



THE AGA KHAN UNIVERSITY

eCommons@AKU

Medical College Documents

Medical College, Pakistan

1-1-2021

Surgical education and training during the COVID-19 pandemic: Strategies and solutions for Pakistan

Edward Anthony Joseph

Russell Seth Martins


Javeria Tariq

Namrah Aziz

Hina Inam

See next page for additional authors

Follow this and additional works at: https://ecommons.aku.edu/pakistan_fhs_mc_mc

 Part of the [Cardiology Commons](#), [Cardiovascular Diseases Commons](#), [Medical Education Commons](#), [Surgery Commons](#), and the [Virus Diseases Commons](#)

Authors

Edward Anthony Joseph, Russell Seth Martins, Javeria Tariq, Namrah Aziz, Hina Inam, and Mahim Malik

Surgical Education and Training during the COVID-19 Pandemic: Strategies and Solutions for Pakistan

Edward Anthony Joseph,¹ Russell Seth Martins,² Javeria Tariq,³ Namrah Aziz,⁴ Hina Inam,⁵ Mahim A. Malik⁶

Abstract

The coronavirus disease-2019 pandemic has severely impacted surgical education and training in Pakistan and worldwide, causing problems, such as risk of infection, limited hands-on training, examination delays, and trainee redeployment to non-surgical specialties. The current review was planned to describe innovative strategies adopted by surgical training programmes worldwide in order to suggest comprehensive recommendations at the level of the College of Physicians and Surgeons Pakistan and individual institutions to counter the challenges presented by the pandemic in Pakistan. The innovative use of technology, including open-access online educational portals, virtual educational activities and simulation-based learning, can help reform education delivery during the pandemic. Hospitals' implementation of "shift schedules" for rotations helps continue training while minimising risks. Moreover, examination boards and residency programmes must appropriately tailor their eligibility criteria and assessment processes to the current situation. Lastly, it is vital to safeguard trainees' mental wellness during the pandemic and after by ensuring readily available professional psychological support when needed.

Keywords: Graduate medical education, Surgical residency, Surgical residents, Developing countries, Coronavirus, Distance learning.

Introduction

The coronavirus disease-2019 (COVID-19) pandemic, with millions of cases and deaths worldwide has challenged healthcare systems globally. In addition to the volume of COVID-19 cases stressing limited healthcare resources — human, financial and infrastructural — healthcare professionals are at high risk of contracting the disease and serving as a means of transmission. This has affected not only healthcare delivery, but has also resulted in consequences for other sectors of healthcare, including

education. In particular, postgraduate surgical education and training has suffered greatly across the world, Pakistan included.¹⁻³ With hospitals focussed on limiting exposure and conserving resources, from a surgical standpoint this means reduced elective procedures, reduced trainee learning, and trainee redeployment to non-surgical services. Understandably, these circumstances have raised concerns regarding the compromised quality of surgical education and training, and require interventions at the institutional and national level to adapt to this "new normal". The current review article was planned to describe challenges faced by surgical education programmes worldwide and in Pakistan, with the aim of suggesting robust strategies towards the development of a comprehensive action plan for Pakistan. This will help ensure continued excellence and high-quality surgical education and training across the country.

Challenges faced: The pandemic has resulted in a massive patient inflow to hospitals worldwide, often to near-full capacity.^{4,5} As a result, many hospitals face shortage of resources,⁶ including personal protective equipment (PPE),^{4,7,8} lack of medications required for operative and postoperative care,⁴ and reallocation of supplies, such as hospital beds, ventilators and dialysis machines, to COVID-19 units.^{4,5} Additionally, some hospitals have had to convert their operating rooms (ORs) to intensive care units (ICUs)⁹ to cater to the increasing load of COVID-19 patients. To preserve resources for COVID-19 patients, hospitals have postponed elective surgeries when possible, especially for oral, maxillofacial, plastic and neurosurgery, and catered mostly to emergent and high-risk cases.^{4,10-15} This has also been implemented in hospitals in Pakistan, such as the Aga Khan University Hospital (AKUH), where both elective and semi-elective surgeries were initially ceased from March 20 to May 12, 2020.^{2,3} Due to the insufficiency of PPE,^{10,11,16} even the few cases in emergency were operated by senior staff, rendering trainees unable to assist in surgical procedures.⁸ Furthermore, regulations, such as permitting only necessary staff in the OR¹¹ and restricting transfer of residents between hospitals,¹⁰ have also limited training opportunities. The National Health

.....
¹⁻⁴Medical Student, ^{5,6}Department of Surgery, Aga Khan University Hospital, Karachi, Pakistan.

