



The effects of COVID-19 on Canadian surgical residents' education and wellness Les effets de la COVID-19 sur la formation et le bien-être des résidents en chirurgie au Canada

Peter Alam, Ali Salimi, Hassan ElHawary, Krystelle Sioufi, Constantine Papanastasiou et Stephanie Thibaudeau

Volume 13, numéro 2, 2022

URI : <https://id.erudit.org/iderudit/1090339ar>
DOI : <https://doi.org/10.36834/cmej.72160>

[Aller au sommaire du numéro](#)

Éditeur(s)

Canadian Medical Education Journal

ISSN

1923-1202 (numérique)

[Découvrir la revue](#)

Citer cet article

Alam, P., Salimi, A., ElHawary, H., Sioufi, K., Papanastasiou, C. & Thibaudeau, S. (2022). The effects of COVID-19 on Canadian surgical residents' education and wellness. *Canadian Medical Education Journal / Revue canadienne de l'éducation médicale*, 13(2), 50–56. <https://doi.org/10.36834/cmej.72160>

Résumé de l'article

Contexte : La pandémie de la COVID-19 a mis au défi les systèmes de soins de santé. Nous avons tenté de mesurer les impacts de la pandémie sur la formation et le bien-être mental des résidents en chirurgie au Canada.

Méthodes : Un sondage en ligne comportant 51 questions a été effectué auprès des résidents des 17 programmes de résidence en chirurgie au Canada. Les questions concernaient les facteurs démographiques et les effets perçus de la pandémie de la COVID-19 sur la formation en chirurgie et sur la santé mentale des résidents (indiquant si leur santé mentale s'était améliorée, si elle était restée inchangée ou si elle s'était détériorée). Les habitudes de santé ont été mesurées en tant que variables continues, et comparées avant et pendant la pandémie. De plus, les participants se sont prononcés sur la capacité des services d'aide au bien-être de répondre à leurs besoins pendant la crise.

Résultats : Au total, 122 des 650 résidents (19 %), toutes spécialités chirurgicales confondues, ont répondu au sondage de manière anonyme. La plupart des participants (68 %) ont signalé une détérioration de leur formation en chirurgie et 94 % d'entre eux se sont dits favorables à l'enseignement en ligne comme méthode complémentaire à l'enseignement en personne. En ce qui concerne les habitudes de santé, 38 % des participants ont signalé une augmentation de leur consommation d'alcool et du temps passé assis. Une minorité de résidents (25 %) se sont sentis plus heureux et 41 % ont déclaré éprouver plus d'anxiété dans leur formation chirurgicale qu'avant la pandémie. Seulement 14 % des participants affirment avoir profité des programmes d'aide au bien-être.

Conclusion : La pandémie de la COVID-19 a eu un effet négatif sur la perception des résidents quant à la qualité de la formation chirurgicale, de l'éducation et de leur santé mentale. Il est urgent de revoir les mesures mises en œuvre dans l'enseignement médical et d'élaborer de meilleurs plans d'action pour faire face à la vague actuelle ou toute autre vague future.



The effects of COVID-19 on Canadian surgical residents' education and wellness

Les effets de la COVID-19 sur la formation et le bien-être des résidents en chirurgie au Canada

Peter Alam,¹ Ali Salimi,² Hassan ElHawary,¹ Krystelle Sioufi,³ Constantine Papanastasiou,⁴ Stephanie Thibaudeau¹

¹Division of Plastic and Reconstructive Surgery, McGill University Health Centre, Quebec, Canada; ²Department of Ophthalmology, Faculty of Medicine, McGill University, Quebec, Canada; ³Faculty of Medicine, University of Montreal, Quebec, Canada; ⁴Department of Pathology, Centre Hospitalier de l'Université de Sherbrooke, Quebec, Canada

Correspondence to: Peter Alam, MD, Division of Plastic and Reconstructive Surgery McGill University Health Center, Montreal General Hospital 1650 Cedar Avenue, Montreal, Quebec, Canada, H3G 1A4; email: peter.alam@mail.mcgill.ca

Published ahead of issue: March 15, 2022; published: May 3, 2022. CMEJ 2022, 13(2) Available at <https://doi.org/10.36834/cmej.72160>

© 2022 Alam, Salimi, ElHawary, Sioufi, Papanastasiou, Thibaudeau; licensee Synergies Partners. This is an Open Journal Systems article distributed under the terms of the Creative Commons Attribution License. (<https://creativecommons.org/licenses/by-nc-nd/4.0>) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is cited.

Abstract

Background: The COVID-19 pandemic has challenged health care systems. We sought to comprehend the impact of the COVID-19 pandemic on surgical residents' education and mental well-being across Canada.

