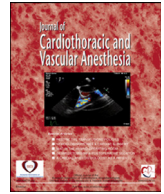


Contents lists available at [ScienceDirect](#)

Journal of Cardiothoracic and Vascular Anesthesia

journal homepage: [www.jcvaonline.com](http://www.jcvaonline.com)

## Original Article

## Challenges in the Cardiothoracic and Vascular Anesthesia Fellowship Program Since the Coronavirus Disease 2019 (COVID-19) Pandemic: An Electronic Survey on Potential Solutions

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### ABSTRACT

**Objective:** The authors explored the current practice of fellowship training in cardiothoracic and vascular anesthesia and surveyed the acceptability of potential solutions to mitigate the interrupted fellowship training during the severe acute respiratory syndrome coronavirus disease 2019 (COVID-19) pandemic.

**Design:** A prospective electronic questionnaire-based survey.

**Setting:** The survey was initiated by the Education Committee of the European Association of Cardiothoracic Anesthesiology and Intensive Care (EACTAIC).

**Participants:** The study comprised EACTAIC fellows, EACTAIC, and non-EACTAIC subscribers to the EACTAIC newsletter and EACTAIC followers on different social media platforms.

**Interventions:** After obtaining the consent of participants, the authors assessed the perioperative management of COVID-19 patients, infrastructural aspects of the workplace, local routines for preoperative testing, the perceived availability of personal protective equipment (PPE), and the impact of COVID-19 on fellowship training. In addition, participants rated suggested solutions by the investigators to cope with the interruption of fellowship training, using a traffic light signal scale.

**Measurements and Main Results:** The authors collected 193 responses from 54 countries. Of the respondents, 82.4% reported cancelling or postponing elective cases during the first wave, 89.7% had provided care for COVID-19 patients, 75.1% reported staff in their center being reassigned to work in the intensive care unit (ICU), and 45% perceived a shortage of PPE at their centers. Most respondents reported the termination of local educational activities (79.6%) and fellowship assessments (51.5%) because of the pandemic (although 84% of them reported having time to participate in online teaching), and 83% reported a definitive psychological impact. More than 90% of the respondents chose green and/or yellow traffic lights to rate the importance of the suggested solutions to cope with the interrupted fellowship training during the pandemic.

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**Conclusions:** The COVID-19 pandemic led to the cancellation of elective cases, the deployment of anesthesiologists to ICUs, the involvement of anesthesiologists in perioperative care for COVID-19 patients, and the interruption of educational activities and trainees' assessments. There is some consensus on the suggested solutions for mitigation of the interruption in fellowship training.

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**Key Words:** Fellowship; survey; cardiothoracic and vascular anaesthesia; COVID-19

SINCE 2020, the world has been subject to the effects of the global pandemic secondary to the coronavirus disease 2019 (COVID-19), with multiple waves affecting different countries at different times.<sup>1,2</sup> Hospitals worldwide have been subjected to an increased demand on their critical care capacity. Fourteen European Association of Cardiothoracic Anesthesiology and Intensive Care (EACTAIC) fellowship centers currently are available for structured training in cardiothoracic and vascular anesthesiology (CTVA) worldwide, offering a total of 31 fellowship positions. During the first wave of COVID-19, formal training in cardiothoracic and vascular anesthesia was impacted by a necessary reduction of the number of elective surgical cases.

The authors previously have reported—similarly to others—that some of the CTVA fellows were required to take over the direct care of COVID-19 patients in the intensive care unit (ICU) while their original duties caring for patients undergoing cardiothoracic and vascular surgeries and interventions could not be completed as per the requirements of the EACTAIC CTVA Fellowship Curriculum.<sup>3,4</sup> They also reported that during the first wave of the COVID-19 pandemic, EACTAIC fellowship program directors stated that the training of their fellows was interrupted in 55.6% of the hosting centers.<sup>3</sup> Consequently, a significant proportion of fellows were unable to meet the required basic and advanced rotations in cardiothoracic and vascular anesthesia. The Accreditation Council for Graduate Medical Education (ACGME) has divided the response to the COVID-19 pandemic into three levels of management of fellowship programs. Level 1 occurs when the health system's response to the pandemic does not overstretch the continuity of the fellowship program activities. Level 2 would result in a slight- to-moderate interruption of fellowship activities so that significant adjustments would have to be made to the fellowship operations to meet the pandemic requirements at this intermediate intensity level. At level 3, the response to the pandemic overtaxes the contingency planning and reserves of the fellowship program, with a moderate-to-severe interruption of the everyday activities of the community, leading to the suspension of the program.<sup>4</sup> The negative impact of the pandemic on the continuity of the formal training of the fellowships likely to be prolonged in the case of subsequent waves.

The purpose of this survey was to examine the impact of the pandemic on the EACTAIC CTVA fellowship program and to explore local changes and adjustments in the CTVA fellowship program to overcome the limitations and necessary structural changes. The present survey results will help EACTAIC

trainers develop consensus-based recommendations for decision-making. The authors believe that some of the proposed mitigating measures could help to take the pressure off both fellows and host centers concerned about meeting fellowship requirements.

