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## ORIGINAL RESEARCH

# Program Directors Survey on the Impact of the COVID-19 Pandemic on Cardiology Fellowship Training



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## ABSTRACT

**BACKGROUND** The COVID-19 pandemic catalyzed unprecedented changes to medical education, including CV fellowship programs. CV fellowship PDs offer a unique perspective regarding the impact of the pandemic on CV medical education.

**OBJECTIVES** The 4th annual Cardiovascular Diseases (CV) Fellowship Program Directors (PDs) Survey sought to understand the impact of the COVID-19 pandemic on CV fellows and fellowship programs.

**METHODS** The survey contained 31 items examining the clinical, educational, and academic impact of the COVID-19 pandemic on CV fellowship programs.

**RESULTS** Survey response rate was 54%. Most respondents (58%) represented university-based programs. Most PDs felt that changes to clinical practice during the COVID-19 negatively impacted fellow education in cardiac catheterization (66%), outpatient cardiology (52%), nuclear imaging (51%), and echocardiography (50%). Despite improving attendance, 75% of PDs felt that virtual educational conferences adversely impacted interaction between participants. Only 22% felt they improved fellow education. Most PDs (85%) reported a negative impact of the pandemic on fellow well-being and burnout, and 57% reported a decrease in research productivity among fellows. Even though virtual recruitment allowed programs to interview more competitive candidates, most PDs felt that virtual interviews adversely impacted interactions between their fellows and candidates (71%) and their ability to convey the culture of their program (60%).

**CONCLUSIONS** Most CV fellowship PDs felt the COVID-19 pandemic brought changes that negatively impacted the clinical training, didactic learning, academic productivity, and well-being among cardiology fellows. The implications of these changes on the competency of cardiologists that trained during the COVID-19 pandemic deserve future study. (JACC Adv 2024;3:101008) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

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**ABBREVIATIONS  
AND ACRONYMS****ACC** = American College of  
Cardiology**CV** = cardiovascular disease**PD** = program director

When the COVID-19 pandemic began in early 2020, it catalyzed unprecedented medical, economic, and cultural upheaval.<sup>1</sup> Disruptions to graduate medical education have been similarly profound.<sup>2-4</sup> Residents and fellows witnessed drastic shifts in patient care volumes, the proliferation of nontraditional and digital education, stresses to personal and professional well-being, and implementation of exclusively virtual recruitment for training programs.<sup>5-9</sup>

Several studies assessed the impact of the COVID-19 pandemic on cardiovascular (CV) training. A survey of 997 adult and pediatric cardiology fellows revealed concerns among trainees regarding their personal safety, professional development, and career opportunities after completion of training.<sup>10</sup> A survey of 126 cardiac electrophysiology fellows and program directors (PDs) reported a substantial reduction in procedural volumes and concerns regarding achievement of procedural competency among fellows.<sup>11</sup> Similarly, a small survey of 14 interventional cardiology fellowship PDs and 25 interventional cardiology fellows in the New York City metropolitan area, the epicenter of the COVID-19 pandemic, identified a decrease in coronary interventions and worries about acquiring adequate procedural experience among PDs and their trainees.<sup>12</sup> In response to these challenges, educational leaders have called for flexibility and innovation in CV training paradigms.<sup>13</sup>

Despite this impact of COVID-19 on CV fellows and fellowship programs, no prior literature has assessed the impact of the COVID-19 pandemic on general CV fellowship programs from the perspective of program leadership. PDs possess direct responsibility over their program's curriculum and professional development of their trainees.<sup>14</sup> Thus, understanding PDs' perceptions regarding the COVID-19 pandemic will allow PDs to more accurately weigh future changes to their program and carries fundamental implications for not only training programs but also cardiology fellows and the patients they serve.

The American College of Cardiology (ACC) Cardiovascular Program Director and Graduate Medical Education Section developed the 4th Annual Cardiovascular Program Director Survey to understand the educational and programmatic impact of

the COVID-19 pandemic on cardiology fellowship training from the perspective of CV fellowship PDs.