Methods: An online 51-question survey was distributed to surgical residents across all 17 Canadian post-graduate surgical residency programs. The questionnaire contained questions concerning demographic factors, perceived effects of COVID-19 pandemic on surgical training and residents' mental health (categorically demonstrating whether it improved, stayed the same, or worsened). Health habits were measured as continuous variables and compared before and during the pandemic. Additionally, participants reported the performance of wellness offices' response to their needs during this crisis.

Results: A total of 122 out of 650 (19%) residents from all surgical specialties anonymously completed the survey. The majority (68%) reported a worsening in their surgical training. 94% of participants favored online teaching as a complementary method to in-person teaching. As to health habits, 38% reported a rise in their alcohol consumption and time spent seated. Only a minority (25%) felt happier and 41% reported experiencing more anxiety in comparison to surgical training pre-COVID-19. Merely 14% reported benefitting from wellness programs.

Conclusion: The COVID-19 pandemic had a negative effect on the perceived quality of surgical training, education, and resident mental health. There is an urgent need to reconsider the implemented measures in medical education and urge us to develop better agendas to face the current or future waves.

Résumé

Contexte : La pandémie de la COVID-19 a mis au défi les systèmes de soins de santé. Nous avons tenté de mesurer les impacts de la pandémie sur la formation et le bien-être mental des résidents en chirurgie au Canada.

Méthodes : Un sondage en ligne comportant 51 questions a été effectué auprès des résidents des 17 programmes de résidence en chirurgie au Canada. Les questions concernaient les facteurs démographiques et les effets perçus de la pandémie de la COVID-19 sur la formation en chirurgie et sur la santé mentale des résidents (indiquant si leur santé mentale s'était améliorée, si elle était restée inchangée ou si elle s'était détériorée). Les habitudes de santé ont été mesurées en tant que variables continues, et comparées avant et pendant la pandémie. De plus, les participants se sont prononcés sur la capacité des services d'aide au bien-être de répondre à leurs besoins pendant la crise.

Résultats : Au total, 122 des 650 résidents (19 %), toutes spécialités chirurgicales confondues, ont répondu au sondage de manière anonyme. La plupart des participants (68 %) ont signalé une détérioration de leur formation en chirurgie et 94 % d'entre eux se sont dits favorables à l'enseignement en ligne comme méthode complémentaire à l'enseignement en personne. En ce qui concerne les habitudes de santé, 38 % des participants ont signalé une augmentation de leur consommation d'alcool et du temps passé assis. Une minorité de résidents (25 %) se sont sentis plus heureux et 41 % ont déclaré éprouver plus d'anxiété dans leur formation chirurgicale qu'avant la pandémie. Seulement 14 % des participants affirment avoir profité des programmes d'aide au bien-être.

Conclusion : La pandémie de la COVID-19 a eu un effet négatif sur la perception des résidents quant à la qualité de la formation chirurgicale, de l'éducation et de leur santé mentale. Il est urgent de revoir les mesures mises en œuvre dans l'enseignement médical et d'élaborer de meilleurs plans d'action pour faire face à la vague actuelle ou toute autre vague future.

Introduction

The COVID-19 pandemic has considerably shaken the medical education systems worldwide.¹⁻³ Standard teaching strategies, such as in-person courses and apprenticeships, have been prohibited to allow for enforcement of COVID-19 safety precautions.¹ In-person courses have been replaced by online sessions and surgical residents were redeployed to cover COVID wards as additional help was necessary.⁴⁻⁶ Furthermore, the mandatory redeployment combined with surgical slowdowns led to missed clinical activities in surgical programs.^{4,5} These major educational changes imposed to surgical residents, in addition to being at higher risk of viral exposure as frontline health workers, have impacted their wellbeing and mental health.⁷ Wellbeing is defined by the World Health Organization (WHO) as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” and mental health is defined as “a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to the community.”

These drastic educational and structural changes, impacting the method of delivery of surgical education, have led us to analyze the impact the COVID-19 pandemic has had on surgical residents’ academic curriculum and mental well-being in Canada, as we truly believe that important lessons can be sought in challenging times like this.

To our knowledge, no study has yet evaluated the effects of COVID-19 pandemic on surgical residents’ education and well-being in Canada. While previous studies analyzed the effect of the COVID-19 pandemic on surgical education in other countries (such as the United States and United Kingdom), most of them primarily focused on its effects on resident exposure to surgical cases without studying its effect on their mental health.^{8,9} We therefore present the first report, stemming from a nation-wide survey, aimed at demonstrating the concrete impact the COVID-19 pandemic has on academia and the wellness of surgical residents across Canada. This cross-sectional study measured the effect of the COVID-19 pandemic on surgical residents’ education and overall well-being. By doing so, it will display the measures that were implemented to reconcile surgical education with the continuously evolving pandemic and prompt us to find better solutions while still

traversing the ongoing pandemic such as the better utilization of wellness resources.