Correspondence: Mahim Akmal Malik. Email: mahim.malik@aku.edu

Services (NHS) in the United Kingdom, for example, has advised only select hospitals to provide cardiac surgery services during the pandemic.⁷ It is thus unsurprising that a survey found that 86.6% surgical residents felt that the pandemic had compromised their hands-on exposure.¹⁷ In Pakistan, the highest percentage of trainees who felt this way were from paediatric surgery, urology and gynaecology.¹⁸

In order to ensure optimum care to COVID-19 patients, some hospitals launched a staffing plan whereby the majority of surgical residents from diverse subspecialties were redeployed to COVID-19-related departments,

mainly ICUs or emergency departments (EDs).^{9,13,14,19-23} General surgery residents were more often recruited by non-surgical wards to take care of COVID-19 patients compared to residents from other surgical subspecialties,²³ while cardiothoracic surgery residents were redeployed mostly to ICUs.¹⁴ Trainees therefore assumed new roles in fields different from their subspecialty of choice,⁴ in order to expand the available workforce to cater to COVID-19 patients.¹⁵ At various Combined Military Hospitals (CMHs) across Pakistan, the redeployment to COVID-19 patient care was strongly associated with decreased training and educational activities for trainees.¹ This inability to work in their

Table: Interventions for surgical education and training during the COVID-19 pandemic in Pakistan.

Type of Intervention	Specific measures that can be taken
Effective usage of technology	<p>At CPSP Level:</p> <ul style="list-style-type: none"> ◆ Online portals with relevant resources for each surgical specialty may be created and maintained to disseminate educational content across the country²⁵ ◆ Live, narrated intra-operative videos and educational material available for all^{8,28} <p>At Institutional Level:</p> <ul style="list-style-type: none"> ◆ Conduct surgical education programmes via virtual lectures through online platforms like Zoom, WebEx, Microsoft Teams etc.^{8,20} ◆ Case discussions, clinic and telemedicine consultations can be held online^{6,11} ◆ Recorded lectures can be uploaded and revisited at convenience^{14,25} ◆ Simulation-based learning via computer- and phone-based simulators^{5,7,28}
Restructuring of surgical training curriculum	<p>At CPSP Level:</p> <ul style="list-style-type: none"> ◆ Encourage and aid hospitals in establishing functional shift schedule formats³¹ <p>At Institutional Level:</p> <ul style="list-style-type: none"> ◆ Transition to a shift schedule format whereby residents are divided into small teams and scheduled to rotate between time off and working different shifts^{8,15,30}
Role of board examinations	<p>At CPSP Level:</p> <ul style="list-style-type: none"> ◆ Re-schedule examinations and explore virtual methods of examination⁵ ◆ Reduce clinical time and operative case number requirements for eligibility⁵ ◆ Increase the number of testing sites to reduce trainee traveling, and to ensure social distancing and PPE protocols²⁴ <p>At Institutional Level:</p> <ul style="list-style-type: none"> ◆ Regular seminars to communicate changes in board certification for residents¹⁴
Ensuring mental wellness	<p>At CPSP Level:</p> <ul style="list-style-type: none"> ◆ Encourage the institutions to set up dedicated crisis hotline for residents working during the pandemic in order to ensure their mental wellness³⁰ and offer medical support to residents virtually in case of any health concerns¹⁰ ◆ Clarify and regularly update institutions about changes to the board examinations/ certifications and recruitment procedures¹¹ ◆ Establish protocols related to appropriate use of PPE and patient care to reduce trainees concerns of exposure^{15,30} <p>At Institutional Level:</p> <ul style="list-style-type: none"> ◆ Develop professional psychological support networks to help trainees deal with acute stress and anxiety^{11,14,19,30} ◆ Encourage working in teams, which allows trainees to discuss challenges and concerns and may provide stress-relief through non-medical activities^{9,11,14,15,31} ◆ Employ effective strategies to reduce family transmission such as donning clean clothes before returning home followed by showering^{10,30} ◆ Retain a focus on mental health even after the pandemic ends due to PTSD³⁰
Changes in recruitment and selection into residency programs	<p>At CPSP Level:</p> <ul style="list-style-type: none"> ◆ Rely on self-assessment scores for the time being²⁴ <p>At Institutional Level:</p> <ul style="list-style-type: none"> ◆ Conducting virtual interviews to select applicants²⁴