**METHODS**

As with prior versions of this survey, members of the ACC's Cardiovascular Program Directors and Graduate Medical Education Section developed questions through an iterative process.<sup>6,15-19</sup> ACC staff with expertise in survey design reviewed survey items prior to distribution. The survey contained 43 questions, 12 of which addressed demographic information about CV fellowship programs. The remaining 31 focused on the impact of the COVID-19 pandemic on cardiology fellowship training. These 31 items addressed questions surrounding the impact of the pandemic on: 1) clinical training of cardiology fellows; 2) fellowship educational practices, 3) fellow academic development; and 4) virtual fellowship recruitment. The items regarding virtual recruitment focused largely on the 2020 recruitment cycle for fellows beginning training in July of 2021.

All U.S.-based general CV fellowship programs with accreditation from the Accreditation Council of Graduate Medical Education were eligible for our survey. We identified these programs through the Accreditation Council of Graduate Medical Education's online database. ACC staff distributed the survey to each program's respective PD via email with a program-specific link and four subsequent reminders. The survey was open April 21, 2021, to July 6, 2021. As with our prior work and in accordance with FREIDA, the American Medical Association Residency and Fellowship Database, we defined program type as university-based (majority of experience in a hospital that is the primary affiliate of a medical school), university-affiliated (majority of experience in a community-based hospital that is affiliated with, but not the primary affiliate of, an academic medical center), community, and military/other.<sup>6,15-19</sup> We defined program size as small (1-10 fellows), medium (11-17), and large (18 or more). We defined PD age as early career (34-45 years), mid-career (46-55 years), and late career ( $\geq 56$  years).

ACC staff collected data in a deidentified manner using Verint EFM, version 15.1 and analyzed data using SPSS, version 23. The MedStar Washington

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

Hospital Center Institutional Review Board in Washington, DC, approved this research.

**RESULTS**

**RESPONDENT CHARACTERISTICS.** PDs from 139 of the 257 eligible programs (54%) completed the survey. **Table 1** shows characteristics of responding programs and PDs. Geographic distribution of responding programs corresponded with our prior surveys.<sup>18,19</sup> The majority of programs were university based (58%). Seventy-seven percent of PDs were men. Median duration in the PD position was 5 years. Most PDs were associate or full professors (68%). Programs with PDs that did not respond were less likely university based (44%) and more likely from the south (39%) compared to programs with PDs that completed the survey.

**CLINICAL IMPACT.** At the time of survey completion in mid-2021, 34% of respondents reported ongoing changes to clinical rotations to adjust for lost procedural or clinical exposure due to practice changes related to the COVID-19 pandemic. **Figure 1** displays the impact of pandemic-induced changes to clinical practice and volumes on fellow education. Most PDs reported a negative impact to education in cardiac catheterization (66%), outpatient general cardiology (52%), nuclear imaging (51%), and echocardiography (50%). Inpatient education was impacted less negatively. Only a third of PDs noted a negative impact, and 14% reported a positive effect of pandemic-related practice changes on inpatient intensive care. These impacts of pandemic-induced changes to clinical practice were consistent across program size and type.

Eighty-seven percent of PDs reported that fellows in their program participated in telehealth or virtual outpatient appointments, and 52% of those felt this would continue in their program when the pandemic ended. Sixty-three percent of PDs reported that their fellows remotely interpreted imaging studies without direct face-to-face supervision during the pandemic. Of those who did, the most common modality was echocardiography (90%) followed by nuclear imaging (56%). This practice was more common in large (78%) compared to small (58%) and medium (50%) programs.

**EDUCATIONAL IMPACT.** At the time of the survey, 50% of PDs indicated >75% of their program’s educational conferences were exclusively virtual, with 28% indicating that all conferences were exclusively virtual. Conducting all conferences virtually was much more common in large (36%) and medium (32%) programs compared to small programs (16%). The most common formats for virtual learning

