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Doing More with Less: Surgical Training in the COVID-19 Era

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ABSTRACT

Background: The impact of COVID-19 in healthcare systems globally was unprecedented leading to cancellations of most planned surgical activities. Surgical trainees were redeployed to Intensive Care and Emergency units supporting urgent and unplanned care on COVID-19 patients. Theater exposure, crucial part of surgical training, was reduced to minimal since elective cases were postponed, and emergency operating was carried out by consultants only. Surgical research has also been severely hit with most of the clinical trials been postponed. Teaching activities as well as national and international congresses and surgical courses important tools for continuous professional development were canceled.

Methods: The primary aim of our study was to summarize the changes in surgical training during the pandemic. This was followed by a review of the existing social media platforms, video-conferencing platforms along with the role of the social media in surgical training. The crucial role of simulation in surgical training was explored and alternative ways of training with engagement of the feedback mechanisms were proposed. The secondary aim was to highlight possible novel educational strategies for the forthcoming post-COVID-19 era.

Conclusions: The “new” era forced the educational boards to reexamine training curriculums. Innovation strategies and cooperation on the part of surgical residency programs is crucial. Strong leadership is needed, on the part of the education bodies with restructuring of the surgical programmes to accommodate alternative ways of training is necessary to maintain rigorous standards of education and training.

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Introduction

The impact of COVID-19 in healthcare systems globally is detrimental. Since its renounce as a global pandemic, national health systems are in constant battle with shortages of resources, equipment issues and increasing numbers of critically ill patients [1,2]. In this attempt, healthcare professionals have joined forces in a regional, national, and international level to fight the “unknown” virus.

Medical and Surgical Colleges and General Medical Councils have announced early on the outbreak cessation of all elective activities, emphasizing the need for concentrating on the care of the Emergency and COVID-19 patients [3–6].

In this battle, the junior doctors play a crucial role. They were redeployed to Intensive Care Units (ICU) and Emergency units supporting urgent and unplanned care. They have shown flexibility in working hours and patterns, having their timetable continuously changing to cover for sick leave and colleague’s isolation [7,8].

Although it is recognized that there are significant learning opportunities in treating and managing patients during a pandemic, the statutory educational bodies accepted the

impact of the outbreak on surgical/medical training and the fact that the full range of the curriculum requirements will not be covered. The American Board of Surgery, the Royal College of Physicians and Surgeons of Canada and the Royal Colleges of Surgeons of the UK were the first to announce their aim to reduce the tight curriculum obligations on trainees during the COVID-19 crisis while enabling as many trainees as possible to progress in their training at the normal rate [9–11].

They advocated the need of appropriate adjustments to the format and timing of examinations to allow senior trainees to graduate and join the workforce. They have also highlighted that training bodies should consider adapting their surgical curriculum and reconfigure the annual training operative logbook to meet the “new” standards while making certain that surgical trainees have adequate exposure in theaters to keep their surgical competency [9–11].

Surgical education has been evolving throughout the years responding to new technologies, new treatments, and new surgical techniques. The impact of the COVID-19 crisis in training has pushed the educational boards globally to reexamine their training curriculum.

The difficult question for the Educational boards is to explore answers on maintaining high quality of surgical training when the main priority of the “new norm” is staff protection but also efficiency of care through maintenance of services. A big “headache” is also how surgical training will evolve after the pandemic when the main priority will be the recovery of services with a massive backlogging of patients. There is no other option for trainees than to adapt to this ongoing situation and innovate, using all available resources to continue their training.

The European experience

In European countries, responses of the Health Systems to the outbreak have involved redeployment of staff, reassignment of resources, triage and major cancellations of surgeries, training and events (including all meetings, courses and congresses). The introduction of the surgical trainees to elective cases has been dramatically reduced secondary to the initial reaction to minimize the exposure of patients and healthcare professionals to the virus by postponing elective surgical procedures and endoscopy. The reduction of the “hands on” surgical training, has also been determined by the redeployment of the surgical trainees to other departments and COVID-19 units. Even when some National Health Systems decided to recommence the elective cancer operating, the presence of the trainees in operating theaters was minimal. Service provision, the need for shortening the operating time (and subsequently the exposure of the theater staff), but also the COVID-19 “new” measure for dual consultant operating were some of the reasons for it.