## Methods

The authors performed an internet-based, global survey regarding the CTVA fellowship program after the COVID-19 outbreak. Addressees were current EACTAIC fellows, EACTAIC, and non-EACTAIC subscribers to the EACTAIC newsletter (860 invitees) and followers on the social media platforms LinkedIn, Twitter, Facebook, and Instagram (8,612 invitees). The invitees comprised a mixture of both trainee grades (including known EACTAIC fellows and other doctors in training outside of fellowship programs) and trainer grades (including those clinicians involved in fellowship training and other senior clinicians with an interest in cardiothoracic and vascular training). The 30-item questionnaire included infrastructural aspects of their workplace, such as logistical and safety measures, and the number of cardiac, thoracic, and vascular procedures performed before and after the COVID-19 pandemic. Furthermore, the questionnaire included a screening of the acceptability to respondents of potential solutions proposed to cope with the interrupted fellowship program during the COVID-19 pandemic. These solutions previously had been theoretically proposed.<sup>3</sup>

This survey used a traffic light system (green-yellow-red) for respondents to evaluate whether these proposed solutions should be considered in the final recommendations. These then potentially could be approved by the EACTAIC Education Committee and Board of Directors after a subsequent quantitative survey. The traffic light system was defined as; "green" is highly recommended, "yellow" may be recommended, and "red" is not recommended. The respondents were asked to choose only one traffic light symbol for each suggested solution. Successful solutions required at least two-thirds green and/or yellow rating to be considered as a consensus opinion for the EACTAIC Education Committee. Addressees received written information about the aims and objectives of the survey, data handling and management, and privacy rights.

All participants provided consent for participation and data analysis. Participation in this study was voluntary and anonymous. The survey was uploaded to the Survey Monkey platform, and the survey link was distributed to all CTVA fellows from the EACTAIC fellow database and other subscribers to

the EACTA newsletter and social media platforms. Reminders were sent until the end of the collection period. All data collected were anonymized, secured, and will remain confidential in the EACTAIC archiving system for five years following the general data protection regulations (accessible at <https://eugdpr.org/>).

### Statistical analysis

Data management and descriptive statistics (number, percentages, median, and interquartile range) were performed using the IBM SPSS Statistics Subscription, Base Edition (Statistical Package for Statistical Analysis, IBM Ireland Product Distribution Limited, IBM House, Shelburne Road, Ballsbridge, Dublin 4, Ireland).

### Results

The initial survey period was set from December 9, 2020, to February 1, 2021. This was extended until March 15, 2021, as only 134 responses had been received. Upon closure of the survey, a total of 193 responses were received. Of those who submitted responses to the survey, eight (4.1%) skipped at least one question. Thus, complete survey data were obtained from 86.5% of respondents. The responses were received from persons in 54 different countries, with the majority in Europe (73.6%), followed by Asia (12.5%), South America (5.7%), Africa (4.7%), North America (3.1%), and Australia and New Zealand (0.5%) (Fig 1). All participants declared their countries of practice. Respondents' type of institution, specialty, and annually performed number of cardiac, thoracic, and vascular surgeries and invasive cardiology procedures (eg, TAVI, MitraClip, TriClip) requiring anesthesia, are presented in Table 1.

The majority of respondents (82.4%) reported some cancellation or postponement of elective cardiac, thoracic, vascular, or invasive cardiology cases due to the COVID-19 first wave in early 2020; pertaining to all cases (45.1%), only cardiac cases (10.4%), or when an intensive care bed for an anticipated postprocedure mechanical ventilation was required (26.9%) (Table 2). A minority of respondents (13.5%) described never

The identified continent of current practice

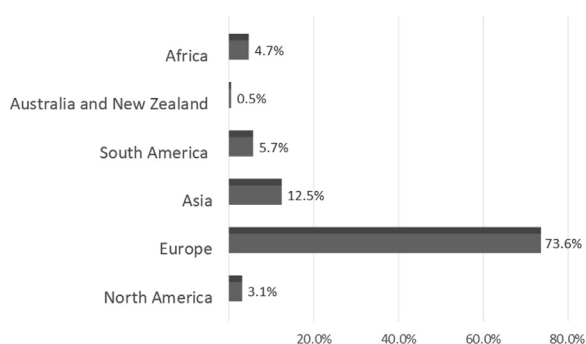


Fig 1. The disclosed location (by continent) of current clinical practice.