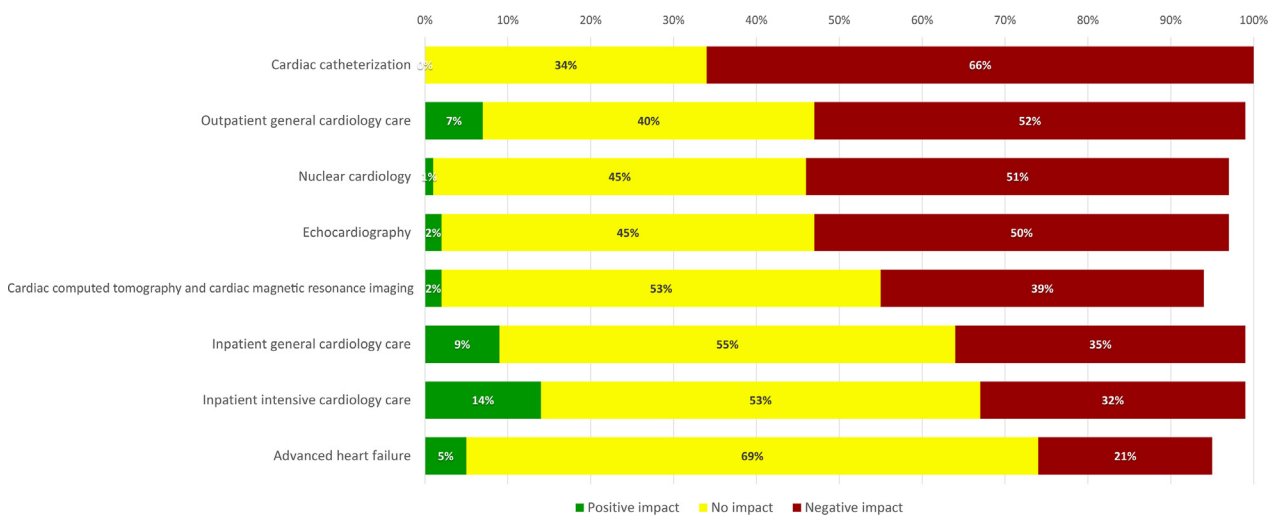
**TABLE 1 Characteristics of Responding Programs and Program Directors**

<b>Region</b>	
South	28%
Northeast	32%
Midwest	22%
West	18%
<b>Program type</b>	
University-based	58%
University-affiliated	31%
Community	9%
Military/other	2%
<b>Size</b>	
Small (1-10 fellows)	32%
Medium (11-17 fellows)	32%
Large (≥18 fellows)	36%
<b>Program director gender</b>	
Men	77%
Women	23%
<b>Program director age</b>	
34-45 y (early career)	31%
46-55 y (mid-career)	33%
56-65 y (late career)	24%
≥66 y (late career)	10%
Declined to answer	2%
<b>Program director ethnicity</b>	
White	58%
Asian	24%
Hispanic	3%
African American	4%
Other	6%
Declined to answer	5%
<b>Program director academic rank</b>	
Full professor	30%
Associate professor	38%
Assistant professor	20%
Instructor	2%
Other or none	8%
Declined to answer	1%
<b>Program director years in current role</b>	
≤3	31%
4-7	37%
≥8	32%

Values are % of total respondents. Percentages may not sum to 100% due to rounding.

included lectures (95%), case discussions (83%), and journal clubs (75%). Fifty-two percent of PDs reported integrating virtual content from other institutions or organizations into their fellows’ regular educational sessions. Most PDs (68%) anticipated delivering their educational conferences in a hybrid format with combined face-to-face sessions coupled with video conferencing options when pandemic-related restrictions ended.

**Figure 2** shows PD’s perceptions regarding the impact of a virtual format on educational aspects of

**FIGURE 1** Impact of Pandemic-Induced Changes to Fellow Education in Clinical Areas

Percentages reflect respondents reporting positive, no, or negative impact to the statement "how have pandemic-induced changes to clinical care and clinical volumes at your institution impacted fellow education in the following areas?" Percentages may not sum to 100% due to a small number of respondents indicating "not applicable" or not answering the item.

fellow conferences. While most PDs felt that virtual conferences improved attendance of faculty (67%) and fellows (56%), 44% reported a negative impact on fellow education, and 75% reported a negative impact on interaction between conference participants. Tools to increase the educational value of virtual conferences included the videoconferencing chat function (68% of respondents), allowing small groups of fellows to join a videoconference together from a specific location (53%), and recording sessions for later viewing (51%). Only 22% of PDs felt that virtual conferences improved fellow education, and 10% required virtual conference participants to activate their cameras so their face was always visible. These findings and practices were similar across program size and type.