COVID-19: Coronavirus disease-2019; CPSP: College of Physicians and Surgeons Pakistan.

originally chosen surgical specialty could result in the loss of trainees' opportunities to enhance their specialty-specific surgical skills.^{12,17} For example, since residents in subspecialties, such as cardiothoracic surgery, get the most complex cases during their final year, senior residents are possibly missing out on valuable operative experience.⁶ Furthermore, all in-person educational activities, including labs, case discussions, conferences, structured learning sessions, multidisciplinary team meetings, outpatient clinics, wards and on-call duties have been severely disrupted by the pandemic.^{10-12,16} In the long term, this may impact their education and board qualification requirements,¹¹ and, in turn, their careers.²³

Counter Measures (summarized in the Table)

Effective usage of technology: Although the pandemic led to a reduction in hands-on training, virtual education has helped to bridge the gap in teaching and learning.⁹ Through online video-conferencing platforms, such as Microsoft Teams, WebEx and Zoom, surgical education programmes are conducting virtual lectures, table rounds, clinic consultations, telemedicine consultations, meetings, journal clubs, webinars, teleconferences, podcasts, etc.^{5,6,8,10,11,17,19,20,24,25} Such transitions to online surgical education have also been implemented at the AKUH and other hospitals in Pakistan with reasonable success.^{2,3,18,26} Such online interactions can continue surgical education, and help keep residents in the loop of patient-case discussions, clinic consultations and procedures.^{6,11,12} Moreover, virtual lectures may be recorded and watched at trainees' own convenience and revisited in the future.^{11,14,25} Virtual sessions also allow for convenient collaboration between different institutions, and online portals with relevant resources for each surgical specialty may be created to disseminate educational content among different institutions nationally and internationally.²⁵ The Imperial College London has created an online video library showing interactions with patients, helping keep their residents updated about incoming cases.¹¹ Similarly, the Royal College of Surgeons in the United Kingdom has provided open access to their online learning resources.²⁴ Also available are live, narrated intra-operative videos and educational material, such as those provided by the Incision Academy, which is a European online educational platform, the Journal of Medical insight, which is a peer-reviewed surgical video journal, and other platforms, like Headmirror, Eyetube, Ortho-oracle, The Neurosurgical Atlas, Teach Me Surgery, Surgery Squad, and WebSurg, which can help trainees hone their surgical skills.^{8,11,27,28}

In addition, simulation-based learning is proved to be useful in improving surgical skills and, hence, should be

utilised effectively.^{5,11,27} Computer-based simulators or advanced surgical simulators can be used for practising a variety of surgical procedures, like valve replacements or cadaveric dissections.^{7,14} Phone-based simulators, like Touch Surgery, provide several surgical interventions covering a wide range of subspecialties.^{28,29} Likewise, several virtual interactive tools are also available for plastic surgery, such as Anatomage Table, which is a three-dimensional (3D) tool that allows dissection of cadavers virtually.²⁹

Restructuring of surgical training curriculum:

Confronted with unprecedented challenges, several hospitals have swiftly reconfigured their surgical residency programmes in order to maximise benefits for and minimise risks to the residents,²⁴ ensuring adequate clinical exposure and learning while limiting exposure to infected patients.⁸