Organized teaching activities such as weekly training days and journal clubs have either been canceled or dramatically reduced with most of the juniors unable to participate due to long-hour shifts in Emergency, ICU or covering for sickness or absence. Regional training days have also been canceled along with national and international congresses and surgical courses which were quite important educational sources for exam preparation and professional development. National examinations for certificate of completion of surgical training along with international examinations such as the European Board of Surgical Qualification (EBSQ) exams have been either postponed or even canceled for next year having a crucial impact on job planning with the possible need for extension of surgical training in some cases. Regarding research activities during the outbreak, there has been a variety of COVID-19 related projects and collaborative studies, but most of the non COVID-19 research projects have been canceled or postponed.

Learning opportunities during the pandemic

Non-technical skills and team-work

The rapid change of scene during the pandemic in the terms of update of guidelines, clinical scenarios and ways of treatment of the critically ill patients can be used to sharpen the communication, the clinical and managerial skills of the

trainees in a continuous evolving field. Redeployment in Intensive Care and Emergency units can further develop the lateral ways of thinking and strengthen collaboration skills and teamwork mentality [12]. Working under stress and in a different environment, using skillsets acquired during previous experience add on building up resilience [8]. Senior trainees can use this unique experience to exploit leadership and supervision skills, qualities needed to progress to consultant level. In a protective and supportive environment, senior trainees can act up as a consultant, participating in government and board meetings and being part of decision making during this period of rapid changes on a daily basis. It is a unique opportunity for the trainees to learn about management of critically ill patients in intensive care units, management of multiorgan failure and ceilings of care.

E-learning

Although there is no substitute for hands-on learning through operative experience and direct patient care, these may be ways to mitigate the loss of learning exposure during this time [13].

The pandemic has caused a knock-on surgical training with the health education boards being in the difficult position to call for cancellation of training activities. In this rapidly involving situation when surgical trainees have been redeployed to cover different units and COVID-19 wards, educational boards need to find ways of reconstructing surgical training. Learning opportunities should be developed through different approaches than the traditional ones, and timetables should be re-scheduled to allow trainees for remote training.

Focusing on junior doctor’s wellbeing, with respect to physical (not to social) distancing, an overview of the present digital and virtual platforms for teaching and education was conducted.

The restructuring of surgical learning and education involves virtual education in the terms of resources library and video assisted education. Many surgical societies offer e-learning resources.

As an example, the European Society of Coloproctology (ESCP) has invested in the development of a resource library with over a 1,000 peer reviewed papers and high-quality video lectures from annual conferences.

ESCP in collaboration with ASCRS has developed the **CREST- the ColoRectal Educational Systems Template**, a dynamic online learning programme which offers different ways of learning through narrated presentations, videos, journal articles and book chapters covering all aspects of colorectal surgery.

The **Surgical Council on Resident Education (SCORE) Portal**© is an educational web portal supporting the curriculum of American General Surgery Resident during their training [14–16]. It focuses on all areas of general surgery and related subspecialties. It is linked with an online surgical curriculum giving a quick access to 800 module topics, book chapters and multiple-choice questions for self-assessment. **eSurgery** is an e-learning platform developed by The Royal

College of Surgeons of England and the Health education England to support trainees in the early years of their training. It offers interactive e-learning sessions that are structured in modules and are mapped to the Intercollegiate Surgical Curriculum Programme. With more than 1 million registered users, it delivers more than 210 e-learning programmes playing an important role in enhancing and supporting traditional teaching methods [17].

Virtual peer review libraries with video-assisted content are the **American College of Surgeons online video library**, the **C surgeries surgical video journal** and the **Journal of Medical Insight**. **Incision academy** is another widely used European based online platform with surgical video material. **Websurg** and **Teach Me Surgery**, as well as the **Advances In Surgery (AIS) channel** and the **International Hernia Collaboration** (through their Facebook group) are online platforms mainly with general surgery content, but that also include material of other (sub)specialties. These interactive collaborative platforms offer live operating, material from important congresses, specialty courses, surgical quizzes, exam topics and archived footage from procedures performed by experts. Trainees can use these projects to interactively discuss hot topics in surgery, learn new surgical techniques and watch complex procedure operating.