**ACADEMIC IMPACT.** Figure 3 shows PD's perceptions of the impact of the COVID-19 pandemic on fellows' research, mentorship, and well-being. The vast majority of PDs (85%) identified a negative impact on fellows' sense of well-being and burnout. Forty percent felt the pandemic reduced access to resources to promote well-being and combat burnout, while 25% identified a positive impact on such resources. Fifty-seven percent reported a negative impact on research productivity, and 48% reported decreased fellow access to research mentorship. Fifty percent and 33% reported decreased access to external and internal career mentorship, respectively. Finally, 43%

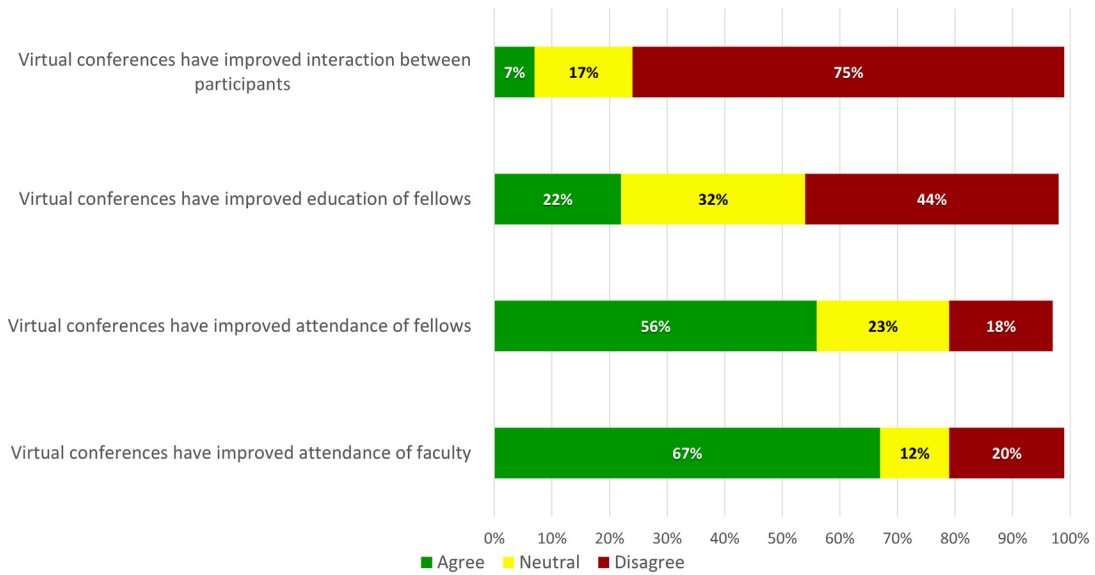
of PDs felt that the pandemic adversely impacted the ability of their fellows to find jobs upon completion of training.

**VIRTUAL RECRUITMENT.** Nearly all responding PDs (94%) reported that their program participated in virtual recruitment in the 2020 to 2021 recruitment cycle. The large majority (89%) reported an increase in applicant volumes, and 64% reported an increase in the number of candidates their program interviewed.

Figure 4 displays the perceptions of PDs regarding various aspects of virtual fellowship recruitment. Most PDs felt that virtual recruitment hindered the interactions between candidates and fellows (71%) and the ability to convey the culture of their program to candidates (60%). Fifty-five percent of PDs reported an increase in the competitiveness of candidates to their program with a shift to virtual recruitment. Furthermore, 49% felt their program was able to assess candidates more effectively in the virtual environment. As a group, PDs reported mixed perceptions regarding the impact of virtual recruitment on the geographic, gender, and racial diversity of their candidates.

