Exploring the Perceived Educational Impact of COVID-19 on Postgraduate Training in Oncology

Eleni Giannopoulos1 · Ankit Agarwal2 · Jennifer Croke3,4 · Daniel W. Golden5 · Ariel E. Hirsch6 · Rachel B. Jimenez7 · Nauman H. Malik4 · Janet Papadakos1,8,9 · Naa Kwarley Quartey1 · Diana Samoil1 · Che Hsuan David Wu10 · Paris-Ann Ingledew11 · Meredith Giuliani3,4

Accepted: 13 June 2022 / Published online: 20 June 2022 © The Author(s) under exclusive licence to American Association for Cancer Education 2022

Abstract

This study sought to report the degree to which postgraduate trainees in radiation oncology perceive their education has been impacted by the COVID-19 pandemic. A cross-sectional online survey was administered from June to July 2020 to trainee members of the Canadian Association of Radiation Oncology (CARO) (n = 203). Thirty-four trainees responded with a 17% response rate. Just under half of participants indicated that COVID-19 had a negative/very negative impact on training (n = 15; 46%). The majority agreed/strongly agreed that they feared family/loved ones would contract COVID-19 (n = 29, 88%), felt socially isolated from friends and family because of COVID-19 (n = 23, 70%), and had difficulty concentrating on tasks because of concerns about COVID-19 (n = 17, 52%). Changes that had a negative/very negative impact on learning included limitations to travel and networking (n = 31; 91%) and limited patient contact (n = 19; 58%). Virtual follow-ups (n = 25: 76%) and in-patient care activities (n = 12; 36%) increased. Electives were cancelled in province (n = 10; 30%), out-of-province (n = 16; 49%), and internationally (n = 15; 46%). Teaching from staff was moderately reduced to completely suppressed (n = 23, 70%) and teaching to medical students was moderately reduced to completely suppressed (n = 27, 82%). Significant changes to radiation oncology training were wrought by the pandemic, and roughly half of trainees perceive that these changes had a negative impact on training. Innovations in training delivery are needed to adapt to these new changes.

Keywords Radiation oncology · Postgraduate medical education · COVID-19

Introduction

The COVID-19 pandemic has necessitated unprecedented upheaval to medical care and the operation of society. In medical care, there was a rapid reduction in in-person care with an increase in virtual care, delays in cancer screening, and delays in cancer surgeries [1]. The Royal College of Physicians and Surgeons of Canada and the American Board of Radiology examinations were postponed in 2020 with implications to registration and independent practice. Faculty were limited in their ability to meet and teach in person necessitating a rapid change to virtual education or

1 Cancer Education, Princess Margret Cancer Centre, Toronto, ON, Canada
2 Western Radiation Oncology/El Camino Health, Mountain View, CA, USA
3 Radiation Medicine Program, Princess Margret Cancer Centre, Toronto, ON, Canada
4 Department of Radiation Oncology, University of Toronto, Toronto, ON, Canada
5 Department of Radiation Oncology, University of Chicago, Chicago, IL, USA
6 Department of Radiation Oncology, Boston University School of Medicine, Boston, MA, USA
7 Department of Radiation Oncology, Massachusetts General Hospital, Boston, MA, USA
8 Cancer Care Ontario, Ontario Health, Toronto, ON, Canada
9 Institute of Health Policy, Management & Evaluation, University of Toronto, Toronto, ON, Canada
10 Division of Radiation Oncology, University of Calgary, Alberta, Canada
11 Department of Surgery, University of British Columbia, Vancouver, British Columbia, Canada
in some cases suspension or delay of regularly scheduled educational activities [2]. Residents and fellows in some settings have been redeployed from their planned oncology activities to support the care of COVID-19 patients.

These changes have significant implications for postgraduate training in radiation oncology both during the pandemic and throughout the subsequent training of those impacted. During the early weeks of the pandemic, surgeons in Italy reported either a severe reduction (> 40%) or complete suppression (> 80%) of training exposure [3]. In the USA, the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) addressed the loss of training opportunities and created flexibility in training requirements by noting “the authority and judgement of Clinical Competency Committees and training program directors to determine readiness for unsupervised practice…when traditional time- and volume-based educational standards may be challenged” [4, 5].