Methods

Institutional Research Board (IRB) approval was obtained prior to the study commencement. All participants voluntarily signed an electronic consent form on the front page of the questionnaire.

Questionnaire and recruitment

A secure and encrypted cloud-based database was used to develop an online survey with a total of 51 questions. The survey was constructed based on a previous study that assessed the effect of COVID-19 on medical students’ mental health and wellbeing.¹⁰ Demographic information included age, gender, marital status, surgical residency program and institution, baseline mental health disorders and anticipated year of graduation. The questionnaire specifically addressed the perceived effects of the COVID-19 pandemic on residents’ education, mental health, health related habits such as tobacco smoking, alcohol consumption, screen and seated time, and levels of moderate and vigorous physical activity (measured as continuous variables).^{9,10} Moderate activity was defined as exercise that allows you to reach 50-70% of your maximum heart rate. Vigorous activity was defined as over 70% of your maximum heart rate.

- how the current pandemic affected their post graduate education
- relative efficacy of online compared to in person teaching
- whether they would opt for online teaching as a preferred teaching method or as a complementary to tradition didactic in-person teaching
- the residents’ perception regarding the performance of wellness offices’ response to the residents’ needs during this pandemic.
- With regards to mental health, levels of depression, anxiety, loneliness, and self-perceived overall quality of life were assessed. Participants were asked to assess these outcomes retrospectively as to how they felt before and during the COVID-19 pandemic.

Data collection occurred over four weeks, from July 15th to August 15th 2020. The online questionnaire was sent to all 17 Canadian post graduate residency programs to be

distributed throughout their surgical residency programs. Data was reported such that no individuals or programs are identifiable.

Statistical analysis

The Shapiro-Wilk test verified that the continuous data respected the parameters for normality. Descriptive analyses were performed for the demographic data of the sample. Continuous data were reported as mean \pm standard deviation. Paired sample t-tests were performed to compare any differences in health habits pre-pandemic to during the pandemic. An a priori sample size calculation based on a moderate effect size with a cohen's d of 0.5, a power level of 0.8 and an alpha set at 0.05 demonstrated a minimum required sample size of 102 participants. All statistical analyses were performed using SPSS 26.0 (IBM, New York, USA) with significance set at $p < 0.05$.

Results

Demographics and health habits

This study included 122 surgical residents across 15 (out of 17) Canadian postgraduate universities. A total of seven out of the 10 Canadian provinces participated in this study (Table 1). The cohort consisted of 53 males and 69 females with an average age of 29.29 \pm 3.05 years. Distribution across surgical specialties was as follows: general surgery 26%, obstetrics and gynecology 18%, orthopedic surgery 16%, plastic surgery 15%, urology 7%, otolaryngology 7%, cardiac surgery 6%, neurosurgery 3%, and vascular surgery 2%. Half of the participants were single, and the other half were married or in a relationship. A history of anxiety or depression was reported among 15% of the participants, 95% were non-smokers, and 26% were non-drinkers. Prior to the COVID-19 pandemic, the participants reported to have spent on average 3.19 \pm 2.01 hours per day seated, 3.24 \pm 2.59 hours per day in front of a computer screen, 3.60 \pm 3.55 hours performing moderate physical activities, and 1.69 \pm 2.00 hours per week performing vigorous physical activities. Table 1 presents the demographic and habits of the participants prior to the COVID-19 pandemic.

COVID-19 and medical education

About three-quarters of the participants (72%) believed that their training was affected in one way or another by the COVID-19 pandemic, despite only 12% of our sample having been redeployed to COVID-19 wards. More specifically, most participants (68%) reported a worsening in their training, 28% believed that their training was not affected, while only 4% reported an improvement. This contrasts with the fact that a vast majority (69%) reported

having significantly more study time during the pandemic. With regards to the implementation of online teaching modules, a quarter of participants found it more efficient than in-person teaching, 39% found it comparable, and 36% found it to be an inferior teaching method. While 94% of participants supported online teaching as a *complementary* method to in-person teaching, less than half (43%) favored it as a *preferred* method or replacement option to in-person teaching (Figure 1).