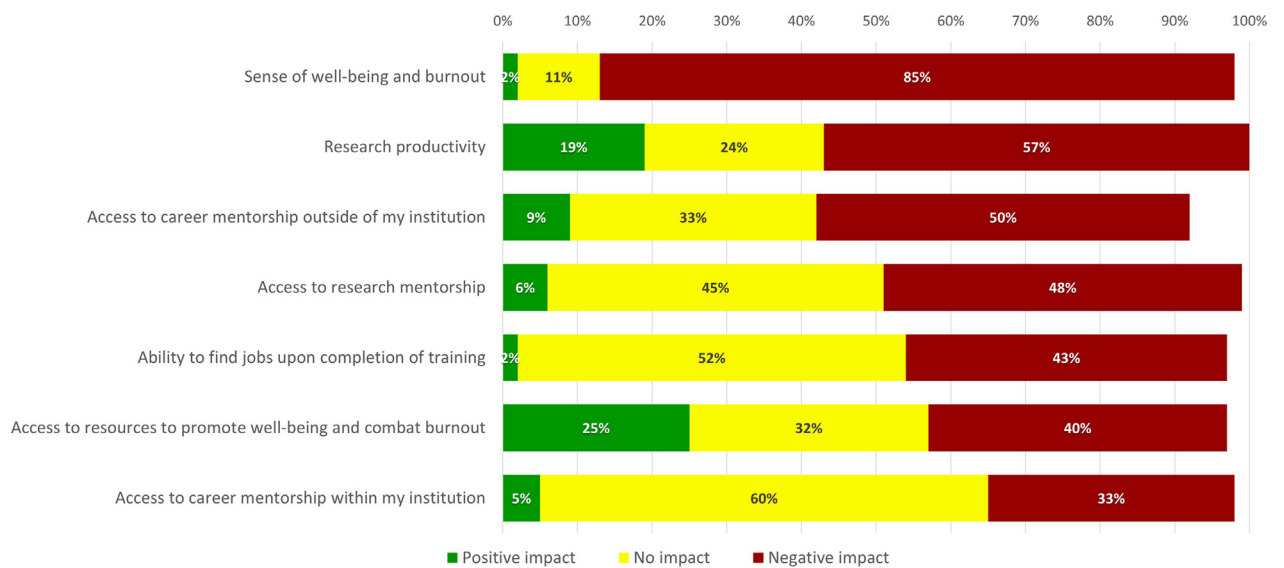
Regarding post-pandemic plans, 35% of PDs anticipated offering only in-person interviews while 24% anticipated a hybrid approach to recruitment, offering both virtual and traditional interview options when able. Only 8% of PDs felt their program would

**FIGURE 2** Impact of Virtual Conferences on Fellow Education

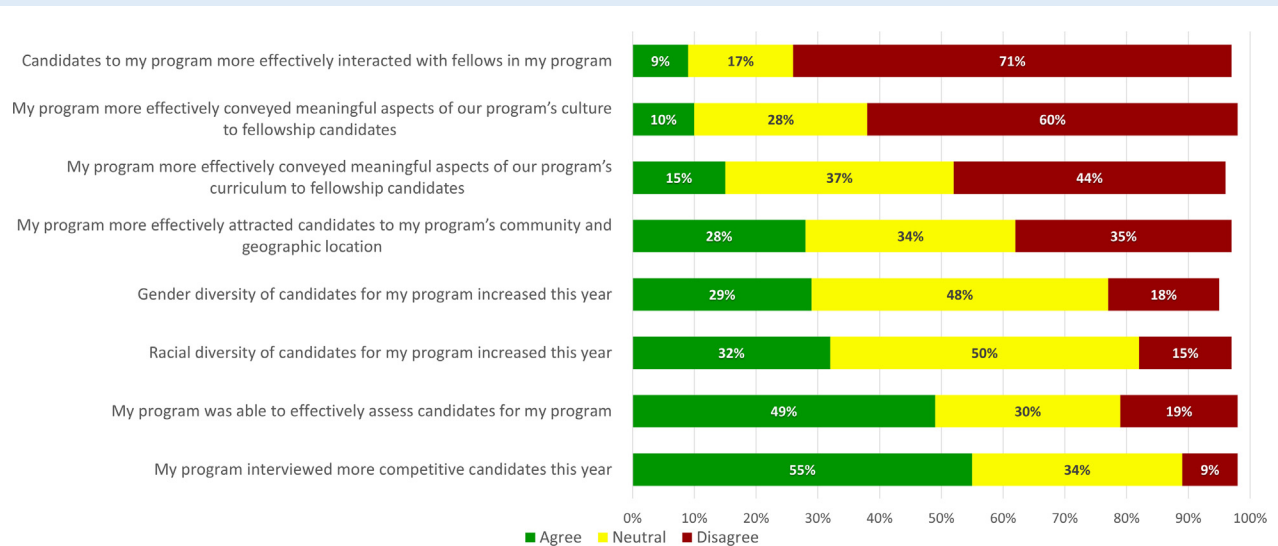


Percentages reflect responses to the statement "based on your current perception of educational conferences in your program, to what extent do you agree with the following statements?" Percentages may not sum to 100% due to a small number of respondents indicating "unable to comment" or not answering the item.