The MD Anderson medical oncology training program has reported on the experience of their fellows in the transition to online learning. They report that most fellows were comfortable with the transition to an online program [6]. While work has been done to assess the psychosocial impacts on fellows early in the pandemic [7], the educational experience of trainees in radiation oncology during the COVID-19 pandemic has not been reported. It is important to ascertain perceptions of these impacts, both positive and negative, because it is highly likely that these changes may usher in new models of education through the disruption of traditional models of teaching. These data may guide the development of future models of education and prepare us for future pandemics or other entities that cause significant disruption to the learning environment. The purpose of this study was to explore the perceived impact of the COVID-19 pandemic on radiation oncology training.

Survey Composition

The 90-item survey was created based on a survey study exploring educational impact of SARS in 2003 on undergraduate medical education and developed using best practices [9]. The survey consisted of four main sections: (1) participant characteristics, (2) impact of COVID-19 on oncology training activities, (3) perceived impact of COVID-19, and (4) resilience and self-determination measures. The draft survey was circulated to experts in oncology education for peer review to ensure the questions were not ambiguous and cognitive pre-testing was performed.

Section 1: Participant Characteristics

Collected participant variables included gender, residency training program site, postgraduate year, living arrangement (e.g., alone, partner, roommates, parents, pets, children), self-isolation status, financial situation, redeployment status, and whether redeployment was voluntary or mandatory. Additionally, participants were asked if they were required to seek alternative housing arrangements and if they felt adequately prepared to medically manage COVID-19 positive patients.

Section 2: Impact of COVID-19 on Oncology Training Activities

To assess the impact of COVID-19 on planned oncology training activities, planned research and academic activities, and unplanned clinical and oncology activities, 21 items were added to the assessment. Participants reported on whether there was no impact on the activity, a moderate reduction (< 50%), severe reduction (> 50%), complete suppression, increase, or if the activity was not applicable.

Section 3: Perceived Impact of COVID-19

This survey consisted of 40 Likert-type items used to assess medical student’s perceived impact of COVID-19 on their psychological health, patient contact, medical training, travel/networking limitations, their perception of the quality of information, and level of social support received during the outbreak. These questions were adapted from other validated questionnaires, including the Stanford Acute Stress Reaction Questionnaire [10] and the Ways of Coping Questionnaire [11]. Items were adapted to focus the present survey on oncology postgraduate training. Eleven items pertained to participants’ psychological health, 10 items pertained to the quality of information received, and 15 items pertained to the level of social support received.

Methods

Design

This study involved an English language, cross-sectional online survey administered in June to July 2020 to residents and fellows who are members of the Canadian Association of Radiation Oncology (CARO). The survey was first sent on June 24, 2020. Two e-mail reminders were sent to residents and fellows on July 2 and July 10, 2020. The survey was informed by the phases of collective trauma response, including (1) sudden impact, (2) heroic, (3) disillusionment, (4) rebuilding and restoration, and (5) wiser living [8], and was administered during the sudden impact phase during what would be known as Wave 1, which was from March to May of 2020.
during the outbreak. Four items were added to assess the perceived impact of the crisis on participants’ clinical and medical education, ability to travel/network for the purpose of their career, the impact of virtual patient contact during the outbreak on their learning needs, and the impact on their medical education.

Section 4: Resilience and Self-Determination Measures

To evaluate whether resident’s personal characteristics influence their perceived impact of COVID-19, the survey included 16 items from two validated scales. The Brief Resilience Scale (BRS) [12] assessed participants’ ability to bounce back in the face of adverse events, and the Self-Determination Scale (SDS) [13] assessed participant perceived self-awareness and choice in one’s actions. The BRS consists of six items on a Likert scale. Responses from the BRS were summated to provide an overall mean score ranging from 1.00 to 5.00. 1.00–2.99 is considered low resilience, 3.00–4.30 is normal resilience, and 4.31–5.00 is high resilience. The SDS consists of two combined 5-item Likert scales assessing respondents’ perceived self-awareness and choice in actions. Respondents were asked to indicate their level of agreement with the statements within each sub-scale. Individual items were reverse scored, and a mean score was computed for each subscale. Both subscales were used to determine an overall mean score for SDS. A higher score signifies greater overall self-determination.