Table 1  
Respondents' Characteristics and Infrastructural Aspects of the Workplace

Variable, n (%)	Responses
Type of institution	
University hospital	128 (66.32)
Heart center	62 (32.12)
Tertiary care hospital (neither university hospital nor heart center)	24 (12.44)
Others	3 (1.55)
Primary specialty	
Anesthesiology	187 (96.9)
Intensive care	5 (2.6)
Internal Medicine (eg, cardiology, respiratory medicine)	1 (0.52)
Number of performed cardiac surgery requiring cardiopulmonary bypass per year	
None	5 (2.6)
≤1000	105 (54.4)
1000-2000	60 (31.1)
2000-3000	11 (5.7)
>3000	9 (4.7)
I don't know	3 (1.5)
Number of performed thoracic surgeries requiring lung separation (eg, double lumen tube) per year	
None	11 (5.7)
≤50	28 (14.5)
>50	22 (11.4)
>100	46 (23.8)
>200	78 (40.4)
I don't know	8 (4.2)
Number of performed major vascular surgeries (eg, surgery of the aorta) per year	
None	4 (2.1)
≤100	60 (31.1)
>100	48 (24.9)
>200	31 (16.0)
>300	37 (19.2)
I don't know	13 (6.7)
Number of performed invasive cardiology procedures per year*	
None	14 (7.3)
≤100	53 (27.5)
>100	50 (25.9)
>200	36 (18.7)
>300	32 (16.6)
I don't know	8 (4.2)

Data are presented as number (percentage).

Abbreviation: COVID-19, coronavirus disease 2019.

\* This category includes transfemoral aortic valve replacement (TAVR), MitraClip, and TriClip.

cancelling or postponing the aforementioned cases. The reasons given included low workload, a low number of COVID-19 patients in the country, an administrative decision due to having a dedicated COVID-19 pathway in an isolated building, the availability of routine preoperative polymerase chain-reaction testing and the number of ICU beds, the absence of COVID-19 infected patients in the hospital, the presence of a high-volume center for cardiac and cancer patients, and the classification of cardiac surgery as 'urgent' surgery (Table 2). Most respondents (89.7%) had provided care for patients with confirmed or suspected COVID-19 infection (Table 2). Furthermore, 75.1% of respondents reported that staff members in their center, primarily employed to perform anesthesia for

Table 2  
Hospitals' Measures to Cope With the Rush of COVID-19 Patients

Variable, n (%)	Responses
Cancelling or postponing elective cardiac, thoracic, vascular, or invasive cardiology cases because of the COVID-19 outbreak at the time of its first wave (early in 2020)	193/193 (100)
Yes, all	87 (45.1)
Yes, but only cardiac cases	20 (10.4)
Yes, but only cases needing intensive care (e.g., anticipated need for postoperative mechanical ventilation)	52 (26.9)
I don't know	8 (4.2)
Never	26 (13.5)
If not, why	14/26 (53.8)
Low workload	1 (3.9)
The low number of COVID-19 patients in the country	3 (11.5)
The availability of routine preoperative PCR testing and number of intensive care beds	2 (7.7)
Administrative decision owing to having a dedicated COVID-19 pathway in an isolated building	3 (11.5)
The hospital has no COVID-19-infected patients	2 (7.7)
The hospital is a reference high-volume center for cardiac and cancer patients	2 (7.7)
Cardiac surgery was classified as an 'urgent surgery	1 (3.9)
The proportion of patients with "suspected" or "diagnosed" COVID-19 presenting in your center during the lockdown underwent emergency cardiac surgery	185/193 (95.9)
A small fraction	140 (75.9)
Half of the patients	5 (2.7)
Majority of patients	11 (5.9)
All patients	3 (1.5)
None	15 (8.1)
I don't know	11 (5.9)
Have you ever provided care for patients with "suspected" or "diagnosed" COVID-19 infection?	185/193 (95.9)
Yes	166 (89.7)
Never	19 (10.3)
Reallocation of staff members usually performing anesthesia for cardiothoracic and vascular surgery to work now full or parttime in the ICU to increase the ICU resources	185/193 (95.9)
10%	22 (11.9)
20%	48 (25.9)
50%	22 (11.9)
>50%	32 (17.3)
All	15 (8.1)
None	38 (20.6)
I don't know	8 (4.3)
Perceived shortage of PPE at center	185/193 (95.9)
Yes	84 (45.4)
No	101 (54.6)
Perceived shortage of PPE type for elective surgery	63/193 (32.6)
Hair cover	4 (6.3)
Hood	1 (1.6)
Goggles	1 (1.6)
Face shield	4 (6.3)
N95	8 (12.7)
FFP3, FFP2	21 (33.3)
Surgical mask	10 (15.9)
Gowns / Aprons	6 (9.6)
Protective suits	7 (11.1)
Gloves	3 (4.8)
Shoe cover	4 (6.3)

(continued)

Table 2 (continued)