Table 1. Demographic characteristics (n = 122)

Characteristics	
Age (years)	29.29 \pm 3.05
Sex	
Male	53 (43%)
Female	69 (57%)
Marital status	
Single	61 (50%)
Married / In a relationship	61 (50%)
Year of training	
Postgraduate year-1	23 (19%)
Postgraduate year-2	25 (20%)
Postgraduate year-3	33 (27%)
Postgraduate year-4	22 (18%)
Postgraduate year-5	17 (14%)
Postgraduate year-6	2 (2%)
Province participation	
Alberta	15 (12.3%)
British Columbia	10 (8.2%)
Manitoba	5 (4.1%)
Nova Scotia	12 (9.8%)
Ontario	41 (33.6%)
Quebec	36 (29.5%)
Saskatchewan	3 (2.5%)
Prior clinical diagnosis of depression or anxiety	
No	104 (85%)
Yes	18 (15%)

Mean \pm standard deviations or the number of residents and the proportions (%) are presented, where applicable.

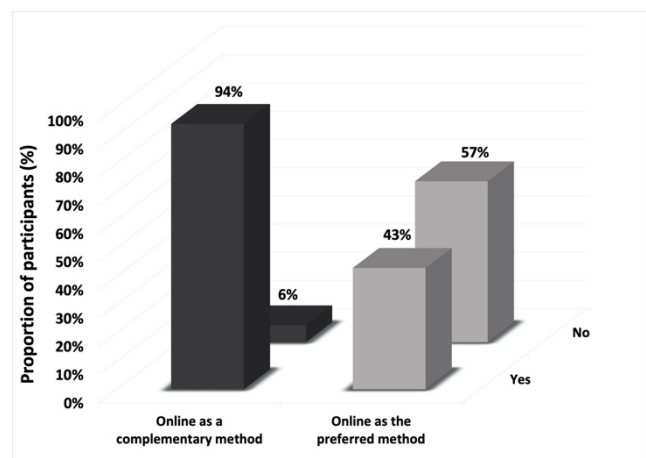


Figure 1. Proportion of participants with positive and negative attitudes toward online teaching compared to in-person teaching (n = 122)

Front and back rows represent positive and negative attitude (respectively) towards online teaching as a complementary method to in-person teaching (black bars) and as the preferred method (grey bars).

COVID-19 and wellbeing

All Canadian Postgraduate Medical Education (PGME) programs have a wellness office that offers both academic and wellness support and counseling. In our sample, 93% were aware of the existence of wellness programs at their home institution; however, only 14% reported benefitting from these services during the pandemic.

The change in wellness measures is presented in Figure 2. Overall perceived quality of life worsened among 35%, remained the same in 35%, and improved in 30% of the participants ($p > 0.05$). While the majority (62%) had more time for leisure activities, only a minority (25%) felt happier than the pre-COVID-19 era. Moreover, 41% of the cohort reported experiencing greater degrees of anxiety, 34% were equally anxious, and a quarter experienced less anxiety in comparison with the pre-Covid period ($p > 0.05$). A vast majority (61%) reported being lonelier and less connected to their friends, 23% reported no change, and 16% felt less lonely ($p > 0.05$). Sleep quality was unchanged or improved among 37% of our cohort, while 26% experienced a decline.

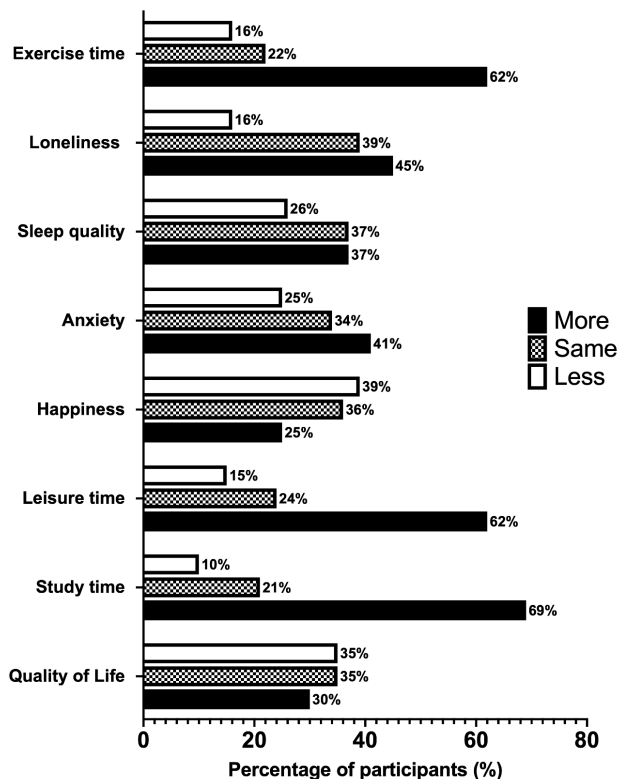


Figure 2. Change in wellness measures during the COVID-19 pandemic ($n = 122$)