Analysis

Descriptive statistics are reported. Means, standard deviations, medians, interquartile ranges, and ranges were used to report SDS and BRS scores. RStudio Version 1.2.5033 was used for analyses.

Results

The survey was sent to 203 CARO residents and fellows. Thirty-four trainees (10 fellows, 24 residents) responded, totaling a 17% response rate. Details of their training sites and living situation are provided in Table 1. Nine (27%) had experienced the need to self-isolate, but none was required to seek alternate housing for this. Two (6%) had been redeployed to a COVID-19 unit (voluntarily), and both reported feeling prepared to medically manage patients.

Impact on Clinical, Academic, and Research Activities

The vast majority of respondents reported an increase in virtual follow-up visits (n = 25, 76%). Twelve participants reported an increase in their on-call hospital duties (36%). Under half of respondents reported no impact on on-call in-hospital duties (n = 14, 42%), radiation contouring/plan ning (n = 16, 49%), and multidisciplinary tumour board conferences (n = 14, 42%). Teaching activities were impacted negatively for the majority of respondents, with participants mainly indicating a moderate reduction to complete suppression in mentorships to medical students (n = 27, 82%) and teaching from staff on rotations (n = 23, 70%). Just under half of respondents reported a complete suppression in elective rotations out of province/state (n = 16, 49%) and out of country (n = 15, 46%). Figure 1 outlines the impact on various activities.

When asked if anything could have been done to minimize the impact on trainees, participants reported greater access to personal protective equipment (PPE), support with virtual consults and follow-ups (e.g., expectations, review procedures), and continued virtual education and rounds (e.g., lectures, treatment planning rounds).

Perceived Impact of COVID-19

Just under half of participants indicated that the overall impact of COVID-19 on training was negative/very negative (n = 15; 46%) or neutral (n = 15; 46%), with a small number indicating a positive/very positive impact (n = 3; 9%). Approximately one-third of respondents indicated that the impact of virtual patient contact during COVID-19 on their learning was negative/very negative (n = 11; 33%), and one-third reported a positive/very positive impact (n = 10; 30%). Over half of participants indicated that the impact of limited patient contact during COVID-19 on their medical training was negative/very negative (n = 15, 46%). Finally, the vast majority of participants indicated that COVID-19 had a negative/very negative impact on travel/networking limitations (e.g., job interviews, conference attendance) (n = 30; 91%).

The COVID-19 pandemic impacted several areas with respect to psychological well-being. Participants reported high/very high social support from family (n = 27, 82%), friends (n = 26; 79%), co-residents/fellows (n = 20; 61%), head of department (n = 18; 55%), department faculty (n = 17, 52%), their program director (n = 17, 52%), nurses and allied health professionals (n = 13; 36%), and mentors (n = 13; 36%). Most participants agreed/strongly agreed when asked if they had fears of family/loved ones contracting COVID-19 (n = 29, 88%); if they felt socially isolated from friends and family because of COVID-19 (n = 23, 70%); and if they had fears of friends contracting COVID-19 (n = 22, 67%). The majority of participants disagreed/strongly disagreed when asked if they questioned their decision to enter
Table 1  Participant characteristics and changes during the pandemic

