

Didactic education in paediatric cardiology during the COVID-19 pandemic: a national fellow survey

Original Article

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Abstract

The coronavirus disease 2019 (COVID-19) pandemic has had a profound impact on medical educational curricula. We aimed to examine the impact of these unprecedented changes on the formal education of paediatric cardiology fellows through a nationwide survey. A REDCap™-based voluntary anonymous survey was sent to all current paediatric cardiology fellows in the United States of America in May, 2020. Of 143 respondents, 121 were categorical fellows, representing over one-fourth of all categorical paediatric cardiology fellows in the United States of America. Nearly all (140/143, 97.9%) respondents utilised online learning during the pandemic, with 134 (93.7%) reporting an increase in use compared to pre-pandemic. The percentage of respondents reporting curriculum supplementation with outside lectures increased from 11.9 to 88.8% during the pandemic. Respondents considered online learning to be “equally or more effective” than in-person lectures in convenience (133/142, 93.7%), improving fellow attendance (132/142, 93.0%), improving non-fellow attendance (126/143, 88.1%), and meeting individual learning needs (101/143, 70.6%). The pandemic positively affected the lecture curriculum of 83 respondents (58.0%), with 35 (24.5%) reporting no change and 25 (17.5%) reporting a negative effect. A positive effect was most noted by those whose programmes utilised supplemental outside lectures (62.2 versus 25.0%, $p = 0.004$) and those whose lecture frequency did not decrease (65.1 versus 5.9%, $p < 0.001$). Restrictions imposed by the COVID-19 pandemic have greatly increased utilisation of online learning platforms by medical training programmes. This survey reveals that an online lecture curriculum, despite inherent obstacles, offers advantages that may mitigate some negative consequences of the pandemic on fellowship education.

The coronavirus disease 2019 (COVID-19) pandemic has had a profound global impact.^{1,2} Social distancing, with limitations on conferences, has emerged as a primary measure to mitigate disease spread amongst medical professionals.³ Although necessary, such interventions may adversely affect medical training by reducing important educational experiences.⁴

Training programmes have recognised and adapted to challenges in maintaining educational curricula for trainees, despite mandates to drastically alter traditional didactic teaching methods. We aimed to examine the impact of these unprecedented changes on the formal education of paediatric cardiology fellows through a nationwide survey.

Methods

A survey designed in Research Electronic Data Capture (REDCap™), hosted by Northwell Health, was shared with current paediatric cardiology fellows through emails to programme directors and mailing lists in May, 2020 and responses were collected for 2 weeks from 22 May, 2020 to 5 June, 2020.⁵ The survey tool was developed by the authors, and included 27 questions pertaining to the impact of changes induced by the pandemic on fellow didactic education (Appendix 1). A Likert scale was used where appropriate. A \$25 gift card was awarded to one respondent, who was picked by a lottery system.

Northwell's Institutional Review Board approved the study with a waiver of signed consent. Data were analysed using SPSS 25.0 (Armonk, NY, USA). Descriptive statistics were used for survey results, and differences in responses were analysed using χ^2 tests. A p -value of <0.05 was considered significant.

Results

Of 143 respondents, 83 (58.0%) were female. There were 121 categorical fellows (32 in the first year of training, 44 in the second, and 45 in the third), and 49 (40.5%) were from small

Table 1. Characteristics of 143 paediatric cardiology fellows, from a nationwide survey, on the impact of COVID-19 on the formal education of paediatric cardiology fellows