One solution that hospitals have followed is transitioning to a "shift schedule" format, whereby residents are divided into small teams of varying numbers and levels of expertise.^{15,30} They are then scheduled to rotate between time-off, working different shifts at the hospital in varying duties⁸ or even working remotely.³¹ Small independent teams working in isolation from each other with no in-person hand-offs help reduce chances of any potential exposure.⁸ The University of Washington has implemented a 3-team approach that rotates weekly around inpatient, operating, and clinical care.³¹ The Vancouver General Hospital has developed a pairing system of junior and senior residents reporting to a single staff surgeon, who work in 2-week shifts with 1-week off, during which they are replaced by another pair.¹⁵ The "shift schedule" has also been implemented at the AKUH where surgery trainees are split into two teams which handled in-patient and on-call services on alternate weeks.^{2,3,26}

Hospitals reported positive results upon adopting a shift-based schedule for their residents.^{30,31} The shift-based schedule reduced exposure via relegating the number of residents working to a functional minimum and reducing exposure time for each resident.³⁰ It also compensates for a symptomatic resident, allowing them to self-quarantine and return once recovered, all while maintaining patients' and fellow residents' health.³⁰ In addition, it means that at any given time, while a portion of residents are working, there is an ample pool of residents quarantined,^{10,14} acting as a reserve deployment unit in case of exposure to other trainees.¹⁵

Role of board examinations: Delays in board examinations and graduation remain major concerns for

surgical trainees during the pandemic. The American Board of Surgery has taken measures to alleviate such concerns, including re-scheduling of examinations, exploring virtual methods of examination, reducing clinical time and operative case number requirements for board eligibility, and extending deadlines for completion of documentation.⁵ The American Board of Thoracic Surgery is also exploring solutions to facilitate board eligibility for current trainees, which may feature personalised eligibility criteria keeping in mind differing institutional operative volumes.⁶ Similarly, UK, Canada, Australia and New Zealand postponed board examinations, with Canada also aiming to increase the number of testing sites to reduce trainee travelling, all while ensuring social distancing and PPE protocols.²⁴ In addition, a survey by Caruana et al.¹⁶ found that majority of residents felt that there was inadequate communication from training bodies with regard to the impact of the pandemic on their training. To help address issues like these, the American Board of Orthopaedic Surgery conducted a series of weekly seminars to communicate logistical changes in board certification and career progression for the residents.¹⁴

Mental wellness: Hospital programmes have set up several measures to support the mental wellbeing of their surgical trainees, as it is important to equip the trainees with the knowledge of various psychological responses during the pandemic and the comfort to seek psychological help.^{10,32} Professional psychological support networks have been developed to help trainees deal with acute stress and anxiety,^{11,14,19,30} with some programmes setting up a dedicated crisis hotline for residents working during the pandemic.³⁰ CopeNYP, developed in New York, is one such telemedicine platform to combat mental stress and to devise effective management strategies.¹⁰ At the AKUH, the surgical trainees were encouraged to attend multiple mental wellness sessions in collaboration with the hospital's Department of Psychiatry.^{2,3}

Hospital programmes have also emphasised on teamwork, as it serves to maintain a support network among colleagues, which fosters motivation and assurance.¹⁹ The team-led focus allows personal interaction between the attendings and the residents to discuss challenges, concerns regarding graduation or board certifications, and mental health regularly, as well as group bonding and stress-relief through non-medical activities.^{9,11,14,15,31}

Trainees' concerns regarding personal exposure may be alleviated with the provision of PPEs and the establishment of protocols related to their appropriate

usage and patient-care.^{15,30} Medical support may be offered via virtual platforms in case of any health concern.¹⁰ Additionally, the risk of COVID-19 transmission to family has raised heavy concern among the residents.^{9,10,14,19,30} Effective strategies to reduce family transmission involve removing hospital scrubs and donning clean clothes before returning home, followed by showering and leaving any contaminated articles outside.^{10,30} Alternatively, the trainees may be offered alternative accommodation on- or off-campus.^{14,19}

Programmes are encouraged to increase trainees' attention to self-care^{31,32} and continue to focus on mental health even after this pandemic ends due to a high probability of post-traumatic stress disorder (PTSD).³⁰