| Variable (N = 34)                                | n   | %  |
|--------------------------------------------------|-----|----|
| **Participant characteristics**                  |     |    |
| Gender                                           |     |    |
| Male                                             | 21  | 61.8|
| Female                                           | 13  | 38.2|
| Other                                            | -   | -  |
| Residence training program site                  |     |    |
| Vancouver                                        | 7   | 20.6|
| Toronto                                          | 6   | 17.6|
| Other                                            | 4   | 11.8|
| Montreal                                         | 3   | 8.8 |
| Missing                                          | 3   | 8.8 |
| Manitoba                                         | 2   | 5.9 |
| Hamilton                                         | 2   | 5.9 |
| Ottawa                                           | 1   | 2.9 |
| Calgary                                          | 1   | 2.9 |
| Quebec City                                      | 1   | 2.9 |
| Kingston                                         | 1   | 2.9 |
| London                                           | 1   | 2.9 |
| Pakistan                                         | 1   | 2.9 |
| Jordan                                           | 1   | 2.9 |
| **Postgraduate year**                            |     |    |
| PGY 4                                            | 11  | 32.4|
| Fellow                                           | 10  | 29.4|
| PGY 5                                            | 4   | 11.8|
| PGY 1                                            | 3   | 8.8 |
| PGY 2                                            | 3   | 8.8 |
| PGY 3                                            | 2   | 5.9 |
| PGY 6                                            | 1   | 2.9 |
| **Household composition during the pandemic**    |     |    |
| Living arrangement                               |     |    |
| Partner                                          | 20  | 58.8|
| Alone                                            | 9   | 26.5|
| Roommates                                        | 3   | 8.8 |
| Children                                         | 3   | 8.8 |
| Pets                                             | 3   | 8.8 |
| Parents                                          | 2   | 5.9 |
| **Financial difficulties during the pandemic**   |     |    |
| Did you experience financial hardships related to the COVID-19 pandemic? |     |    |
| No                                               | 30  | 88.2|
| Yes                                              | 3   | 8.8 |
| Other                                            | 1   | 2.9 |
| **Self-isolation status during the pandemic**    |     |    |
| What is your self-isolation status during the COVID-19 outbreak? |     |    |
| Not required to self-isolate                      | 24  | 70.6|
| Required to self-isolate, continued duties by working remotely | 6 | 17.6|
| Required to self-isolate, did not work remotely  | 3   | 8.8 |
| Other                                            | 1   | 2.9 |
| **Redeployment during the pandemic**             |     |    |
| Are you/have you been redeployed to a COVID-19 unit/department? |     |    |
| No                                               | 32  | 94.1|
| Yes                                              | 2   | 5.9 |
oncology as a result of my experience during the COVID-19 outbreak (n = 29, 88%) and if they questioned their decision to enter medicine as a result of their experience during the COVID-19 outbreak (n = 28, 85%). Table 2 describes details of these items and their perceived impact.

Trainees obtained information about COVID-19 from several sources. Public health department and press releases (n = 26, 79%), hospital information services (n = 26, 79%), and the university or faculty of medicine (n = 21, 66%), were rated as the good/excellent sources for COVID-19 information by most respondents. Social media (e.g., Twitter, Facebook) was rated as a poor/very poor source for COVID-19 information by most respondents (n = 23, 70%), and just under half of respondents rated news media as a poor/very poor source of COVID-19 information (n = 14, 42%).

Resiliency and Self-Determination

The mean score on the Brief Resiliency Scale was 3.7 (range 2.8 to 5) with a standard deviation of 0.5. Most respondents had normal resilience (n = 24, 86%), followed by high (n = 3, 11%) and low (n = 1, 4%). The overall mean score on the Self-Determination Scale was 3.8 (range = 2.3 to 4.8), indicating high overall self-determination. The mean score for awareness was 4.1 (range = 3.0 to 5.0) and 3.5 (range = 1.4 to 4.8) for perceived choice.

Discussion

This is the first multi-institutional study to report on the perceived impact of the COVID-19 pandemic on training in radiation oncology. Overall, our findings indicate a shift in work and education to virtual methods, which is reinforced in the literature [14, 15]. Singhi et al. reported a transition to a completely virtual academic program for hematology/oncology fellows and found that the majority of participants were comfortable with the shift to virtual methods, retained the same level of information as they would in person, and appreciated the flexibility of the online environment [6]. However, given the negative perceptions of the shift to virtual education in our study, with respect to time with faculty, training programs will need to pivot to address knowledge gaps and provide skills training for both trainees and faculty.
Although patient care will largely continue in-person, many activities will shift to a remote environment [14]. As such, appropriate structure and organization in training programs will be needed to support virtual learning moving forward. The shift to virtual has been seen across not only cancer care but healthcare more broadly [16–18] and virtual care models will likely have a permanent role in cancer care moving forward. The concept of “web side manner” [19] is a learning curve for all clinicians and will require purposeful attention [17] as clinicians try to navigate virtual patient visits. Faculty will have to embrace new pedagogical techniques for workplace learning and assessment, which is inclusive of virtual care. Within radiation oncology, there is an opportunity for programs to work collaboratively with regulatory and accreditation bodies to embrace these changes and support their integration into training programs. Virtual education has also ushered in greater opportunities for collaboration. Residency programs have an opportunity to bring their trainees together in the virtual environments to network, learn together and hear from non-local experts in a variety of fields. We may also see an emergence of “superstar virtual educators” which could modify the current educational landscape for faculty [17].