Characteristics		n	%
Gender	Male	60	42.0
	Female	83	58.0
Age	24–29	4	2.8
	30–34	110	76.9
	35–39	25	17.5
	40–44	4	2.8
Fellowship year	1	32	22.4
	2	44	30.8
	3	45	31.5
	4	22	15.4
Programme size (categorical fellows only)	Small (≤ 6 categorical fellows per year)	49	40.5
	Large (> 6 categorical fellows per year)	72	59.5
State of residence	Top five COVID-19-affected states	40	28.0
	Rest of the country	103	72.0

programmes with 6 or fewer fellows. There were 22 advanced fourth-year fellows. Twenty-six states and the District of Columbia were represented with 40 responses from states in the top five most heavily affected by COVID-19 at the time of survey distribution including New York ($n = 18$), Illinois ($n = 8$), California ($n = 10$), and Massachusetts ($n = 4$).⁶ Forty-three respondents (30.0%) reported no pandemic-related changes in clinical responsibilities, while 73 (51.0%) reported decreased and 12 (8.4%) increased clinical work. Fifteen (10.5%) were redeployed to an alternate unit, 13 of whom were from New York (Table 1).

Nearly all (140/143, 97.9%) respondents utilised online learning during the pandemic, with 134 (93.7%) reporting an increase in use from prior to the pandemic (Fig 1). In fact, 127 (88.8%) reported that $> 75\%$ of lectures were online during the pandemic, while only 2 (1.4%) reported this pre-pandemic. Lecture frequency increased for 90 (62.9%), stayed the same for 35 (24.5%), and decreased for 17 (11.9%). Unchanged or improved lecture attendance was reported by 120 (83.9%), and was more likely in females (90.4 versus 74.6%, $p = 0.012$), those not redeployed (87.5 versus 53.3, $p = 0.001$), those whose lecture frequency did not decrease (87.3 versus 58.8%, $p = 0.003$), and respondents from states other than the most heavily affected (92.2 versus 62.5%, $p < 0.001$).

The most commonly used platform was Zoom (Zoom Video Communications, San Jose, California; $n = 126$), followed by WebEx (Cisco Webex, Milpitas, California; $n = 52$) and Teams (Microsoft Corporation, Redmond, Washington; $n = 23$). PowerPoint (Microsoft Corporation, Redmond, Washington) use increased by 72.7% with a corresponding decrease in whiteboard, roundtable, and bedside teaching. Sixty (42.0%) recorded lectures for future viewing.

The percentage of respondents reporting curriculum supplementation with lectures from outside of their own division

increased from 11.9 to 88.8% during the pandemic. These included combinations of lectures given by other internal departments ($n = 34$, 23.8%), and local ($n = 26$, 18.2%), national ($n = 117$, 81.8%), and international ($n = 55$, 38.5%) institutions.

Respondents considered online learning to be “equally or more effective” than in-person lectures in convenience (133/142, 93.7%), improving fellow attendance (132/142, 93.0%), improving non-fellow attendance (126/143, 88.1%), and meeting individual learning needs (101/143, 70.6%). However, only about half considered online lectures to be “equally or more effective” in contributing to effective communication (72/143, 50.3%), promoting trainee participation/interaction (64/143, 44.8%), and allowing less distractions (70/143, 49.0%). The majority considered the overall educational value of online learning to be “equally or more effective” than in-person lectures (109/143, 76.2%), especially those respondents whose lecture frequency did not decrease (79.4 versus 52.9%, $p = 0.016$) and those whose programmes utilised outside lectures (78.7 versus 56.3%, $p = 0.046$). This perception did not vary significantly by year of training, with 75.0% of the first year, 77.3% of the second year, 80.0% of the third year, and 68.2% of the fourth year fellows considering the overall educational value to online learning to be “equally or more effective” ($p > 0.05$).

Some areas of paediatric cardiology were perceived to be more conducive to digital education. The percentage of respondents ranking online lectures “equally or more effective” was 87.1% for pulmonary hypertension, 85.6% for adult CHD, 83.6% for heart failure/transplant, 75.7% for electrophysiology, 75.0% for ambulatory cardiology, 65.2% for anatomy/physiology, 56.4% for critical care, 54.3% for interventional cardiology, 49.6% for echocardiography/non-invasive imaging, and 17.7% for physical examination.