**FIGURE 3** Impact of the Pandemic on Fellow Research, Mentorship, and Well-Being



Percentages represent respondents reporting positive, no, or negative impact to the statement "what is your perception of how the COVID-19 pandemic impacted research, mentorship, and well-being for fellows in your program?" Percentages may not sum to 100% due to a small number of respondents indicating "unable to comment" or not answering the item.

**FIGURE 4** Impact of Virtual Fellowship Recruitment

Percentages reflect responses to the statement "to what extent do you agree with the following statements regarding virtual recruitment for the December 2020 fellowship match?" from the 131 respondents who indicated their program participated in the December 2020 fellowship match. Percentages may not sum to 100% due to a small number of respondents indicating "unable to comment" or not answering the item.

proceed with completely virtual recruitment for the foreseeable future. These findings were not significantly different across program size, type, or geographic location. The most common novel tools for virtual recruitment included video tours (79%), virtual question and answer sessions between fellows and candidates without faculty present (65%), videos highlighting program curriculum (61%), and recorded testimonials from fellows (56%). Small programs were less likely to employ recordings from fellows (41%) compared to medium (67%) and large (57%) programs. Forty-one percent of PDs reported using social media postings for the first time as part of the shift to virtual recruitment.

## DISCUSSION

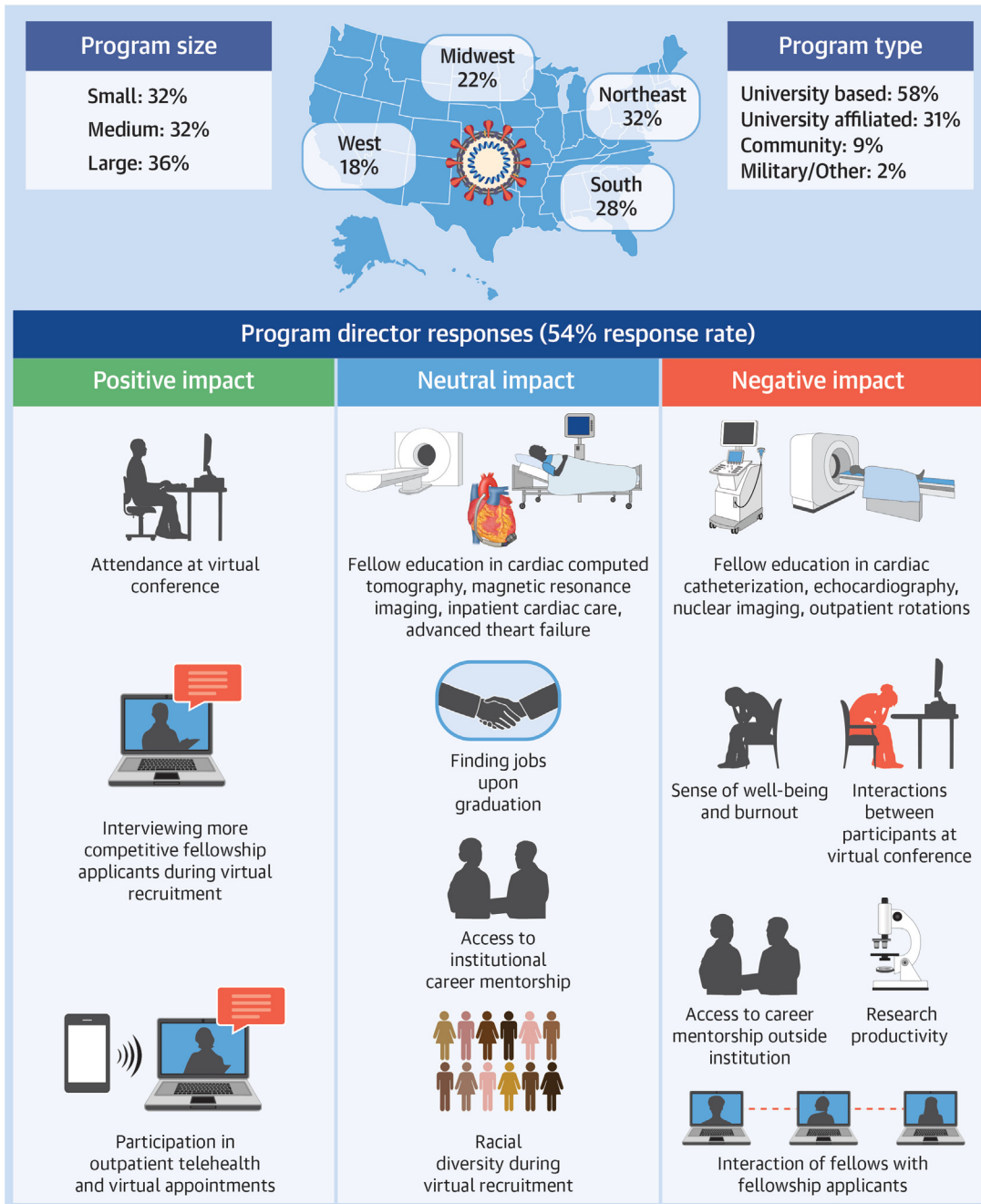
Our survey of cardiology fellowship PDs during the COVID-19 pandemic found widespread changes to clinical practice impacting cardiology training programs. Adverse impacts were most pronounced in procedural and outpatient areas, while fellowship programs noted an expansion of telehealth and remote image interpretation. PDs oversaw the growth of virtual educational conferences and had mixed perceptions regarding the shift to virtual recruitment for fellowship programs. Finally, respondents identified pervasive negative effects of the pandemic on

