some of the most exciting research, education, speakers, and science in the field, in addition to a Virtual Expo.¹³ This effort demonstrates dedication to not only the academic enterprise but also equity of access and global outreach for the future of education and subspecialty meetings. Presenters can share their science via this virtual format, as well as social media platforms such as the Thoracic Surgery Social Media Network and the Cardiothoracic Surgery Network.¹⁴ Finally, although many professional relationships begin at in-person meetings, we must harness the capabilities of e-mail and social media to remain connected with mentors and mentees.

Trainee Safety and Health

It is especially important to be sensitive to the vulnerabilities of trainees during the COVID-19 pandemic, including the direct burden of illness and exposure, comorbidities, caregiver responsibilities, work-hour restrictions, and financial and personal considerations. Gaudino and colleagues¹ reported that around one half of cardiac surgery programs have mandated that trainees stay at home unless on call or critically needed. To protect vulnerable patients with cardiovascular disease, trainees should avoid working with both patients who are positive and negative for COVID-19 simultaneously or in close succession. Although the debate regarding trainee involvement leans toward limiting direct exposure to patients with COVID-19 and high-risk environments, trainees and educators may view being shielded from serving as responders in hospitals as a missed learning opportunity.

OPPORTUNITIES FOR TRAINEE ENGAGEMENT DURING THE COVID-19 PANDEMIC

We have identified several means of supporting cardiothoracic surgery trainees and sustaining the intellectual and academic rigor of the specialty when in-person efforts are less feasible.

Contemporize Cardiothoracic Surgical Education

Remote clinical experience. Resident participation in virtual rounds and clinics permits ongoing involvement in patient care while ensuring social distancing and minimizing potential exposure. Programs in the United States like Perfect Care, an Atrium Health initiative funded by The Duke Endowment, and in Canada like the University of Ottawa Heart Institute's Virtual Care Program have expanded their services during the COVID-19 pandemic to aid cardiac surgical patients through virtual real-time monitoring and wearable technologies, converting as many as 95% of visits from in-person to virtual.¹⁵

Didactics on COVID and ICU management. Focused learning in cardiothoracic surgery should continue while the COVID-19 pandemic necessitates instruction on caring for infected patients and prioritizing our health care systems' resources. Many training programs now require or offer supplemental instruction on the presentation and diagnosis of COVID-19, chest imaging, blood gas analysis, airway management, circulatory support (eg, extracorporeal membrane oxygenation), percutaneous access, infection control, and other topics in critical care, crisis management, and leadership. Notably, the Society of Thoracic Surgeons (STS) led a COVID-19 webinar series on numerous hot topics, including an hour-long session regarding the pandemic's impact on residency and training, with valuable program director and resident perspectives.

Virtual classrooms. Teleconferencing of grand rounds; educational and case conferences; morbidity and mortality rounds; debate-style journal clubs, as implemented by the University of Texas MD Anderson Cancer Center¹⁶; and faculty-led and -scored mock orals, such as those at the University of Wisconsin¹⁷ allow academic instruction to continue. The role of virtual technical-skills training through livestream, augmented and virtual reality, wearable and head-mounted devices, and pocket vessel-anastomosis kits could be expanded to incorporate new dimensions, audio and tactile feedback, and hands-on remote simulations.¹⁸

Virtual texts and resources. Cardiothoracic surgery is already at the forefront of supplemental e-learning resources. These are crowdsourced at [CTSNet.org](https://www.ctsnet.org), which houses a broad range of video- and text-based educational content. Other e-learning resources for cardiothoracic surgery trainees include well-known academic textbooks and journals including the *Journal of Thoracic and Cardiovascular Surgery*, *Annals of Thoracic Surgery*, *Operative Techniques in Thoracic and Cardiovascular Surgery: A Comparative Atlas*, and the *Multimedia Manual of Cardiothoracic Surgery*; the Thoracic Surgical Curriculum, a new customizable learning management system available for all Accreditation Council for Graduate Medical Education-accredited programs, provided by the TSDA through the STS¹⁹; the Houston Methodist DeBakey Cardiovascular Education YouTube channel; and online question banks, podcasts, and textbooks available through the Thoracic Surgery Residents Association. Furthermore, programs are encouraged to share learning resources with each other and to collaborate to produce a virtual repository of education materials.

Virtual mentoring. Many trainees are technically equipped to teach their mentors about advanced communication technologies and online tools for teaching and simulation. Residents may host virtual review sessions and residency-oriented panels for medical students, while students should offer to assist residents with academic projects. Trainees

should be given guidance and mock training on the virtual interview format, including techniques to minimize technical failures, optimize physical space, and anticipate expectations for evaluation, as well as pocket resources such as the University of Utah Cardiothoracic Surgery Program's virtual interview primer.²⁰

Technological innovation and development. Crisis often fosters the development of new technologies. We envision an expanded role for 3-dimensional printing of health care equipment such as masks and simplified mechanical components for ventilators, as well as the adaptation of household items for personal protective equipment. We encourage trainees to collaborate in these efforts.

Expand Social Media Engagement

Now more than ever, as we rely on virtual communication, we encourage other trainees and faculty of all generations to create professional accounts on social media to facilitate learning and discussion about COVID-19 and other topics in cardiothoracic surgery. Of course, merely having a social media account does not necessarily guarantee positive academic or social engagement. As always, trainees should proceed with caution given the evolving nature of scientific evidence and the political sensitivity of certain topics during the pandemic. Furthermore, social media can pose ethical challenges for physicians and trainees. The AATS and the STS have issued a joint statement regarding ethical standards for cardiothoracic surgeons' use of social media.²¹

Ensure the Safety and Health of Trainees

It is vital that programs proactively advocate for and protect the health and safety of their trainees. Therefore, trainee work schedules should be optimized to maintain health and reserve in the overall pool of health care workers, such as by avoiding >24-hour shifts as much as possible, having blocks of days on and days off to minimize cross-contamination of work cohorts, and not alternating days and nights. Work-hour requirements should be honored whenever possible to allow trainees to rest adequately between clinical duties. Decontamination efforts, adequate accommodation, and providing food and other essentials—including psychological services and counseling—within the hospital may become necessary to protect colleagues and family from exposure should trainees become infected and to appropriately address any associated emotional repercussions, as it is still too early to gauge the full scope of these effects. In addition, the TSDA wellness guide for fighting fatigue provides specific guidance on preparing for strenuous shifts, maintaining vigilance while on duty, and recovering after difficult periods.²² Fostering expectations, establishing routines, delegating tasks, and remaining connected with others are now more important than ever.²³

Limitations

We acknowledge that the issues and suggestions discussed here do not reflect the opinions of all trainees and faculty, should not replace institutional guidelines and governing bodies' policies, are not meant as a comprehensive survey, and are subject to change, given the pandemic's rapid evolution.

CONCLUSIONS

The COVID-19 era is a challenging time for health care workers around the globe and hopefully will be a once-in-a-lifetime experience for many. This unprecedented time of pandemic crisis calls for modifications to and greater flexibility of cardiothoracic surgery training requirements to address issues unique to trainees and surgical education. A restructuring of the timeline and curriculum for surgical learners is inevitable and ongoing. This review could serve a greater purpose as a widely available and peer-reviewed list of specific concerns and clear opportunities as outlined by trainees around the globe.

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