With respect to drinking habits, 38% of participants reported an increase in their amount of alcohol

consumption, 31% reported no change, and 5% diminished their alcohol consumption. More precisely, the average amount of alcoholic beverages consumed weekly (measured in beer bottles/cans consumed) increased by 48% from 3.70 ± 2.93 to 5.46 ± 3.87 ($p < 0.001$). A notable proportion of participants (62%) reported having more available time for physical activity; however, no differences was observed in the time spent performing moderate physical activity pre-COVID-19 (3.60 ± 3.55 hours/week) in comparison to during the pandemic (3.78 ± 3.13 hours/week; $p = 0.536$). Similarly, the amount of time spent performing vigorous physical activity was not different either (1.69 ± 2.00 pre-pandemic and 1.64 ± 1.66 during the pandemic; $p = 0.813$). In contrast, the time spent seated increased by 95% from 3.19 ± 2.01 hours per day prior to the pandemic to 6.22 ± 3.10 hours per day ($p < 0.001$), and the time spent in front of a computer screen increased by 93% from 3.24 ± 2.59 hours per day prior to the pandemic to 6.25 ± 3.10 hours per day ($p < 0.001$).

Discussion

The delivery of quality surgical education during this pandemic has proved to be one of many challenges. The present study demonstrates that the COVID-19 pandemic, from the Canadian surgical resident's perspective, has worsened the quality of education for the majority of the sampled surgical residents as well as had a detrimental impact on their physical and mental wellbeing.

The pre-pandemic demographics and health habits of our study cohort demonstrate a history of anxiety or depression that was reported at levels higher than that of the general population.¹¹ This is consistent with prior studies showing higher rates of anxiety and depression in resident physicians compared to the general population.¹²⁻¹⁴ Almost all participants were physically active, non-smokers, and most casually consumed alcohol.

There was a strong consensus that the quality of residency training was affected by COVID-19. This is in keeping with other studies, where a reduction in surgical time and clinical activities, when unanimously perceived, was a detriment to surgical training.^{5,15-35} With significantly reduced operating time and in-person teaching, the vast majority of participants reported having significantly more free time. Residency programs have been forced to transition to online teaching modalities and telemedicine. Most participants indicated that online teaching is comparable if not superior to in-person teaching; less than half would want to replace in-person teaching

permanently. Surgical programs globally have reported similar success in implementing virtual learning and telemedicine tools during the pandemic.^{5,16,17,20-23,25,28,30,32,33,35} With these new training routines still in their early stages, it remains to be seen if their success can be sustained long-term and, whether the shift in the balance between hands-on versus virtual learning will cause an alteration in graduate competency. Another way to mitigate the negative effects of the pandemic on surgical education is by using simulators. One successful example of this comes out of Italy where plastic surgery residents have reported positive experiences using Anatomage and Touch Surgery smartphone applications. The Touch Surgery application contains over 42 virtual plastic surgery procedures and helps visualize, in a step-by-step fashion, the surgical procedure.¹⁵ Virtual applications are effective learning tools and the combination of both physical and mental tasks increases their effectiveness.^{36,37}

The COVID-19 pandemic has resulted in increased anxiety levels among surgical residents.³⁸ Known contributors to this elevated stress include overwork, inadequate PPE, assignment to COVID-19 wards, impact on surgical training, fear of infection, and fear of infecting family.^{5,20,23,31} In this study, change in wellness scores were consistent with those in the literature review. Most respondents indicated equal or worse overall perceived quality of life. Additionally, the majority indicated experiencing equal or greater levels of stress. Despite significantly more reported leisure time and sleep, only a quarter of participants felt happier. This may suggest that for many, professional and personal stress overshadows any wellness “benefits” that have accompanied the pandemic. Moreover, most respondents reported higher levels of loneliness and less connection with friends. Despite these troubling figures, only a small fraction of residents sought support from their respective PGME program wellness office.

In addition to prompting changes to resident medical education and quality of life, the COVID-19 pandemic has also brought about alterations to their health habits. With regards to alcohol consumption, a disquieting proportion of respondents (38%) reported an increase in their drinking habits, with volume of consumption increasing by nearly 50%. Despite this consumption increase, this is still within the normal level of consumption recommended by Health Canada guidelines.³⁹ There is a strong relationship between medical trainee/physician alcohol abuse and depression/anxiety.^{40,41} Luckily, physicians have an excellent prognosis when substance abuse is identified

early with appropriate intervention, treatment, and monitoring compared to the general population (relapse rate of physicians is 19% that of the general population).^{42,43} As such, enhanced promotion and targeted advertisement of current wellness education programs for resident occupational stress may be a valuable change to prevent further decompensation and substance abuse.^{44,45}

Despite most participants reporting an increase in leisure time, there were no significant differences in time spent for moderate nor vigorous exercise. In fact, time spent per day seated nearly doubled, as did time spent per day in front of a computer screen. This can be interpreted through many lenses. Perhaps it can be inferred that residents are filling their leisure time with sedentary activities due to facility closures. Alternatively, the data may suggest that residents favor allocating their newfound leisure time to independent study, forgoing exercise as a priority.