well-being and burnout, research productivity, and access to mentorship in cardiology fellowship programs (Central Illustration).

Multiple prior studies have documented a reduction in cardiovascular procedural volumes associated with the COVID-19 pandemic.<sup>11,12,20,21</sup> Our study supports these findings from the perspective of fellowship PDs. Despite the patient volume, increased complexity, and workflow adjustments in cardiac intensive care unit practice that the COVID-19 pandemic catalyzed,<sup>22,23</sup> only 13% of PDs reported a positive impact of such pandemic-related changes on fellow education in the cardiac intensive care unit. This lack of educational benefit despite higher inpatient volume could be related to the need to redeploy cardiology fellows to noncardiology services.<sup>10</sup> What remains unknown is the long-term educational impact of reduced procedural exposure and other alterations to clinical practice.

Social distancing to mitigate the spread of COVID-19 necessitated a rapid shift to virtual educational conferences across medical education, including in cardiology fellowship programs.<sup>5,24</sup> Despite better attendance at conferences from both faculty and fellows, most PDs reported decreased participant interaction in this virtual environment. To address these concerns, PDs reported use of the chat function and allowing small groups to attend virtual

**CENTRAL ILLUSTRATION** Program Directors' Perspective Regarding the Impact of the COVID-19 Pandemic on General Cardiovascular Diseases Fellowship Programs



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Due to changes with the COVID-19 pandemic, the majority of program directors reported increased attendance at conferences, increased competitiveness of candidates for fellowship, and more participation in telehealth. The majority of program directors also reported decreased educational opportunities in multiple core cardiovascular clinical areas, reduced well-being among fellows, decreased interactions during virtual conferences, reduced access to external mentorship, decreased research productivity, and decreased ability to interact with candidates to their program. Figure created with BioRender.com.



conferences together. The latter technique can simulate a breakout room as a tool to improve educational engagement. Studies have found that these methods represent common practices across medical education in response to the COVID-19 pandemic.<sup>24</sup> However, only 22% of PDs felt that virtual conferences improved fellow education.

The necessity for a prolonged period of all-virtual education may have adverse effects on medical knowledge acquisition. The American Board of Internal Medicine reported decreased pass rates on the initial certification examination in cardiovascular disease from 96% in 2018 to 86% in 2022.<sup>25</sup> The relationship of these lower pass rates to the educational changes that the pandemic necessitated remains uncertain. However, the trend raises concern and merits further study.