YouTube channels have also served as a platform for surgical journals, such as *Colorectal Disease Journal*, to upload operating procedures, where a trainee can learn by shared experience from experts in the field of operating. Video-based education can provide the opportunity to learn the cognitive part of the procedure in a step to step manner, whereas the visual image adds to refining technical skills and to aid decision-making. Part of the preparation for an operating procedure is to read through the important steps of the operation. Video libraries, with an increasing number of uploaded operations, are important tools in surgical education since the trainee can visualize the procedure at their own pace. The variety of videos with the same procedure performed by different surgeons, helps the trainee understand anatomical and technical variations while picking up surgical ‘tips and tricks’ from different experts. The fact that the surgical junior can watch the same procedure multiple times without the time pressure and the stress of live operating gives an opportunity of mastering the preparation for the procedure. A recent study on surgical training has shown that surgical trainees mainly use YouTube as the preferred video channel for surgical preparation [18].

During this “social distancing-era”, video conference-based platforms, such as **Zoom**, **Google Meet** and **Microsoft Teams**, among others, have expanded the traditional teaching and learning techniques since they provide the flexibility of recording and listening the lecture out of hours. Easy to access through smartphones and tablets, they allow for learning opportunities anywhere. They can be used for educational departmental meetings, for the reintroduction of journal clubs and weekly training days. Video conference platforms could also be utilized in accommodating multidisciplinary committee meetings and virtual board/ward rounds where surgical trainees could present

interesting in-patient cases with educational messages participating in departmental activities.

In an incredibly stressful era for the surgical trainees where their training but also their wellbeing is in question, participating in these virtual departmental meetings where they could ask questions on matters of interest, having continuous updates about the new policies and hospital guidelines is quite crucial.

These platforms can serve for national and international collaboration in expanding the surgical education. Surgical Societies such as ESCP, by using these video conference platforms, have brought together education and guidelines committees along with experts in the field of surgery to discuss the “hot” topics around COVID-19 and the impact of COVID-19 in services.

Podcasts have gained popularity and can be used as a valuable source of information for surgical education. Podcasts with a special interest for surgical trainees include *BehindTheKnife* and *Surgery101* where the trainee can download lectures, exam topics but also listen to interviews and lectures from surgical congresses and meetings. Podcasts provide exam material and experts discussion on exam topics, tricks on answering difficult questions which could be used by the trainees as part of their revision and preparation. *JAMA*, *New England Journal of Medicine*, *Diseases of Colon Rectum* and *Techniques in Coloproctology* are some of the medical journals involved with producing podcasts.

Social Media platforms have emerged as powerful tools for keeping surgical trainees connected. One of the main microblogging platforms, Twitter has attracted interest from healthcare professionals globally. It is used to as a distributor of information about up-coming research, journal articles and future meetings and congresses. It is an ideal platform for learning since it stimulates interest with continuous information shared by experts and role models in the field of surgery. Surgical journals such as *British Journal of Surgery* have adopted Twitter (@BJSurgery) and broadcast recent publications and visual abstracts. Hashtags such as #colorectalsurgery #SoMe4Surgey or #SurgTweeting have gained great popularity, and brought surgeons around the world together sharing continuously their ideas and personal and departmental experience. Several authors highlighted the value of Twitter on surgical education through its global access and the continuous exposure in surgical discussions and opinions exchange from experts in the field of colorectal surgery [19–21].

Mobile applications about surgical training or procedures are a growing field in surgical education. Using digital technology they can test the ability to digitally ‘perform’ a step-by-step surgical procedure aiming for patient safety. Platforms such as **Touch Surgery** are interactive surgical stimulators providing a realistic and detailed guide for the surgical trainee to perform a procedure. It is used in more than 230 countries and the user has the chance of performing 50 different procedures in 10 different specialties. *Touch Surgery* is also helping delivery of tailored training for residency programmes. A second mobile application with global

Table 1. Available resources for surgical training during the pandemic.