Changes in recruitment and selection into residency programmes: The COVID-19 pandemic, with its limitations on physical interaction, has made the residency selection process challenging.²⁴ Responses to this handicap were variable in different countries.²⁴ In the United States, the 2020 residency selection process had already been conducted in the traditional manner.^{9,24} However, in the UK, Canada, Australia and New Zealand, the pandemic interrupted the residency selection process.²⁴ While the UK reverted their process to relying on self-assessment scores, Canada, Australia and New Zealand employed remote methods, such as virtual interview, to select the applicants.²⁴

Positives amidst the pandemic

Significant reduction of burnout due to work-from-home arrangements: Most residency programmes reported that the COVID-19 pandemic resulted in a reduced workload for residents due to adoption of a shift-based work schedule.^{9,10,17,30} A study from Pakistan, using the Maslach Burnout Inventory, reported a decrease of >40% in burnout experienced by surgical residents before and after the onset of the pandemic.¹⁷ This may be attributed to reduced working hours and operational procedures, and increased time spent with family and friends, personal hobbies and exercise.^{9,17,30}

Catch-up on research projects and studies: Although the impact on surgical research activity has been variable,^{4,16} much of the focus has shifted to projects highlighting the impact of COVID-19,¹⁹ with global research opportunities, such as COVIDSurg and COVIDSurg-Cancer, available for trainees to participate in. Residents, especially those in the initial years of training, have been made to work from home, and reduced duty hours have allowed them to dedicate more time to research projects and studies.^{17,20,22,25} At the AKUH, the

residents were able to spend time completing unfinished research projects, and the institutional grant committee also facilitated research by increasing the speed of grant review by 4 times the usual.²⁶ A survey conducted by Kapila et al. showed that 65% residents were able to get involved in research more actively and 81% were able to enhance their theoretical understanding of their respective field of surgery.²³ Moreover, the changes in schedules and new roles of residents provided them with time to approach their mentors and seek guidance related to career pathways and application procedures.¹⁴

Development of non-cognitive skills: Residency programmes normally focus on learning skills in an operative and clinical capacity. However, these trying times have provided the residents with a unique experience to develop resilience, perseverance, adaptability, self-control and leadership.^{9,14,16} These skills will equip surgical residents to handle pressure and reduce burnout in their future careers.¹⁴ Thus, these experiences are expected to develop characteristics associated with success in residents' personal and professional lives.¹⁴

Conclusion

The COVID-19 pandemic is an unprecedented situation, and has severely impacted surgical education and training in Pakistan and worldwide. Issues including limited hands-on training, delays in board examinations, and trainee redeployment to non-surgical specialties, have likely affected surgical trainees' learning and their future careers. However, the current situation has paved the way for the implementation of novel solutions to counter the challenges presented by the pandemic. Innovative uses of technology to reform education delivery, and adopting shift schedule formats for residents' rotations have shown to be effective in continuing education and training while minimising risks to the residents. Moreover, it is imperative that educational boards and residency programmes appropriately tailor their criteria and assessment processes to the current situation. At the same time, it is equally important to ensure physical and mental wellness of surgical trainees, both during the pandemic and after it has ended. However, on the brighter side, the pandemic has led to a significant reduction in burnout amongst residents, and has provided time to catch up on research projects and studies. More importantly, dealing with this challenge has helped hone skills, such as perseverance, leadership and resilience, shaping future surgeons who would excel in both personal and professional lives.

Acknowledgements: We are grateful to the Research

and Development (R&D) wing of the Society for Promoting Innovation in Education (SPIE) at the Aga Khan University (AKU) for providing valuable research mentorship to the authors.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