This study has several limitations typical of survey-based results. The first of which is the relatively small sample size which can be potentially explained by the busy schedules of surgical residents. To maintain a systematic method of data collection, the survey was distributed to all surgical programs in Canada but was left to the programs’ discretion whether to distribute it to their residents or not. This could have contributed to the overall low response rates (19%). Response rates to email surveys vary significantly and traditionally are around 25%. Reasons for this includes survey fatigue, competing demands and privacy concerns.^{40,41} Moreover, due to the voluntary nature of participation, our sample might have incurred a selection bias where residents who have a stronger opinion about the pandemic were more likely to fill out the survey. Furthermore, due to the questionnaire-based nature of this study, there is an inherent recall bias especially that some of the questions required participants to recall sentiments and habits in the past. Finally, while our results showed that very few residents used the wellness programs offered by their respective residency programs, we did not assess how often they used it pre-pandemic.

Conclusion

In this study, residents reported that the COVID-19 pandemic had an overall negative impact on their lives. The effects were broad reaching and impacted surgical education, personal wellbeing, and both physical and mental health. Despite increased time for sleep and leisure activities, there was a perceived decrease in quality of

training and quality of life. Additionally, there was an increase in perceived anxiety levels, alcohol consumption, and time spent sitting. While there is an abundance of PGME wellness offices across Canada, the discordance between COVID-19's negative effects on mental wellness and how much residents sought support from their respective wellness offices identifies an interesting phenomenon that needs further studying. It is worth investigating if this discrepancy can be attributed to a lack of visibility, as the principal method of advertisement of these services were done electronically via email. Given the positive outcome of virtual teaching and simulators, we highly recommend pursuing this practice during the pandemic, and encourage its use as an adjunct to in-person teaching once the pandemic is controlled and the government restrictions are lifted. Only time will tell whether this pandemic can be controlled and, if not, whether surgical residents will be able to adapt to the "new normal."