| Name of resource | Web/access | Description | Free access? |
|--|---|--|---|
| ESCP resource library | https://www.escp.eu.com/members/resources | The Resource Library currently holds presentations from ESCP's conferences (videos and lectures) and all chapters of the 2nd Edition of the European Manual of Medicine: Coloproctology. | Included in ESCP membership (reduced membership available for trainees and on-line only) |
| CREST® <i>the ColoRectal Educational Systems Template</i> | https://fascrs.org/my-ascrs/education/crest | CREST® is the premier online educational portal for physicians interested in colorectal surgery. It offers health care providers an interactive venue to review all aspects of colorectal disease to ensure their delivery of the highest quality of patient care. | Included in American Society of Colon & Rectal surgeons (and soon for ESCP) membership access. Reduced fees available for trainees. |
| SCORE Portal© Surgical Council on Resident Education | https://www.surgicalcore.org/ | Educational portal provides content (modules, books, videos) and assessment (quiz questions) in support of the curriculum to USA general surgery residency programs | No, institutional or individual subscription necessary |
| eSurgery Royal College of Surgeons of England and Health education England | https://www.rcseng.ac.uk/education-and-exams/courses/rcs-elearning/esurgery/ | Web-based educational tool that helps to develop the basic knowledge and skills required of a surgeon. It is suitable for healthcare professionals globally. | Free for NHS (UK) workers and trainees Annual registration fee for others (with certificate of completion) |
| American College of Surgeons online video library | https://cine-med.com/acsonline/ | Featuring educational topics from credible authors, these resources offer videos on landmark surgical procedures and are updated annually with the current innovative techniques in surgery. | No, available as individual or institutional subscription (reduced fee for trainees) |
| C surgeries surgical video journal | https://www.csurgeries.com/ | Designed to provide brief, accurate, high quality surgical video clips that are approved by international experts through the peer-review process. | Yes, but registration needed |
| Journal of Medical Insight | https://jomi.com/ | JOMI films and publishes surgical procedures offering incision-to-closure, long-form, high-quality, surgeon-narrated didactic experiences / masterclasses. | Yes |
| Incision Academy | https://academy.incision.care/ | Multiple available courses on surgical specialties & techniques and 3D anatomy models, | Yes with institutional code or 4-week complimentary (COVID19) Individually, free access to 1 course of your choice. Registration needed. |
| Websurg Online university of IRCAD | https://websurg.com/en/virtual-university/ | first-rate educational content provided by world-renowned experts in all fields of minimally invasive surgery. HD videos, lectures, webinars, etc. | Yes, but registration needed |
| Teach Me Surgery | https://teachmesurgery.com/ App available (App store and Google Play) | Comprehensive encyclopedia on surgery and perioperative care, provides a concise and structured insight into over 400 surgical topics across a wide range of specialties, with each article individually reviewed and revised by world-leading experts. Quiz questions available | Yes |
| Advances In Surgery (AIS) channel | https://aischannel.com/ | AIS Channel is a new approach to the communication of advances in cutting-edge surgical expertise, provided by leading surgeons. It offers videos, lectures, 2open classroom, e-congresses, live surgeries, etc. | Yes, but registration needed |
| International Hernia Collaboration Facebook group | https://www.facebook.com/groups/herniacollab/ | International platform for all surgeons, healthcare providers, and industry friends interested in the repair of hernia and optimizing outcomes to come together to collaborate, share, discuss, post photos, videos, and simply post anything related to the disease of hernia. | Yes, free to join by Facebook. Private group, so access must be requested |

(continued)

Table 1. Continued.