Variable, n (%)	Responses
Others	2 (3.2)
PAPR	2 (3.2)
All at the beginning of the pandemic	7 (11.1)
Available negative-pressure operating rooms	183/193 (94.8)
Yes	95 (51.9)
No	79 (43.2)
Not known	9 (4.9)
Number of rooms	89/193 (46.1)
1	9 (10.1)
2	20 (22.5)
3	10 (11.2)
4	19 (21.4)
5	3 (3.4)
6	5 (5.6)
≥7	23 (25.8)
Preoperative routine testing for COVID-19 infection	181/193 (93.8)
No	5 (2.8)
Yes	176 (97.2)
Preoperative testing is considered for the following cases	145/193 (75.1)
All cases	130 (89.7)
Elective cases only	14 (9.6)
Urgent and emergent cases only	1 (0.7)
The most commonly performed diagnostic tests	144/193 (74.6)
PCR	130 (90.3)
Chest CT scan	3 (2.0)
Chest CT scan only in symptomatic patients with a negative PCR result	2 (1.4)
Other	9 (6.3)
Availability of a local protocol/guideline for the management of suspected or proven COVID-19 cases with STEMI or high-risk acute coronary syndrome	114/167 (68.3)
Hygienic precautions used for invasive procedures	167/193 (86.5)
Removal of the outer layer gloves	15 (8.9)
Disinfecting the inner layer gloves	2 (1.2)
Wearing a disposable surgical gown and sterile gloves over the PPE	45 (26.9)
Doffing the PPE, hand washing, and redonning of the PPE	13 (7.8)
Removal of the outer layer gloves, disinfecting the inner layer gloves, wearing a disposable surgical gown, and sterile gloves over the PPE	65 (38.9)
Wearing a disposable surgical gown and sterile gloves over the PPE and doffing the PPE, hand washing, and redonning of the PPE	7 (4.2)

Data are presented as ratio or number (percentage).

Abbreviations: COVID-19, coronavirus disease 2019; CT, computed tomography; FFP2, filtering face piece mask type 2; FFP3, filtering face piece mask type 3; ICU, intensive care unit; PPE, personal protection equipment; PAPR, powered air-purifying respirator; PCR, polymerase chain reaction; STEMI, ST-elevation myocardial infarction.

cardiac, thoracic, and vascular surgery, were reassigned to work full or parttime in the ICU to increase ICU staffing, with 25.9% of respondents reporting 20% reallocation of staff and 17.3% reporting more than 50% reallocation of staff (Table 2).

Regarding the perioperative care of patients with confirmed or suspected COVID-19 infection undergoing cardiac, thoracic, and vascular surgery, most respondents reported the use of personal protective equipment (PPE) including hair cover (89.2%), face shield (74.1%), long-sleeve fluid-resistant gowns

(68.7%), goggles (68.1%), standard gloves (55.1%), filtering face piece mask type 2 (FFP2) or FFP3 (42.7%), N95 (37.8%), long gloves (34.1%), hood (31.9%), surgical masks (30.8%), and protective suits (21.1%). The use of a powered air-purifying respirator and plastic apron was reported by only 1.6% of respondents (Fig 2). Perceived shortages of PPE were reported by 45.4% of respondents, including FFP2 or FFP3 respirators (33.3%), surgical masks (15.9%), N95 masks (12.7%), protective suits (11.1%), gowns or aprons (9.6%), hair cover (6.3%), goggles (1.6%), face shield (6.3%), shoe cover (6.3%), gloves (4.8%), or hood (1.6%) (Table 2). The perceived shortage of PPE was reported by 11.1% of respondents as occurring at the beginning of the pandemic (Table 2). The availability of negative-pressure operating theaters was reported by 51.9% of respondents (Table 2). Preoperative routine COVID-19 testing was utilized in the centers of 97.2% of respondents. Testing reportedly was considered in all cases by centers from 89.7% respondents, compared with only in elective cases by centers from 9.6% respondents (Table 2). The polymerase chain-reaction test was the most commonly reported modality for routine preoperative COVID-19 testing (90.3% of respondents) (Table 2). In addition, 68.3% of respondents reported the availability of a local protocol or guideline to manage suspected or confirmed COVID-19 cases with ST-elevation myocardial infarction or high-risk acute coronary syndrome. When carrying out invasive procedures in suspected or proven COVID-19 cases, the most commonly reported method for hygienic precautions utilized the removal of the outer layer of gloves and disinfecting the inner layer of gloves, together with wearing a disposable surgical gown and sterile gloves over PPE (38.9% respondents). Wearing a disposable surgical gown and sterile gloves on top of the PPE was the method reported by 26.9% of respondents (Table 2).

Most of the respondents reported the termination of local educational activities, including clinical rounds, grand rounds, echocardiography rounds, morbidity and mortality conferences (133/167 (79.6%), and the fellowship assessments (eg, Direct Observation of Procedural Skills and 360 evaluations) (86/167 (51.5%) because of the COVID-19 pandemic (Table 3). During this time, 83.9% of respondents reported devoting sufficient time to participating in webinars or other online teaching activities either regularly or intermittently (22.8% and 61.1%, respectively) (Table 3). The vast majority of respondents (83.2%) reported a perceived psychological impact from the COVID-19 pandemic (Table 3).