1. Feroze N, Ans M, Mahmood K, Ali HA, Afzal H. Impact of covid-19 pandemic on training activities of general surgery residents in Pakistan Army. *Pak Armed Forces Med J* 2020;70(COVID-19):s326-30.
2. Rana RE, Ather MH, Enam SA. Change in surgical practice amidst COVID 19; example from a tertiary care centre in Pakistan. *Ann Med Surg (Lond)* 2020;54:79-81. doi: 10.1016/j.amsu.2020.04.035.
3. Qazi SH, Saleem A, Pirzada AN, Hamid LR, Dogar SA, Das JK. Challenges to delivering pediatric surgery services in the midst of COVID 19 crisis: experience from a tertiary care hospital of Pakistan. *Pediatr Surg Int* 2020;36:1267-73. doi: 10.1007/s00383-020-04721-0.
4. Megaloikonomos PD, Thaler M, Igoumenou VG, Bonanzinga T, Ostojic M, Couto AF, et al. Impact of the COVID-19 pandemic on orthopaedic and trauma surgery training in Europe. *Int Orthop* 2020;44:1611-619. doi: 10.1007/s00264-020-04742-3.
5. Fong ZV, Qadan M, McKinney R Jr, Griggs CL, Shah PC, Buysse J, et al. Practical Implications of Novel Coronavirus COVID-19 on Hospital Operations, Board Certification, and Medical Education in Surgery in the USA. *J Gastrointest Surg* 2020;24:1232-6. doi: 10.1007/s11605-020-04596-5.
6. Shah JP. The impact of COVID-19 on Head and Neck surgery, education, and training. *Head Neck* 2020;42:1344-7. doi: 10.1002/hed.26188.
7. Shafi AMA, Atieh AE, Harky A, Sheikh AM, Awad WI. Impact of COVID-19 on cardiac surgical training: Our experience in the United Kingdom. *J Card Surg* 2020;35:1954-7. doi: 10.1111/jocs.14693.
8. Gawad N, Towajj C, Stuleanu T, Garcia-Ochoa C, Williams LJ. Prioritizing resident and patient safety while maintaining educational value: emergency restructuring of a Canadian surgical residency program during COVID-19. *Can J Surg* 2020;63:e302-5. doi: 10.1503/cjs.006120.
9. Bernstein DN, Greene N, Ibrahim IO. The personal and professional impact of COVID-19 on orthopedic surgery trainees: reflections from an incoming intern, current intern, and chief resident. *Acta Orthop* 2020;91:547-50. doi: 10.1080/17453674.2020.1789310.
10. Juprasert JM, Gray KD, Moore MD, Obeid L, Peters AW, Fehling D, et al. Restructuring of a General Surgery Residency Program in an Epicenter of the Coronavirus Disease 2019 Pandemic: Lessons From New York City. *JAMA Surg* 2020;155:870-75. doi: 10.1001/jamasurg.2020.3107.
11. 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* 2020;34(Suppl 3):1603-11. doi: 10.21873/invivo.11950.
12. Gallo G, Trompetto M. The Effects of COVID-19 on Academic Activities and Surgical Education in Italy. *J Invest Surg* 2020;33:687-89. doi: 10.1080/08941939.2020.1748147.
13. Calhoun KE, Yale LA, Whipple ME, Allen SM, Wood DE, Tatum RP. The impact of COVID-19 on medical student surgical education: Implementing extreme pandemic response measures in a widely