| Name of resource | Web/access | Description | Free access? |
|---------------------------|---|---|---|
| YouTube (surgical videos) | Colorectal Disease Journal Surgical Educator School of Surgery Quarantine Surgery Education (website & YouTube channel) https://www.quarantinesurgical.education/ https://www.sages.org/residents_courses/free_courses/ https://globalsurg.org/covidsurg-dissemination-and-outputs/ | YouTube videos on surgical techniques or lectures, useful for trainees | Yes |
| Zoom webinars | | Available in multiple platforms and topics. Specific webinars offered by surgical Societies and Industry, especially during the COVID-19 pandemic. | Yes (some) Others offered by surgical Societies available for members only |
| Podcasts | BehindTheKnife Surgery101 New England Journal of Medicine JAMA Network-Surgery Surgical Grand Rounds Lectures (University of Oxford) Diseases of Colon Rectum Techniques in Coloproctology | A variety of audios on different topics of surgery, including short topics, presentations, lectures, read-outs of papers, interviews with authors, comments on papers, etc. | Yes |
| Twitter | Popular Hashtags: #SurgTweeting #ColorectalSurgery #SurgEd #surgicaltraining #SoMe4Surgery Useful Twitter accounts: @BrJSurgery , @AnnalsOfSurgery @ColorectalDis and other Journals <i>Collaboratives:</i> @GlobalSurg , @STARSSurg , @EuroSurg <i>Societies:</i> @escp_tweets @ASITofficial @SAGES_Updates , @AmCollSurgeons @ACPGBI | Hashtags and accounts that join the surgical community and allow for interaction, case discussions, comments of recently published papers, connections for research, presentation of new/ongoing studies, promotion of courses, mentorship, collaboration, etc. | Yes |
| Mobile Apps | Touch Surgery https://www.touchsurgery.com/ iLappSurgery (VIPicture, TaTME, iLappLiver, iLapVIP) http://www.ilappsurgery.com/ | Surgical operations simulator Joins pictures to videos in visual educational materials | Yes (costs apply in some content upgrades) |

presence is the **iLappSurgery** app which was created to educate trainees advanced techniques in laparoscopic surgery. For every procedure there is a detailed discussion on embryology, anatomy, step by step approach using 3D animations and colorized videos.

These interactive surgical simulation platforms offer a model of mentorship and guidance to trainees learning new surgical techniques. Aiming to serve as a framework for surgeons in training, but also in practice, to enhance surgical skills through mentoring by a colleague experienced in the procedure.

During the COVID-19 crisis, where elective surgical operating is minimal, it can be a great opportunity for surgical trainees to have video sessions with the consultant bodies walking them through surgical procedures and using these interactive surgical stimulation platforms. Trainees can get a flavor of new surgical techniques in a virtual environment, having a direct discussion with an expert in the field [22].

Can virtual training replace traditional training to some extent?

This raises an important question: if virtual training can replace traditional ways of surgical training and if it provides enough information to the surgical trainees to build up their surgical knowledge and skills. In the COVID-19 era, where all training activities have been stopped or postponed, virtual training can play a key role in surgical education. The step by step approach that the video platforms

provide, the freedom of making mistakes in a blame-free environment where an error doesn't influence the patient's safety) are important tools for the surgical trainee to keep his surgical skills up to date since there is a minimal exposure to operating theaters during the pandemic.

There are several publications in the current literature describing effectiveness of virtual platforms and social media platforms on surgical education. With the surgical training being stopped for the last 2 months, educational boards thinking ahead should invest on careful integration of virtual training and social media in surgical curriculums. During the COVID-19 crisis with trainees working long hours, virtual platforms could be used to fill the educational gaps allowing trainees to choose and pick the time and the type of learning.

The COVID-19 crisis has also led to cancellation of surgical congresses and courses which are important aspects of surgical education where the trainees can present their research activities and work [7]. Exit exams have also been postponed raising questions on gaps in services and extension of surgical training. Education boards have to work on finding alternative ways of covering these educational needs and one way could be investing on virtual platforms being free and available for the trainees. Virtual meetings and congresses are already being scheduled so the scientific activity may continue, and they may be here to stay.

Through redeployment strategies and rescheduling of junior doctors' timetable its crucial for the trainees to have time off to recover and use it for education purposes. The educational boards should invest on providing courses on

non-technical skills for surgeons (NOTSS), courses on leadership and management helping the trainees building up their curriculum vitae.

Remote training can also serve as the base of the introduction of a global e-curriculum, development of educational relationships and sharing of resources which can lead to an establishment of different ways of surgical training.

Several limitations have been described on the functionality of videoconference platforms, such as microphone interference noises, internet connection issues with subsequent difficulties in reviewing radiology images and following up a presentation. There are referred issues with time-lagging between speaking and response receiving that could disrupt the natural flow the conversation. There are also disadvantages on using non-official video-platforms for education since there is no quality control of the viewing material but also there is no active professional feedback and no interaction between the trainee and the educator. The advantages of video platforms on training are well established and some providers have worked on creating specific channels with videos which are peer reviewed and are fit for the education purposes. The quality of content must be guaranteed to assure educational and curricular standards are met. A selection of high-quality resources for surgical trainees can be found in [Table 1](#).