Our findings demonstrated that the majority of respondents reported reductions in various clinical and research activities, such as teaching and mentorships. The reported reduction in clinical and laboratory work early in the pandemic reflect the reports of reductions in abstract submissions to annual meetings and publications. As we move towards a new normal, having a strong understanding of these impacts is critical as our trainees move into the job market [20]. In a recent study by Rao et al., cardiovascular trainees reported concerns about career advancement and fellowship applications following the cancellation of national conferences and meetings during the pandemic [21]. Another study reported that fellows experienced difficulty securing a job during the pandemic [22]. Follow-up data collection to better understand this issue is needed. Along with the negative impact of travel reductions [23] which, in the Canadian context, has been long in duration, this cohort of trainees will have unique considerations as they look for employment. Purposefully addressing these considerations will be important and require collaboration from trainees, program directors, and department heads. We need to mitigate the impact of these restrictions on those entering the job market. [20]. Additionally, further work is needed to understand which groups, if any, are particularly impacted within radiation oncology trainees. There are many reports of the disproportionate impact on academic productivity during the pandemic for women, those with young children and little to no childcare options [6, 24]. As we embrace mentoring at a distance, there may be an opportunity for trainees across programs to broaden their mentoring network and pursue their passions.

| Variable (N=33)                                                                 | Agree/strongly agree n (%) | Neutral n (%) | Disagree/strongly disagree n (%) |
|--------------------------------------------------------------------------------|---------------------------|---------------|----------------------------------|
| I had fears of family/loved ones contracting COVID-19                          | 29 (87.9)                 | 1 (3.0)       | 3 (9.1)                          |
| I felt socially isolated from friends and family because of COVID-19           | 23 (69.7)                 | 6 (18.2)      | 4 (12.1)                         |
| I had fears of friends contracting COVID-19                                    | 22 (66.7)                 | 6 (18.2)      | 5 (12.2)                         |
| I was concerned that my personal safety was at risk when I was redeployed from | 20 (60.6)                 | 9 (27.3)      | 4 (12.1)                         |
| clinical duties                                                               |                           |               |                                  |
| I had difficulty concentrating on tasks because of concerns about COVID-19    | 17 (51.5)                 | 4 (12.1)      | 12 (36.4)                        |
| I had fears about contracting COVID-19                                         | 17 (51.5)                 | 7 (21.2)      | 9 (27.3)                         |
| I felt angry and irritable because of COVID-19                                 | 17 (51.5)                 | 3 (9.1)       | 12 (39.4)                        |
| I felt safe from COVID-19 in the hospital during my clinical duties           | 15 (45.4)                 | 9 (27.3)      | 9 (27.3)                         |
| I felt my personal safety was at risk when I performed my clinical duties    | 14 (42.4)                 | 7 (21.2)      | 12 (36.4)                        |
| during COVID-19                                                               |                           |               |                                  |
| I had difficulty sleeping because of concerns about COVID-19                  | 10 (30.3)                 | 7 (21.2)      | 16 (48.5)                        |
| I worry about financial stability due to COVID-19                              | 9 (27.3)                  | 8 (24.2)      | 16 (48.5)                        |
| Having restricted access to the hospitals affected my perception of the health | 9 (27.3)                  | 12 (36.4)     | 12 (36.4)                        |
| risks posed by COVID-19                                                       |                           |               |                                  |
| I questioned my decision to enter medicine as a result of my experience during | 2 (6.1)                   | 3 (9.1)       | 28 (84.8)                        |
| the COVID-19 outbreak                                                         |                           |               |                                  |
| I questioned my decision to enter oncology as a result of my experience during| 1 (3.0)                   | 3 (9.1)       | 29 (87.9)                        |
| the COVID-19 outbreak                                                         |                           |               |                                  |
The pandemic has had a negative impact on the mental health for many healthcare workers and trainees. Our data demonstrated safety concerns amongst trainees, as well as concerns for their families and friends. This may in part be explained by the initial uncertainty of the transmissibility of COVID-19 in the early months of the pandemic and, additionally, by the resource issues in Canada related to the availability of personal protective equipment (PPE). Perceptions of workplace safety are a critical factor in the learning environment and ensuring a safe environment is a central role of all training programs in Canada [25]. Our data provides important insight into perceived safety concerns, and programs should look to prepare themselves for future waves of COVID-19 or future pandemics. Furthermore, we found that 70% of trainees reported feeling socially isolated from friends and family during the pandemic, suggesting that greater support and resources are needed. One study reported efforts to support trainees through greater self-care and wellness strategies, and through implementation of support networks for trainees [20]. There is an urgent need to address wellness and mental health supports at a structural level [14], to enhance funding and accessibility for mental health supports and to reduce barriers to accessing these supports. Findings from this study can be used to inform the development of interventions to help respond to these challenges in future pandemics. One such intervention would be to build a psychosocial program to enhance interpersonal supports for trainees that are required to self-isolate, adopt social distancing practices, and who may feel distressed, for example, through discussion boards, video-based platforms, and vetted resources. Additionally, consensus guidelines and frameworks for communicating and disseminating information in a consistent, effective, and timely manner are needed.