Conflicts of Interest: None

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- Liang ZC, Ooi SBS, Wang W. Pandemics and their impact on medical training: lessons from Singapore. *Acad Med*. Sep 2020;95(9):1359-1361. <https://doi.org/10.1097/acm.0000000000003441>
- Dhillon J, Salimi A, ElHawary H. Impact of COVID-19 on Canadian medical education: pre-clerkship and clerkship students affected differently. *J Med Educ Curric Dev*. Jan-Dec 2020;7:2382120520965247. <https://doi.org/10.1177/2382120520965247>
- ElHawary H, Salimi A, Alam P, Gilardino MS. Educational alternatives for the maintenance of educational competencies in surgical training programs affected by the COVID-19 pandemic. *J Med Educ Curric Dev*. Jan-Dec 2020;7:2382120520951806. <https://doi.org/10.1177/2382120520951806>
- Parija S, Das S. COVID-19 and the medical education system in ophthalmology - lessons learned and future directions. *Indian J Ophthalmol*. May 2021;69(5):1332-1333. https://doi.org/10.4103/ijoo.IJO_540_21
- Kogan M, Klein SE, Hannon CP, Nolte MT. Orthopaedic Education During the COVID-19 Pandemic. *J Am Acad Orthop Surg*. Jun 1 2020;28(11):e456-e464. <https://doi.org/10.5435/jaaos-d-20-00292>
- ElHawary H, Salimi A, Diab N. How the COVID-19 Pandemic Will Make Us Better Future Physicians. *AEM Educ Train*. Oct 24 2020;5(1):130-1. <https://doi.org/10.1002/aet2.10542>
- Khusid JA, Weinstein CS, Becerra AZ, et al. Well-being and education of urology residents during the COVID-19 pandemic: results of an American national survey. *Int J Clin Pract*. Sep 2020;74(9):e13559. <https://doi.org/10.1111/ijcp.13559>
- Amparore D, Claps F, Cacciamani GE, et al. Impact of the COVID-19 pandemic on urology residency training in Italy. *Minerva Urol Nefrol*. Aug 2020;72(4):505-509. <https://doi.org/10.23736/s0393-2249.20.03868-0>
- Aziz H, James T, Remulla D, et al. Effect of COVID-19 on Surgical training across the United States: a national survey of general surgery residents. *J Surg Educ*. Mar-Apr 2021;78(2):431-439. <https://doi.org/10.1016/j.jsurg.2020.07.037>
- ElHawary H, Salimi A, Barone N, Alam P, Thibaudeau S. The effect of COVID-19 on medical students' education and wellbeing: a cross-sectional survey. *Can Med Educ J*. Jun 2021;12(3):92-99. <https://doi.org/10.36834/cmej.71261>
- Langlois KA SA, Rehm J, Spence ST, Connor Gorber SK. Health state descriptors for Canadians: Mental illnesses. *Statistics Canada*. 2011;catalogue no. 82-619-MIE2005002
- Sadiq MS, Morshed NM, Rahman W, Chowdhury NF, Arafat S, Mullick MSI. Depression, anxiety, stress among postgraduate medical residents: a cross sectional observation in Bangladesh. *Iran J Psychiatry*. Jul 2019;14(3):192-197.
- Jimenez-Lopez JL, Arenas-Osuna J, Angeles-Garay U. Depression, anxiety and suicide risk symptoms among medical residents over an academic year. *Rev Med Inst Mex Seguro Soc*. Jan-Feb 2015;53(1):20-8.
- Buddeberg-Fischer B, Stamm M, Buddeberg C, Klaghofer R. [Anxiety and depression in residents - results of a Swiss longitudinal study]. *Z Psychosom Med Psychother*. 2009;55(1):37-50. Angst und Depression bei jungen Ärztinnen und Ärzten - Ergebnisse einer Schweizer Longitudinalstudie. <https://doi.org/10.13109/zptm.2009.55.1.37>
- Zingaretti N, Contessi Negrini F, Tel A, Tresoldi MM, Bresadola V, Parodi PC. The Impact of COVID-19 on Plastic Surgery Residency Training. *Aesthetic Plast Surg*. May 26 2020; <https://doi.org/10.1007/s00266-020-01789-w>
- Tomlinson SB, Hendricks BK, Cohen-Gadol AA. Editorial. Innovations in neurosurgical education during the COVID-19 pandemic: is it time to reexamine our neurosurgical training models? *J Neurosurg*. Apr 17 2020;1-2. <https://doi.org/10.3171/2020.4.JNS201012>
- Reinholz M, French LE. Medical education and care in dermatology during the SARS-CoV2 pandemic: challenges and chances. *J Eur Acad Dermatol Venereol*. May 2020;34(5):e214-e216. <https://doi.org/10.1111/jdv.16391>
- Oldenburg R, Marsch A. Optimizing tele dermatology visits for dermatology resident education during the COVID-19 pandemic. *J Am Acad Dermatol*. Jun 2020;82(6):e229. <https://doi.org/10.1016/j.jaad.2020.03.097>
- Nassar AH, Zern NK, McIntyre LK, et al. Emergency restructuring of a general surgery residency program during the coronavirus disease 2019 pandemic: the University of Washington experience. *JAMA Surg*. Apr 6 2020; <https://doi.org/10.1001/jamasurg.2020.1219>
- Mishra D, Nair AG, Gandhi RA, et al. The impact of COVID-19 related lockdown on ophthalmology training programs in India - outcomes of a survey. *Indian J Ophthalmol*. Jun 2020;68(6):999-1004. https://doi.org/10.4103/ijoo.IJO_1067_20
- Mak ST, Yuen HK. Oculoplastic surgery practice during the COVID-19 novel coronavirus pandemic: experience sharing from Hong Kong. *Orbit*. Aug 2020;39(4):316-318. <https://doi.org/10.1080/01676830.2020.1754435>
- Lewis EE, Taylor LJ, Hermsen JL, McCarthy DP, Fiedler AG. Cardiothoracic education in the time of COVID-19: how I teach