Simulation in surgical training

Simulation training has proven its value in mastering surgical skills but also in improving clinical outcomes and patient's safety [23–26].

Since 2007, the Residency Review Committee of Surgery in the US required development of programs to offer training assessing surgical skills outside of the operating room. As a response to this requirement, teaching tools ranging from laparoscopic box trainers to cadavers and virtual reality (VR) mannequins were developed and gained popularity.

The same year, the ACS/APDS Surgery Resident Skills Curriculum was developed jointly by the American College of Surgeons (ACS) and the Association of Program Directors in Surgery (APDS) a 3-phase simulation curriculum which was integrated to the training curriculum.

The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), in 2007, published a consensus document on the essential components for a robotic surgical training program which was a combination of didactics, hands-on training, and guided operating room components [27].

In 2009, a study group of the American Surgical Association has emphasized the need for additional infrastructure to allow surgical skills development and learning through stimulation [28]. Since 2010, every graduating surgical resident in the US must have demonstrated excellency in fundamentals in laparoscopic surgery before the completion of residency.

The Joint Committee on Surgical Training in the UK, in 2012, agreed to integrate simulation into Surgical Curriculum Project [29].

Since the early 2000, there are studies that shown the benefits of proficiency-based VR training of novices in performing laparoscopic procedures with significant reduction of errors and operating time [30]. Larsen et al. [31], on a randomized control trial on the effect of VR reality on surgical training on laparoscopic surgery, reported that the systematic use of VR increased the performance level of novices to that of intermediately experienced laparoscopists with the operation time being halved. The increased use of robotics in surgery resulted in an increase of the available VR modalities in surgical curriculums. Some of them are web-based such as Fundamentals of Robotic Surgery and some others such as Fundamental Skills of Robot-Assisted Surgery (FSRS) training program and the Robotics Training Network curriculum need trainees being on-site since they provide a presence learning approach. Current simulators enable trainees to practice basic procedural skills along with psychomotor skills. The robotic simulator consoles also match actual surgical consoles, for more precise familiarization with console settings.

The COVID-19 pandemic led to cancelation of elective operating with minimal presence of surgical trainees in theatres [32]. Although hands-on training is postponed during the pandemic, simulation training should be expanded. The educational bodies should use this opportunity to invest on ways of integration of laparoscopic and robotic simulation on surgical curriculum.

There are several web-based programmes that provide modules for basic laparoscopic and robotic-assisted surgical training that could help surgical trainees in developing their surgical skills.

To prevent deskilling of the trainee's educational boards in conjunction with regional training committees should allow laparoscopic training boxes along with instruments and suturing material could be borrowed by the trainees with specific tasks to be completed. Recording of the tasks should allow professional based feedback by the trainers. Real time feedback through video conference platforms such as ZOOM could also be possible, to evaluate progress. On-site simulation training is challenging during the pandemic in an era of respecting the social distancing. The laparoscopic and robotic on-site training consoles need more than one person to operate. Important mechanisms for enhancing the learning outcomes and sharpen surgical skills are constructive professional feedback at the end of the session and practising on different levels of difficulty. Carefully designing of the rotas and timetables of the surgical juniors allocating free time for educational activities (respecting social distancing and taking the required personal protective equipment), could give the trainees opportunities to further develop their surgical skills in simulation consoles getting real time feedback.

The critical times in Healthcare beg for new measures. Globalization of simulation training through telemetry, internet and other distant learning techniques could be a different way of ensuring surgical training with feedback in real time from peers or senior colleagues.

Table 2. Recommendations for surgical training during the pandemic.

| |
|---|
| Educational bodies should invest in simulation training which should become part of the revised surgical curriculum |
| Re-designing of the surgical rotas with respect to social distancing should allow the surgical trainees exposure in “hands on” training through laparoscopic/ robotic simulation platforms, allowing real time feedback |
| Virtual platforms and media could be used as alternatives for surgical education |
| Social media platforms can serve as the media for globalization of surgical education |
| Mental health and wellbeing of surgical trainees is a priority and the role of mentoring is more crucial than ever |

Surgical research

Part of the continuous professional development as an aspect of the training curriculum is the involvement of surgical trainees with research studies.