Mentorship and research represent key aspects of cardiology fellowship training.<sup>26-28</sup> In our study, PDs identified reduced access to mentorship and reduced research productivity due to the COVID-19 pandemic. In response to these disruptions, others have called on graduate medical education training programs to implement concerted efforts toward facilitating mentorship relationships and trainee research productivity.<sup>29</sup> Whether these initiatives ultimately change scholarly output and mentoring relationships in medical learners, specifically among cardiology fellows, remains unknown.

Virtual recruitment has elicited controversy in undergraduate and graduate medical education since the outset. At the time of our survey, nearly all responding PDs indicated participating in virtual recruitment. Despite acknowledging the increase in competitiveness of candidates that virtual recruitment enabled, most PDs anticipated a return to traditional interviews when the pandemic ended. This sentiment to return to traditional interviews may have been driven by the feeling that negative aspects of virtual recruitment regarding candidate interaction with fellows and ability to convey a program's culture outweighed the benefits of interviewing more competitive candidates.

Outside of cardiology, some specialties reported a more favorable initial impression of virtual interviews with a desire to maintain at least a virtual option for recruitment interviews moving forward.<sup>30,31</sup> Initial concerns about limited geographic placement of CV fellowship candidates have not come to fruition.<sup>7</sup> Studies have clearly identified a reduction in candidate and program costs associated with virtual recruitment.<sup>31,32</sup> In response, some national

organizations have recommended exclusively virtual interviews for the foreseeable future.<sup>33</sup> Despite the higher financial cost, a survey of cardiology fellows revealed a preference for some in-person component to the interview process.<sup>32</sup> The specific direction of the cardiology community remains uncertain. In light of recent recommendations, our data provide a unique perspective on how the perceptions of virtual recruitment evolved throughout the COVID-19 pandemic.

**STUDY LIMITATIONS.** Our survey did not garner a universal response, but response rates remain consistent with prior surveys from our group.<sup>6,15-19</sup> As previously noted, we possess limited data on PD nonrespondents. We also do not possess objective data on procedural volumes, educational conference participation, in-training examination scores, and fellow academic productivity before or after pandemic-related changes.

We conducted this survey in 2021, during a different phase of the pandemic, and our survey items on virtual recruitment focused specifically on the 2020 recruitment season. Despite changes in the pandemic since we conducted this survey, our findings add the perspective of cardiology fellowship PDs to survey data of PDs in other specialties regarding the impact of the COVID-19 pandemic on graduate medical education.<sup>30,31,34,35</sup> It also remains useful at the current time to reflect on PD perceptions of cardiology education during the pandemic. As our data demonstrate, we learned from the COVID-19 pandemic that virtual recruitment can increase candidate competitiveness and may increase candidate diversity. We also learned that virtual conferences could augment attendance. Understanding these benefits allows PDs to balance decisions more effectively regarding incorporating virtual recruitment and education into their programs moving forward.

Finally, our study did not collect data on the educational outcomes surrounding the clinical, educational, and academic changes to cardiology training that PDs report. Future work may assess how the COVID-19 pandemic impacted granular aspects of competency among cardiology fellows and practicing cardiologists who trained in this period.

## CONCLUSIONS

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Our study found substantial and durable changes to clinical rotations in cardiology training programs during the COVID-19 pandemic. PDs reported a near universal shift toward virtual educational

conferences and fellowship recruitment. PDs also identified adverse effects of the pandemic on fellow well-being, mentorship, and scholarship productivity. It is important to reflect on these data as the COVID-19 public health emergency has ended. We, as a cardiology community, must now grapple with the long-term changes to cardiology fellowship training that COVID-19 brought. The implications of these changes remain largely unknown.

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Dr Theriot is a paid employee of the American College of Cardiology. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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### PERSPECTIVES

**COMPETENCY IN SYSTEMS-BASED PRACTICE:** The COVID-19 pandemic catalyzed incredible changes to practice, education, and academic opportunities in cardiology fellowship programs.

**TRANSLATIONAL OUTLOOK:** The long-term implications of the changes the COVID-19 brought to cardiology fellowship education on the competency of cardiologists who trained in this time deserve further study.

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**KEY WORDS** cardiology fellowship, Covid-19, graduate medical education, pandemic, program director

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**APPENDIX** For the Cardiology Program Directors 2021 Omnibus Survey, please see the online version of this paper.