- It. *Ann Thorac Surg*. Apr 10 2020;
<https://doi.org/10.1016/j.athoracsur.2020.04.002>
23. Kanneganti A, Sia CH, Ashokka B, Ooi SBS. Continuing medical education during a pandemic: an academic institution's experience. *Postgrad Med J*. May 13 2020;
<https://doi.org/10.1136/postgradmedj-2020-137840>
 24. Hourston GJM. The impact of despecialisation and redeployment on surgical training in the midst of the COVID-19 pandemic. *Int J Surg*. Jun 2020;78:1-2.
<https://doi.org/10.1016/j.ijsu.2020.03.082>
 25. Hoopes S, Pham T, Lindo FM, Antosh DD. Home surgical skill training resources for obstetrics and gynecology trainees during a pandemic. *Obstet Gynecol*. Apr 29 2020;
<https://doi.org/10.1097/AOG.0000000000003931>
 26. He K, Stolarski A, Whang E, Kristo G. Addressing general surgery residents' concerns in the early phase of the COVID-19 pandemic. *J Surg Educ*. Apr 17 2020;
<https://doi.org/10.1016/j.jsurg.2020.04.003>
 27. Gallo G, Trompetto M. The effects of COVID-19 on academic activities and surgical education in Italy. *J Invest Surg*. Apr 5 2020;1-2. <https://doi.org/10.1080/08941939.2020.1748147>
 28. Fuller S, Vaporciyan A, Dearani JA, Stulak JM, Romano JC. COVID-19 disruption in cardiothoracic surgical training: an opportunity to enhance education. *Ann Thorac Surg*. Jun 1 2020; <https://doi.org/10.1016/j.athoracsur.2020.05.015>
 29. Dedeilia A, Sotiropoulos MG, Hanrahan JG, Janga D, Dedeilias P, Sideris M. Medical and surgical education challenges and innovations in the COVID-19 era: a systematic review. *In Vivo*. Jun 2020;34(3 Suppl):1603-1611.
<https://doi.org/10.21873/invivo.11950>
 30. De Luca P, Colacurcio V, De Bonis E, et al. Impact of the COVID-19 pandemic on otolaryngology residency: a real-life experience. *Ear Nose Throat J*. May 18 2020;145561320926291.
<https://doi.org/10.1177/0145561320926291>
 31. Crosby DL, Sharma A. Insights on otolaryngology residency training during the COVID-19 pandemic. *Otolaryngol Head Neck Surg*. Apr 21 2020;194599820922502.
<https://doi.org/10.1177/0194599820922502>
 32. Coe TM, Jogerst KM, Sell NM, et al. Practical techniques to adapt surgical resident education to the COVID-19 era. *Ann Surg*. Apr 29 2020;
<https://doi.org/10.1097/SLA.0000000000003993>
 33. Chick RC, Clifton GT, Peace KM, et al. Using technology to maintain the education of residents during the COVID-19 Pandemic. *J Surg Educ*. Apr 3 2020;
<https://doi.org/10.1016/j.jsurg.2020.03.018>
 34. Bambakidis NC, Tomei KL. Editorial. Impact of COVID-19 on neurosurgery resident training and education. *J Neurosurg*. Apr 17 2020;1-2. <https://doi.org/10.3171/2020.3.JNS20965>
 35. Amparore D, Claps F, Cacciamani GE, et al. Impact of the COVID-19 pandemic on urology residency training in Italy. *Minerva Urol Nefrol*. Apr 7 2020;
<https://doi.org/10.23736/S0393-2249.20.03868-0>
 36. Griffith SF, Hagan MB, Heymann P, Heflin BH, Bagner DM. Apps as learning tools: a systematic review. *Pediatrics*. Jan 2020;145(1) <https://doi.org/10.1542/peds.2019-1579>
 37. Ekstrand C, Jamal A, Nguyen R, Kudryk A, Mann J, Mendez I. Immersive and interactive virtual reality to improve learning and retention of neuroanatomy in medical students: a randomized controlled study. *CMAJ Open*. Feb 23 2018;6(1):E103-E109. <https://doi.org/10.9778/cmaj.20170110>
 38. Collins C, Mahuron K, Bongiovanni T, Lancaster E, Sosa JA, Wick E. Stress and the surgical resident in the COVID-19 pandemic. *J Surg Educ*. Jul 25 2020;
<https://doi.org/10.1016/j.jsurg.2020.07.031>
 39. Oreskovich MR, Shanafelt T, Dyrbye LN, et al. The prevalence of substance use disorders in American physicians. *Am J Addict*. Jan 2015;24(1):30-8. <https://doi.org/10.1111/ajad.12173>
 40. Tabibian JH, Bertram AK, Yeh HC, et al. Health and wellness among incoming resident physicians: a multi-domain survey. *J Community Med (Reno)*. 2018;1
<https://doi.org/10.33582/2637-4900/1003>
 41. Buhl A, Oreskovich MR, Meredith CW, Campbell MD, DuPont RL. Prognosis for the recovery of surgeons from chemical dependency: a 5-year outcome study. *Archives of Surgery*. 2011;146(11):1286-1291.
<https://doi.org/10.1001/archsurg.2011.271>
 42. McLellan AT, Skipper GS, Campbell M, DuPont RL. Five year outcomes in a cohort study of physicians treated for substance use disorders in the United States. *Bmj*. Nov 4 2008;337:a2038. <https://doi.org/10.1136/bmj.a2038>
 43. Jackson ER, Shanafelt TD, Hasan O, Satele DV, Dyrbye LN. Burnout and alcohol abuse/dependence among U.S. medical students. *Acad Med*. Sep 2016;91(9):1251-6.
<https://doi.org/10.1097/ACM.0000000000001138>
 44. Mavroforou A, Giannoukas A, Michalodimitrakis E. Alcohol and drug abuse among doctors. *Med Law*. Dec 2006;25(4):611-25.