More than 90% of 167 respondents chose green and/or yellow traffic lights to rate the importance of the suggested solutions to cope with the obstacles faced because of the interrupted fellowship training during the COVID-19 pandemic (Table 4). The rated suggested solutions can be ordered according to the sum of chosen green and/or yellow traffic lights as follows: (1) ensuring continuous communication and providing the fellows with accurate information about local actions to contain the COVID-19 infection and protect employees (99.4%); (2) encouraging fellows to participate in online learning activities (99.4%); (3) supervising and debriefing the fellows whenever possible by the cardiovascular staff, the local CVTA program director, and the ICU staff when the fellow is assigned to the ICU (97.6%); (4) having an agreement between host centers and their fellows covers the time frame for continuing medical care for COVID-19 patients and associated ICU and/or intermediate care unit shifts (97.1%); (5) offering some privileges and/or compensations to the fellows charged with caring for COVID-19 patients at the host centers that cannot afford a payment of a monthly salary (eg, days off, free catering during the shifts, healthcare services if

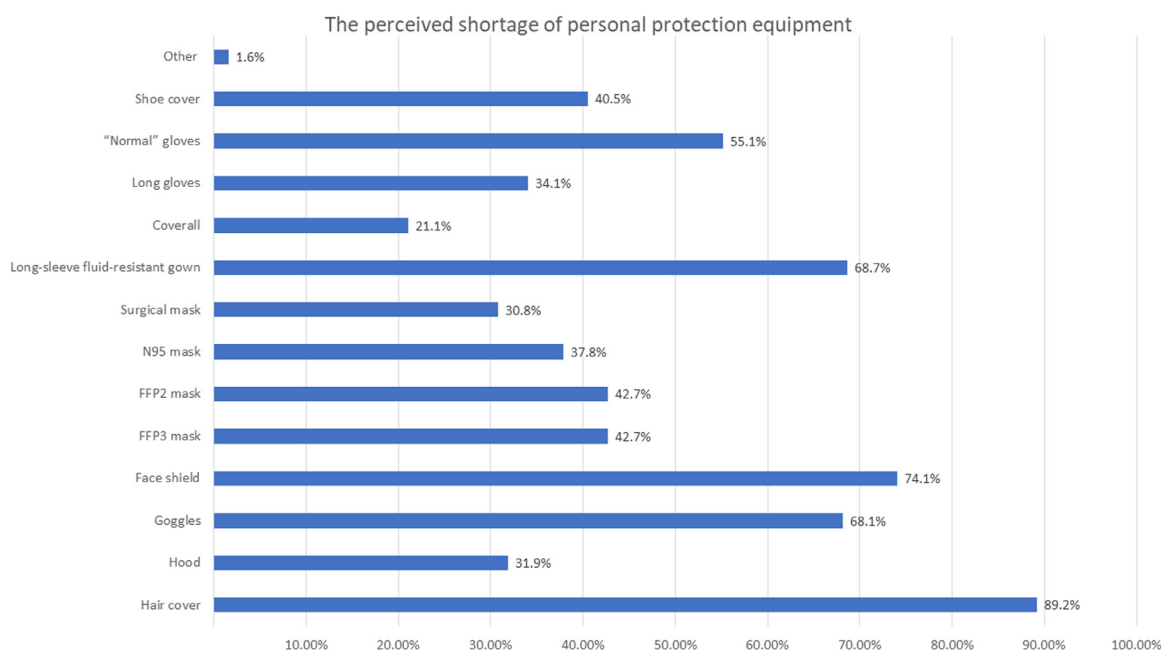


Fig 2. The perceived shortage of personal protection equipment. Data are presented as a percentage. PAPR; powered air-purifying respirator; PPE, personal protection equipment.

Table 3  
Impact of COVID-19 Pandemic on Education and Staff

Variable, n (%)	Responses
Termination of educational activities (clinical rounds, grand rounds, echo rounds, Morbidity and mortality conferences)	167/193 (86.5)
Yes	133 (79.6)
No	34 (20.3)
Termination of fellowship assessments DOPS, 360 evaluations)	167/193 (86.5)
Yes	86 (51.5)
No	81 (48.5)
Devoted sufficient time to participate in webinars or other online teaching activities	167/193 (86.5)
Regularly	38 (22.8)
Intermittently	102 (61.1)
Rarely or never	27 (16.2)
The perceived psychological impact of COVID-19 on respondents	167/193 (86.5)
Definitely	100 (59.9)
I could visit my relatives and friends in the domestic country less often and therefore had emotional stress	16 (9.6)
I could visit my relatives and friends abroad less often and therefore had emotional stress	15 (8.9)
No	19 (11.4)
I don't know	9 (5.4)
Yes, but	8 (4.8)
I am fine	1/8 (12.5)
Only sometimes	1/8 (12.5)
Because of national social restrictions rather than professional circumstances	1/8 (12.5)
I am desperate because my family members are sick in the hit region	1/8 (12.5)
I feel that we are left lonely during the on-call duties	1/8 (12.5)
I am trying to cope with it	3/8 (37.5)

Data are presented as ratio or number (percentage).

Abbreviations: COVID-19, coronavirus disease 2019; DOPS, Direct Observed Procedural Skills.

they are not covered with medical insurance, or free access to (national and international educational courses) (95.8%); (6) moving toward a competency-based rather than time-based curriculum (95.8%); (7) providing psychological and mental support by the host centers (94.1%); (8) waiving the requirement to complete the European Association of Cardiovascular Imaging and/or EACTAIC certification examination for transesophageal echocardiography, with completion of the examination at the earliest possible date (92.8%), (9) considering the time spent in the ICU during the COVID-19 outbreak as fulfilling the requirements for rotation in the ICU during the basic training and advanced training periods (92.8%), and (10) extending the training periods to allow the Fellow to fulfill the required number of cases and competency levels (91.6%). Other suggestions by respondents are included in [Table 4](#).