Unfortunately, surgical research has been heavily hit by the novel coronavirus and today most of the multicentre studies, as well as clinical trials, have been postponed or canceled [33]. Furthermore, consider undertaking a fellowship right now is meaningless.

Scientific Societies, such as the European Society of Coloproctology, should continue to support trainee’s involvement [34] in collaborative studies and international research projects [35,36]. Social media can act as a powerful tool informing healthcare professional about upcoming studies. A characteristic example of the power in disseminating information is the microblogging platform Twitter where a study through hashtags, tweet and retweets becomes known in the global community instantly. International COVID-19 collaborations such as CovidSurg have been widely disseminated through Social media, providing at least some research opportunities during the pandemic [37,38].

The role of the mentoring is vital for both surgical training and surgical research. Especially in this chaotic situation, trainees may present a lack of non-technical skills. Leadership was included as critical attribute for all clinicians by The Royal College of Physicians and Surgeons of Canada [39]. Cochran et al. [40] identified three key characteristics of an effective mentoring relationship from a mentee perspective: working with a strategic advisor, working with an unselfish mentor, and finding a mentor who engages with diverse mentees. In this challenging times for the wellbeing of trainees, the role of mentor is more important than ever.

After the pandemic

It is important for the educational bodies to find ways of restarting surgical training after the end of the pandemic. It is essential that all the lessons learnt from this crisis are put down as policies and guidelines should a 2nd wave of COVID-19 attack the healthcare systems (Table 2).

Restarting of surgical training should be carefully structured meeting the needs of trainees but also the needs of the health systems, to deal with the extra-long waiting lists and the backlogs in endoscopy. The Surgical curriculums and annual competency logbooks should be restructured to allow trainees to meet the annual targets. There will be extensive opportunities for the trainees to build up operating

experience and confidence, but it needs to be combined with their training needs to complete operative curriculum targets. The post-traumatic stress disorder effects should be considered, and the trainees should be counseled regularly and supported. The return to “normal” means that the number of emergency surgical patients will raise substantially. Rota organizers should carefully re-structure the training rotas so service provision (i.e. on call duties) meets the training needs (i.e. elective work) making certain that there is a balance between elective and emergency cover. The role of the trainer should also be restructured and reinforced so they can spend more daily time in theaters with the trainees, ensuring their needs are covered. Trainees being off-training for a period of time, while deployed to COVID-19 or Emergency wards, should be supported to return to their “old” duties with direct supervision and guidance from the consultant bodies aiming for a swift transition without compromising patient care.

Truly, Educational boards have to answer some very difficult questions with regards to extent of training with subsequent gaps in services, new training models, exit exams, in an era where the huge surgical waiting lists will put a strain on health systems.

Conclusions

This unprecedented circumstance will change the way we educate surgical trainees for at least the coming months, if not longer. Innovation and cooperation on the part of surgical residency programs, and leadership on the part of our national societies to maintain rigorous standards of education and training for surgical residents, will be crucial. The recovery time for the “hands on” operative experience for the surgical trainees is difficult to predict. Although it is hard to replicate the surgical skills acquired in the operating theater, technology-focused surgical training based on both computer- and phone-based platforms could be an alternative, closing the educational gap in surgical training. The National Health Systems should make provisional plans on the ways of recovery of surgical training after the pandemic. Thinking ahead, the educational bodies should work collaboratively and through surgical societies (such as the ESCP) to incorporate digital training as part of the surgical curriculum.

Availability of data and material

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Authors’ contributions

Triantafyllos Doulias, Gaetano Gallo & Ines Rubio-Perez contributed equally to this work: Substantial contributions to the conception and design of the work; acquisition, analysis, and interpretation of data for the work. Drafting the work and revising it critically for important intellectual content. Final approval of the version to be published.

Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

Stephanie O. Breukink & Dieter Hahnloser contributed equally to this work: Drafting the work and revising it critically for important intellectual content. Final approval of the version to be published. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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