This study has some limitations. First, our sample size was small and represents the perceptions of a modest proportion of CARO trainees. However, our response rate is in keeping with other similar studies. Additionally, self-selection and response bias are possible limitations, with those who participated representing a sample of trainees who are highly invested in this work, and thus may limit the generalizability of results. This study was also conducted early in the pandemic following Wave 1 in Canada, and participants may have been redeployed, taken on additional duties and responsibilities, and were learning how to adjust to changes, such as self-isolating, practicing physical distancing measures, and navigating a virtual environment. It is possible that trainee perceptions of the impact of the pandemic on their education changed over time and subsequent surveys could elucidate a more fulsome picture of the impact of the pandemic over time.

Conclusion

The unprecedented COVID-19 pandemic brought significant changes for radiation oncology trainees, including shifts to virtual education and care, reductions in clinical and research activities, and impacts on psychological well-being. New models of education and training will be required moving forward to adapt to these changes.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1007/s13187-022-02192-6.

Funding

This study was supported by the Canadian Association of Radiation Oncology.

Data availability

Not applicable.

Code Availability

Not applicable.

Declarations

Ethics Approval

Not applicable.

Consent to Participate

Not applicable.

Consent for Publication

Not applicable.

Conflict of Interest

Meredith Giuliani (AstraZeneca and Bristol Myers Squibb).

References

1. Bambakidis, N.C. and K.L. Tomei. (2020). Editorial. Impact of COVID-19 on neurosurgery resident training and education. J Neurosurg: p. 1–2. DOI: https://doi.org/10.3171/2020.3.JNS20965
2. Ahmed H, Allaf M, Elghazaly H (2020) COVID-19 and medical education. Lancet Infect Dis. https://doi.org/10.1016/S1473-3099(20)30226-7
3. Amparore D et al (2020) Impact of the COVID-19 pandemic on urology residency training in Italy. Minerva Urol Nefrol. https://doi.org/10.23736/S0393-2249.20.03868-0
4. Weinstein DF (2022) Reengineering GME in a pandemic — looking back, and forward. N Engl J Med 386(2):97–100. https://doi.org/10.1056/NEJMp2116760
5. American Board of Medical Specialties. ABMS and ACGME Joint Principles: Physician Training During the COVID-19 Pandemic. (2020); Available from: https://www.abms.org/news-events/abms-and-acgme-joint-principles-physician-training-during-the-covid-2019-pandemic/
6. Singh EK et al (2020) Medical Hematology/oncology fellows’ perceptions of online medical education during the COVID-19 pandemic. J Cancer Educ 35(5):1034–1040. https://doi.org/10.1007/s13187-020-01863-6
7. Pilar A et al (2021) Coronavirus disease 2019’s (COVID-19’s) silver lining-through the eyes of radiation oncology fellows. Adv Radiat Oncol 6(1):100527. https://doi.org/10.1016/j.adro.2020.07.004
8. Phases of Collective Trauma Response. [cited May 6, 2020]; Available from: https://www.ictg.org/phases-of-disaster-response.html