## Discussion

During this pandemic, COVID-19 has had implications for both COVID-19 and non-COVID-19 patients and the staff caring for them. The results from this survey showed the nature

of these implications and demonstrated that they have occurred for a multitude of reasons. The majority of survey respondents reported providing care to suspected and/or confirmed COVID-19 patients and also experiencing the reallocation of staff from their usual clinical roles to support the need for increased critical care capacity in their centers. It is clear from the data that individual centers delivering fellowship programs were all either working at pandemic response levels 2 or 3 according to the ACGME definition. Furthermore, the majority of survey respondents also reported a degree of postponement or cancellation of cardiothoracic and vascular cases. Future study might include consideration of whether some specific areas of cardiac intervention may have, in fact, increased in this time (something not specifically asked during this current study). A potential example of this might be an increase in the utilization of transcatheter aortic valve implantation in the context of curtailment of conventional, open-heart aortic valve replacement during the pandemic (typically, transcatheter aortic valve implantation cases do not require a level 3 intensive care bed).

It has been recognized in other specialties that the COVID-19 pandemic has negatively impacted operative volumes experienced by training-grade doctors in general surgery.<sup>5,6</sup> The adverse effects on clinical training following the cancellation or curtailment of usual clinical services have been recognized in other subspecialty areas, including neuroanesthesia, cardiology, radiology, and plastic surgery.<sup>7-11</sup> The results from this survey were in line with these findings in that the COVID-19 pandemic has negatively impacted the caseload available for the EACTAIC CTVA fellows in training. Furthermore, this survey also has demonstrated that teaching and training opportunities have been reduced, as were opportunities for training evaluation. This was consistent with a study of residents and fellows in a nationwide study in Saudi Arabia in 2020 that showed 84.6% of respondents reported a reduction in training activities.<sup>12</sup> The significant impact of the pandemic on subspecialty fellowship training also has been reported from the United States.<sup>13,14</sup>

While it is positive that preoperative COVID-19 testing of patients was reported by the majority of respondents, worryingly, 45% of respondents perceived a shortage of PPE in their centers. Moreover, this survey also highlighted the presence of the adverse psychological impact of COVID-19 on the survey respondents. These results were consistent with previously published studies regarding the adverse mental health and well-being effects of the pandemic upon both surgical and nonsurgical residents within a large hospital and upon radiology trainees.<sup>9,15</sup> Despite these challenges, most respondents in the current survey found some time to participate regularly or intermittently in educational activities.

The current EACTAIC curriculum for CTVA fellows is based on predefinitions of training duration, case numbers, and competency levels. This survey supported the notion that the COVID-19 pandemic has limited the ability of EACTAIC fellows to successfully meet these training requirements.

An important focus for this study was to attempt to understand the perceived value of some proposed solutions that

Table 4

The Suggested Solutions to Cope With Interruption of the Fellowship Training on the Traffic Light Signals Scale, Where “Green” Is Highly Recommended, “Yellow” May Be Recommended, and “Red” is Not Recommended

Variable, n (%)	Green	Yellow	Red
The time spent in the intensive care unit during the COVID-19 outbreak should be considered as fulfilling the requirements for rotation in the intensive care unit during the obligatory basic training and advanced training periods.	87 (52.1)	68 (40.7)	12 (7.2)
Dispensing with training periods and rotations or the number of cases required for training periods, moving towards a competency-based rather than time-based curriculum.	86 (51.5)	74 (44.3)	7 (4.2)
Waiver of the requirement to complete the EACVI and/or EACTAIC certification examination for transesophageal echocardiography in 2020, with completion of the examination at the earliest possible date for the Fellow and Program Director.	90 (53.9)	65 (38.9)	12 (7.2)
Extension of the training periods to allow the Fellow to fulfill the required number of cases and competency levels.	113 (67.7)	40 (23.9)	14 (8.4)
An agreement between host centers and their fellows covering the time frame for continuing medical care for COVID-19 patients and associated ICU and/or IMC shifts.	104 (62.4)	58 (34.7)	5 (2.9)
Host centers ensure continuous communication and providing their Fellows with accurate information about local actions to contain the COVID-19 infection and protect employees.	131 (78.4)	35 (21)	1 (0.6)
Host centers that cannot afford a payment of a monthly salary could offer some privileges and/or compensations to the Fellows charged with caring for COVID-19 patients, such as days off, free catering during the shifts, healthcare services if they are not covered with medical insurance, or free access to (national and international) educational courses (webinars) whenever possible.	98 (58.7)	62 (37.1)	7 (4.2)
Host centers provide psychological and mental support.	116 (69.5)	41 (24.6)	10 (5.9)
Supervise and debrief Fellows whenever possible by the cardiovascular staff and the local CVTA program director, and the ICU staff when the Fellow is assigned to the ICU.	123 (73.7)	40 (23.9)	4 (2.4)
Encouraging fellows to participate in online learning activities (eg, webcasts, webinars, and forums) to improve their knowledge of cardiothoracic and vascular medicine and related topics.	147 (88)	19 (11.4)	1 (0.6)
<b>Other suggested solutions</b> (Free text responses)			49/193 (25.4)
Encourage mutual exchange among the mentors for education and lectures			2 (4.1)
EACTAIC should come in direct contact with the fellows of each center, asking their opinion regarding the training they are receiving.			1 (2.0)
EACTAIC should also check closer the quality of the training of the different centers.			1 (2.0)
A fellowship program cannot be called a Fellowship in Cardiac Anesthesia when the fellow attends the theatres only 6 days per month.			1 (2.0)
Offering other alternatives for fellows to protect their training time, such as working in private hospitals.			1 (2.0)
Extending the fellowship training period with competency-based outcome assessment.			3 (6.1)
Working in COVID-19 ICU can be considered as only partial fulfillment for the ICU training rotation.			1 (2.0)
A granted grace period should be offered for overseas trainees to joining the fellowship program because of international travel restrictions			2 (4.1)
The EACTAIC host centers for the EACTAIC fellowship program should pay for the fellows for caring for COVID-19 patients.			2 (4.1)