When ranking advantages of online lectures in order of importance, convenience/flexibility was in the top three rankings of 85.6% of respondents. Remotely attending lectures by regional or national experts, recording lectures, improving fellow attendance, and avoiding commute were ranked top three by 74.6, 50.0, 43.6, and 27.3%, respectively. Categorical fellows were more likely than advanced fellows to rank supplemental lectures in their top three advantages (78.5 versus 52.4%, $p = 0.011$).

When ranking weaknesses of online learning in order of importance, certain topics being less amenable to remote teaching was in the top three most important weaknesses of 76.8%, impaired communication in 77.3%, and inadequate video quality in 65.2% of respondents. Inadequate audio quality, need for increased personal motivation, and security concerns were ranked top three by 36.2, 36.0, and 7.2% of respondents, respectively. Men were more likely than women to rank the need for increased personal motivation (50.9 versus 25.9%, $p = 0.003$), and less likely to rank video quality (55.2 versus 72.2%, $p = 0.040$) in their top three obstacles.

The pandemic positively affected the lecture curriculum of 83 respondents (58.0%), with 35 (24.5%) reporting no change and 25 (17.5%) reporting a negative effect. A positive effect was most noted by those whose programmes utilised supplemental outside lectures (62.2 versus 25.0%, $p = 0.004$) and those whose lecture frequency did not decrease (65.1 versus 5.9%, $p < 0.001$). A less favourable impact of the pandemic was perceived on the overall educational experience, with 58 (40.6%) reporting a negative effect, 28 (19.6%) reporting no change, and 57 (39.9%) reporting a positive effect. Fellows from smaller programmes, and those whose lecture frequency did not decrease, were more likely to report a positive effect on the entire educational experience (55.1 versus 34.7%, $p = 0.026$ and 43.7 versus 11.8%, $p = 0.012$, respectively). Fellows who were redeployed were more likely to view their overall

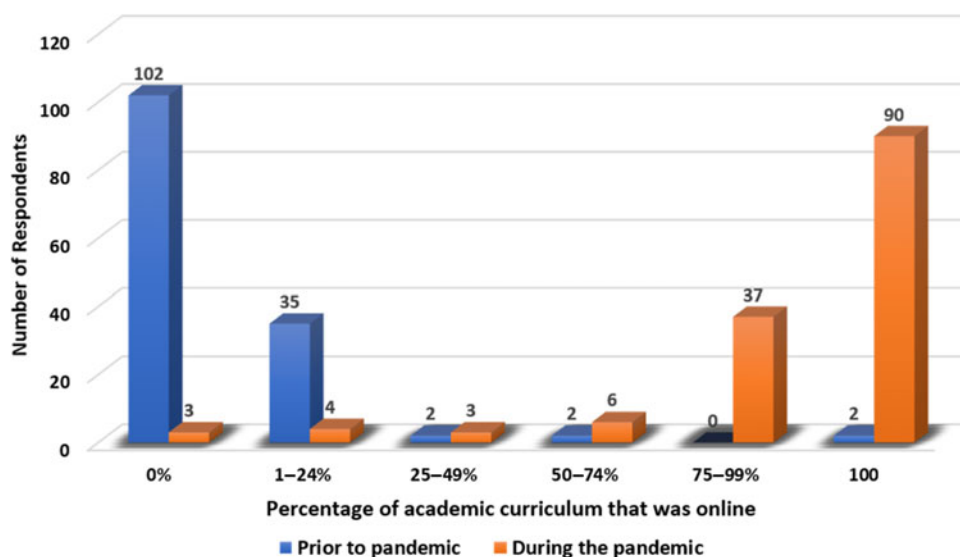


Figure 1. The figure shows percentage change in the academic curriculum towards online or web-based learning with the onset of pandemic.

educational experience as negatively affected (66.7 versus 37.5%, $p = 0.030$). Perceptions of pandemic effects on the lecture curriculum and on the overall educational experience did not vary significantly by year of training ($p > 0.05$).