9. Landis MS, Bradley JW (2005) The impact of the 2003 SARS outbreak on medical students at the University of Toronto. Univ Tor Med J 82(3):158–164

10. Cardena E et al. (2000) Psychometric properties of the Stanford Acute Stress Reaction Questionnaire (SASRQ): a valid and reliable measure of acute stress. J Trauma Stress 13(4):719–734. https://doi.org/10.1023/A:1007822603186

11. Van Liew C et al. (2016) Assessing the structure of the ways of coping questionnaire in fibromyalgia patients using common factor analytic approaches. Pain Res Manag 2016:7297826. https://doi.org/10.1155/2016/7297826

12. Smith BW et al. (2008) The brief resilience scale: assessing the ability to bounce back. Int J Behav Med 15(3):194–200. https://doi.org/10.1080/1070550802222972

13. Sheldon K, Deci EL (1996) The Self-Determination Scale. University of Rochester, Rochester

14. Gordon M et al. (2020) Developments in medical education in response to the COVID-19 pandemic: a rapid BEME systematic review: BEME Guide No 63. Med Teach 42(11):1202–1215. https://doi.org/10.1080/0142159x.2020.1807484

15. Essilfie AA et al. (2020) Resident, Fellow, and attending perception of E-learning during the COVID-19 pandemic and implications on future orthopaedic education. JAAOS - J Am Acad Orthop Surg 28(19):e860–e864. https://doi.org/10.5435/jaaos-d-20-00579

16. Berlin A et al. (2021) Implementation and outcomes of virtual care across a tertiary cancer center during COVID-19. JAMA Oncol 7(4):597–602. https://doi.org/10.1001/jamaoncol.2020.6982

17. Woolliscroft JO (2020) Innovation in response to the COVID-19 pandemic crisis. Acad Med 95(8):1140–1142. https://doi.org/10.1097/acm.0000000000003402

18. Rao SR et al. (2020) Impact of COVID-19 on oncology education and training in India. Ecancermedicalscience 14:ed107. https://doi.org/10.3332/ecancer.2020.ed107

19. Chua IS, Jackson V, Kamdar M (2020) Webside manner during the COVID-19 pandemic: maintaining human connection during virtual visits. J Palliat Med 23(11):1507–1509. https://doi.org/10.1089/jpm.2020.0298

20. Shapiro H, Reza N (2021) Cardiovascular medical education during the coronavirus disease 2019 pandemic: challenges, adaptations, and considerations for the future. US Cardiol 15:e05. https://doi.org/10.15420/usc.2020.25

21. Rao P et al. (2020) The impact of the COVID-19 pandemic on cardiovascular fellows-in-training: a national survey. J Am Coll Cardiol 76(7):871–875. https://doi.org/10.1016/j.jacc.2020.06.027

22. Truong A et al. (2021) The fellow’s perspective: the impact of the COVID-19 pandemic on fellowship training and job appointment. Am Surg 87(10):1678–1683. https://doi.org/10.1177/00031348211024195

23. Weissgerber T et al. (2020) Mitigating the impact of conference and travel cancellations on researchers’ futures. Elife 9. https://doi.org/10.7554/eLife.57032

24. Ipe TS et al. (2021) The impact of COVID-19 on academic productivity by female physicians and researchers in transfusion medicine. Transfusion 61(6):1690–1693. https://doi.org/10.1111/trf.16306

25. Royal College of Physicians and Surgeons of Canada. CanERA - Canadian Excellence in Residency Accreditation. (2021); Available from: https://www.royalcollege.ca/rcsite/accreditation-pgme-programs/accreditation-residency-programs-e

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.