might be employed by the EACTAIC Education Committee in due course. The respondents of this survey positively rated a number of proposed solutions to mitigate the negative effects of COVID-19 on training. Strategies, such as moving toward a competency-based curriculum, waiving the requirement to complete the transesophageal echocardiography certification until the next possible date, recognizing the time in ICU during the COVID-19 pandemic toward ICU training time, or extending training periods to allow fellows to fulfill training requirements, either were recommended or highly recommended by respondents using the traffic light system. These aspects require consideration by the EACTAIC Education Committee and Board of Directors. Indeed, in recent times in many European countries, there has been a move toward a competency-based curriculum,<sup>16</sup> and, therefore, these solutions may have particular merit.

Within the United States, the ACGME has highlighted that the “. . .visits/case logs of a program’s graduates who were on duty during this pandemic. . . will be judiciously evaluated in light of the impact of the pandemic on that program.”<sup>17</sup> Further, the National Board of Echocardiography temporarily has given trainees more time to fulfill log-book requirements considering interruptions that occurred to training during the pandemic.<sup>18</sup> These measures mirror

some of those most highly recommended within this current survey.

There were a number of limitations to this survey. Firstly, the actual response rate was difficult to assess given the multiple platforms and modalities used to generate invitations to the survey. In this respect, only a low percentage of respondents from North America completed the survey—probably because of its marketing mainly through the subscribers of EACTAIC newsletter and related social media platforms. The majority of EACTAIC subscribers are practicing in Europe and Asia. Perhaps, surprisingly, when EACTAIC conducted an unpublished joint survey on the practice of cardiac anesthesia during the COVID-19 pandemic with the Society of Cardiovascular Anesthesiologists, the majority of 385 participants from 48 countries were from North America and Europe (46.7% and 36%, respectively). The second potential limitation was that given the widespread subscriber base to EACTAIC, the invitees (and, therefore, respondents) encompassed specialty doctors from centers that were not necessarily accredited by EACTAIC for CTVA fellowship training. Thus, the authors here were unable to specifically identify whether individual respondents were from accredited fellowship centers or were trainees or trainers from other institutions. Given there are a limited number of EACTAIC-accredited centers, each with a

Table 5  
Summary Table

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Main messages from this study

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Most respondents to this survey reported a termination of local educational activity during the COVID-19 pandemic  
Most respondents to this survey reported an adverse psychological impact of the COVID-19 pandemic.

Potential solutions for mitigating the effects of interruptions to fellowship training have been proposed and rated by respondents.

These data will assist the EACTAIC Educational Committee to come to informed decisions on the mitigation of the impact of future pandemics.

**Potential imitations of this Study**

The precise demographics of all respondents are unknown due to the wide-ranging nature of the survey.

There were multiple platforms used to approach potential participants meaning that it was not possible to identify the precise response rate.

**Future areas for research**

Identification of differences in the experience of pandemic conditions between trainees/fellows and trainers.

Bench-testing of some of the proposed mitigation solutions in real-world conditions.

Identification of the impact of future pandemic waves and the impact of vaccination roll-out on the fellowship program.

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Abbreviations: COVID-19, coronavirus disease 2019; CTVA, cardiothoracic and vascular anesthesia; EACTAIC, European Association of Cardiothoracic Anaesthesiology and Intensive Care; EACVI, European Association of Cardiovascular Imaging; ICU, intensive care unit; IMC, intensive medical care.

relatively small number of fellowship positions, it is most likely that the vast majority of respondents were doctors working outside of EACTAIC fellowship programs. Although this can be seen as a limitation of the current study, it did permit the canvassing of a large number of clinicians with an interest in cardiothoracic and vascular training, with an improved chance of gaining an insight into both the broader effects of COVID-19 and potential solutions for the future. Any future study certainly should aim to gain further insight into the nature of the respondents to understand what (if any) existing experience they have had with the EACTAIC fellowship program. The scope of the survey was extensive, including questions on the educational impact of COVID-19, the clinical service effects that were encountered, and other challenges (including the sourcing of PPE) that respondents experienced. Some of the respondents may inevitably, as a consequence of the wide-ranging nature of this survey, have had limited knowledge or experience of training EACTAIC fellows.