Once restrictions are lifted, 132 (92.3%) would prefer in-person lectures with the continued ability to attend online, and 10 (7.0%) would prefer exclusively online lectures. The vast majority (95.8%) would prefer continued access to online lectures by outside institutions even after the pandemic, and 19 of the 28 free-text comments included extremely positive praise for these supplemental experiences.

Discussion

Coverage of the COVID-19 pandemic has shed light on its impact on healthcare providers as front-line workers, but effects on medical education are less reported and understood. As programmes strive to provide learning opportunities within the constraints of social distancing, disruption of education is inevitable.^{7,8} The previously gradual incorporation of digital platforms into medical training was dramatically hastened by COVID-19, but helped mitigate some of its adverse effects.⁹ This survey studied these changes as perceived by 121 of the nearly 440 United States of America categorical paediatric cardiology fellows, and 22 advanced fellows.¹⁰

Almost all respondents reported increased use of online platforms for didactic lectures. This abrupt change did not come with a drop in lecture frequency or attendance for most surveyed trainees, and in fact, nearly two-thirds reported increased lecture frequency during the pandemic and 84% reported sustained or improved attendance. This is not surprising considering the convenience offered by online platforms – namely ease of use, avoiding commute and other incidental expenses, ability to transmit to a wide audience simultaneously as well as a record for later viewing, and importantly, allowing for social distancing during the pandemic.^{11,12} However, redeployment (typically, to adult COVID-19 units) and training in one of the five most heavily affected states made maintaining lecture attendance more challenging. Redeployed fellows were more likely to view their overall educational experience as negatively affected.

Drawbacks of digital platforms included diminished interaction amongst trainees and educators and hindrance of communication,

consistent with previous studies.^{13,14} In addition, respondents recognised that some areas of paediatric cardiology are not amenable to online learning. Although studies show web-based simulation models can be used in skill-based subspecialties, it is inherently difficult to digitally reproduce the experience of cardiac catheterisation, echocardiography, or physical examination.¹⁵ Online learning could be used to augment skills previously learned by hands-on practice.

Resoundingly positive feedback was provided for supplemental didactics, including the Pediatric Cardiology National Educational Series developed by the Society of Pediatric Cardiology Training Program Directors.¹⁶ These lectures, delivered to a nationwide audience, helped programmes maintain if not increase the frequency of didactics and may have mitigated some negative consequences of COVID-19 on paediatric cardiology education. Significantly more fellows from programmes utilising these lectures actually reported a positive effect of the pandemic on their didactic curriculum. Respondents commented that national lectures are a “huge addition to [the] educational experience”, create a “sense of community”, and may “level the playing field for trainees in smaller programs”.

As most respondents reported a preference for continued access to online learning and supplemental didactics even after restrictions are lifted, online learning may become the “new normal” in paediatric cardiology fellowship education. This paradigm shift in medical education, which was already emerging due to its intrinsic advantages, was likely hastened by the onset of the pandemic.^{17–19} The success of online resources such as Heart University has improved access to web-based learning as an effective way to supplement textbook-based learning in low-resource settings.¹⁹

Limitations of the current report include those inherent to survey-based studies. A majority of responses were from larger fellowship programmes with more than six fellows, and this might confound results as presumably larger programmes are able to adapt better to acute changes imposed by the onset of pandemic. With over one-fourth of all United States of America categorical paediatric cardiology fellows represented, we have likely captured a representative sample of this specialty’s trainees.

Conclusions

Restrictions imposed by the COVID-19 pandemic have greatly increased utilisation of online learning platforms by medical

training programmes. This survey reveals that an online lecture curriculum, despite inherent obstacles, offers advantages that may mitigate some negative consequences of COVID-19 on fellowship education.

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Conflicts of interest. None.

Ethics approval. This project was approved by the Northwell's Institutional Review Board.

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