- distributed surgical clerkship experience. *Am J Surg* 2020;220:44-7. doi: 10.1016/j.amjsurg.2020.04.024.
14. Kogan M, Klein SE, Hannon CP, Nolte MT. Orthopaedic Education During the COVID-19 Pandemic. *J Am Acad Orthop Surg* 2020;28:e456-64. doi: 10.5435/JAAOS-D-20-00292.
 15. Hintz GC, Duncan KC, Mackay EM, Scott TM, Karimuddin AA. Surgical training in the midst of a pandemic: a distributed general surgery residency program's response to COVID-19. *Can J Surg* 2020;63:e346-8. doi: 10.1503/cjs.008420.
 16. Caruana EJ, Patel A, Kendall S, Rathinam S. Impact of coronavirus 2019 (COVID-19) on training and well-being in subspecialty surgery: A national survey of cardiothoracic trainees in the United Kingdom. *J Thorac Cardiovasc Surg* 2020;160:980-87. doi: 10.1016/j.jtcvs.2020.05.052.
 17. Osama M, Zaheer F, Saeed H, Anees K, Jawed Q, Syed SH, et al. Impact of COVID-19 on surgical residency programs in Pakistan; A residents' perspective. Do programs need formal restructuring to adjust with the "new normal"? A cross-sectional survey study. *Int J Surg* 2020;79:252-6. doi: 10.1016/j.ijisu.2020.06.004.
 18. Kamran M, Mirza MB, Aziz U, Tahir W, Nawaz K, Singh N, et al. Changes in surgical practice by surgical residents and consultants during COVID-19 pandemic: A cross-sectional survey. *J Pediatr Adolesc Surg*. 2020; 1:22-27. DOI: 10.46831/jpas.v1i1.33
 19. Blanco-Colino R, Soares AS, Kuiper SZ, Zaffaroni G, Pata F, Pellino G. Surgical Training During and After COVID-19: A Joint Trainee and Trainers Manifesto. *Ann Surg* 2020;272:e24-6. doi: 10.1097/SLA.0000000000003929.
 20. Bernardi L, Germani P, Del Zotto G, Scotton G, de Manzini N. Impact of COVID-19 pandemic on general surgery training program: An Italian experience. *Am J Surg* 2020;220:1361-3. doi: 10.1016/j.amjsurg.2020.06.010.
 21. Al-Jabir A, Kerwan A, Nicola M, Alsafi Z, Khan M, Sohrabi C, et al. Impact of the Coronavirus (COVID-19) pandemic on surgical practice - Part 2 (surgical prioritisation). *Int J Surg* 2020;79:233-48. doi: 10.1016/j.ijisu.2020.05.002.
 22. Pertile D, Gallo G, Barra F, Pasculli A, Batistotti P, Sparavigna M, et al. The impact of COVID-19 pandemic on surgical residency programmes in Italy: a nationwide analysis on behalf of the Italian Polyspecialistic Young Surgeons Society (SPIGC). *Updates Surg* 2020;72:269-80. doi: 10.1007/s13304-020-00811-9.
 23. Kapila AK, Farid Y, Kapila V, Schettino M, Vanhoeij M, Hamdi M. The perspective of surgical residents on current and future training in light of the COVID-19 pandemic. *Br J Surg* 2020;107:e305. doi: 10.1002/bjs.11761.
 24. James HK, Pattison GTR. Disruption to Surgical Training during Covid-19 in the United States, United Kingdom, Canada, and Australasia: A Rapid Review of Impact and Mitigation Efforts. *J Surg Educ*. 2020: 1931-7204(20)30213-0. doi: 10.1016/j.jvsurg.2020.06.020. [ahead of print]
 25. Coe TM, Jogerst KM, Sell NM, Cassidy DJ, Eurboonyanun C, Gee D, et al. Practical Techniques to Adapt Surgical Resident Education to the COVID-19 Era. *Ann Surg* 2020;272:e139-41. doi: 10.1097/SLA.0000000000003993.
 26. Zahid M, Ali A, Baloch NJ, Noordin S. Effects of coronavirus (COVID-19) pandemic on orthopedic residency program in the seventh largest city of the world: Recommendations from a resource-constrained setting. *Ann Med Surg (Lond)* 2020;56:142-44. doi: 10.1016/j.amsu.2020.06.026.
 27. 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* 2020;110:1443-46. doi: 10.1016/j.athoracsur.2020.05.015.
 28. McKechnie T, Levin M, Zhou K, Freedman B, Palter VN, Grantcharov TP. Virtual Surgical Training During COVID-19: Operating Room Simulation Platforms Accessible From Home. *Ann Surg* 2020;272:e153-4. doi: 10.1097/SLA.0000000000003999.
 29. 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* 2020;44:1381-85. doi: 10.1007/s00266-020-01789-w.
 30. 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* 2020;77:735-38. doi: 10.1016/j.jvsurg.2020.04.003.
 31. Meneses E, McKenney M, Elkbuli A. Reforming our general surgery residency program at an urban level 1 Trauma Center during the COVID-19 pandemic: Towards maintaining resident safety and wellbeing. *Am J Surg* 2020;220:847-49. doi: 10.1016/j.amjsurg.2020.06.001.
 32. Chew QH, Chia FL, Ng WK, Lee WCI, Tan PLL, Wong CS, et al. Psychological and coping responses to COVID-19 amongst residents in training across ACGME-I accredited specialties in Singapore. *Psychiatry Res* 2020;290:113146. doi: 10.1016/j.psychres.2020.113146.