Despite these limitations, this survey highlighted some of the issues experienced by the respondents in terms of their clinical work, training experiences, and psychological impact during the COVID-19 pandemic. This survey offered a number of proposed solutions in response to these issues, which warrant consideration by EACTAIC (Table 5).

**Acknowledgments**

The authors appreciate the assistance provided by Ms. Noemi Albanese, EACTAIC Association Manager, AIM Italy Srl.

**Conflict of Interest**

All authors are members of the European Association of Cardiothoracic Anesthesiology and Intensive Care.

**References**

- 1 Organization WH. WHO Coronavirus disease (COVID-19). Situation Report – 162. Available at: <https://www.who.int/docs/default-source/coronavirus/20200630-covid-19-sitrep-162>. Accessed June 2021.
- 2 Cacciapaglia G, Cot C, Sannino F. Multiwave pandemic dynamics explained: How to tame the next wave of infectious diseases. *Scientific Reports* 2021;11:6638.
- 3 El-Tahan MR, Schreiber JU, Diprose P, et al. Interruption of the European Association of Cardiothoracic Anaesthesiology (EACTA) fellowship program during the coronavirus disease 2019 pandemic: Consequences and solutions. *J Cardiothorac Vasc Anesth* 2020;34:2581–5.
- 4 Feinman JW, Roberts ML, Al-Ghofaily L, et al. The fellowship experience in adult cardiothoracic anesthesiology-strategies for applicants and fellows to navigate the coronavirus crisis. *J Cardiothorac Vasc Anesth* 2020;34:2561–5.
- 5 Cryer CM, Murayama KM. Paradox of resident case numbers. Is there a number that qualifies competence? *JAMA Surg* 2021;156:774.
- 6 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;156:767–74.
- 7 Rajan S, Bebawy J, Avitsian R, et al. The impact of the global SARS-CoV-2 (COVID-19) pandemic on neuroanesthesiology fellowship programs worldwide and the potential future role for ICPNT accreditation. *J Neurosurg Anesthesiol* 2021;33:82–6.
- 8 Rao P, Diamond J, Korjian S, et al. The impact of the COVID-19 pandemic on cardiovascular fellows-in-training: A national survey. *J Am Coll Radiol* 2020;76:871–5.
- 9 Alhasan AS, Alahmadi SM, Altayeb YA, et al. Impact of COVID-19 pandemic on training and well-being in radiology residency: A national survey of diagnostic radiology trainees in Saudi Arabia. *Acad Radiol* 2021;28:1002–9.
- 10 Hoegger MJ, Shetty AS, Denner DR, et al. A snapshot of radiology training during the early COVID-19 Pandemic. *Curr Probl Diagn Radiol* 2020;50:607–13.
- 11 Hamidian Jahromi A, Arnautovic A, Konofaos P. Impact of the COVID-19 pandemic on the education of plastic surgery trainees in the United States. *JMIR Med Educ* 2020;6:e22045.
- 12 Balhareh A, Alduhileb MA, Aldulajjan FA, et al. Impact of COVID-19 pandemic on residency and fellowship training programs in Saudi Arabia: A nationwide cross-sectional study. *Ann Med Surg (Lond)* 2020;57:127–32.
- 13 Johnson J, Chung MT, Stathakios J, et al. The impact of the COVID-19 pandemic on fellowship training: A national survey of pediatric otolaryngology fellowship directors. *Int J Pediatr Otorhinolaryngol* 2020;136:110217.
- 14 Salehi PP, Torabi SJ, Lee YH, et al. Effects of COVID-19 on facial plastic and reconstructive surgery fellowship training and director practices. *OTO Open* 2021;5:2473974X211014130.
- 15 Alshdaifat E, Sindiani A, Khasawneh W, et al. The impact of COVID-19 pandemic on training and mental health of residents: A cross-sectional study. *BMC Med Educ* 2021;21:208.
- 16 Jonker G, Manders LA, Marty AP, et al. Variations in assessment and certification in postgraduate anaesthesia training: A European survey. *Br J Anaesth* 2017;119:1009–14.
- 17 Accreditation Council for Graduate Medical Education, Statement on 'ACGME Response to the Coronavirus (COVID-19). Available at: <https://acgme.org/Newsroom/Newsroom-Details/ArticleID/10111/ACGME-Response-to-the-Coronavirus-COVID-19/>. Accessed June 12, 2021.
- 18 National Board of Echocardiography. Statement on 'Covid-19 Temporary Extended Certification Pathways. Available at: <https://files.constant-contact.com/86e6a2a6be/65e81537-9c66-4420-9c36-a58f2bd5c93e.pdf>. Accessed June 12th.