“The show must go on”: Aftermath of Covid-19 on anesthesiology residency programs

ABSTRACT
COVID-19 has caused tectonic changes in the personal and professional lives of anesthesiologists and, among several aspects, anesthesiology residency and sub-specialty training has also undergone an unforeseen overhaul. We read the articles published on the impact of COVID-19 on training of anesthesiologists and set out to extract and narrate all the significant observations. At the outset, we begin by explaining how this pandemic posed a threat to the safety of the residents and mitigating measures like PPE and barriers that have now become ‘the new normal’. Sub-specialties like critical care, cardiac anesthesia, pain and palliative care have also faced difficulty in imparting training due to an initial dearth in elective surgery case load but have adapted innovative measures to overcome that. Initially, conducting thesis and research became difficult due to problems in achieving the desired sample size needed to get significant results, but this pandemic has emerged as a dynamic laboratory where topics like ‘psychological impact of COVID-19’ and ‘development of artificial intelligence models in COVID-19 ICUs’ came into the fore. Pattern of examination has also become virtual and webinars showed how knowledge, with the right medium, has the potential of global outreach. As the pandemic took a toll on the mental health of the residents, attention was paid to this previously neglected aspect and ensuring their emotional well-being became a priority to avoid the issue of burn-out. We comment on how what initially was considered a scary problem, actually paved way for growth. It brought attention to safety, innovation, new tools for training, finding solutions within constraints, continuing developing our residents into future leaders who were also trained for mitigating disasters. Changes like online education, research on socio-economic impact, priority to mental health and artificial intelligence are here to stay and by imbibing it, we ensure that ‘the show must go on’.

Key words: Academic, anesthesia, burnout, Covid-19, resident training

Introduction
Ever since Coronavirus disease 2019 (Covid-19) was declared a pandemic by WHO,[1] there have been profound alterations in our lives, both personal and professional. The medical fraternity has geared up to face the challenge head-on. In these times of crises, critical care is being prioritized for the most affected Covid-19 patients and hospital working practices are being adjusted as many hospitals are being converted to COVID-19 dedicated hospitals. This has led to an unforeseen compromise in medical education. In a world where work from home, virtual training and simulation-based teaching is becoming the new normal, evolution in medical education is of utmost importance.[2,3]
Anesthesiologists worldwide have emerged as frontline warriors in the war against the pandemic, but the pandemic has adversely affected the academics and training of resident anesthesiologists globally. Anesthesia training, which usually requires a demonstration on patients and teaching on the table, has faced major interruption in hands-on practices, academics, research and pain services. However, owing to the disruptive changes that this pandemic has brought with itself, the modalities of training, education and examination have also been modified which has brought some twists, new challenges and an overall evolution in the field of anesthesiology and critical care.

Recently, few online surveys and articles have highlighted the impact of the pandemic on training of residents of various specialties and super specialties. This can cause an inevitable breach in residents’ training and experience if not addressed timely. In this review article, we have tried to summarize the impact of the pandemic on training of resident anesthesiologists and possible adaptation toward the same.

Walking on Thin Ice Yet Emerging Strong: Safety Considerations and Plausible Solutions

In the current pandemic scenario, every patient exposure is a potential risk due to the highly contagious nature of the Covid-19 virus, so elective surgeries, subspecialty rotations and PAC clinics temporarily came to a halt in most of the hospitals worldwide, because of which seeking surgical consultation and treatment has become quite difficult. Anesthesiology is a hands-on specialty, and anesthesiologists performing aerosol generating procedures are at the greatest risk. The onus of performing any procedure now mostly lies on senior residents or faculty to minimize exposure time and to ensure safety of junior residents. Cancellation of elective procedures grappled postgraduate anesthesia trainees who would usually, from their second year onward, get opportunities for independent working experience, fine-tuning of their skills and creating one’s own style of practice. Hands-on experience of difficult airway management, fiber-optics, video-laryngoscopy, nerve blocks, ultrasound-guided procedures, labor epidurals and many more such opportunities was missed out. Though anesthesiologists are mandated to wear personnel protective equipment (PPE) during any kind of procedure being performed on patients, understanding and communication with PPE is a big hassle and is more problematic for residents who are just starting out. Thus, the learning curve for residents is now anticipated to be longer. A nationwide survey conducted by Halder et al. highlighted the effect of the pandemic on postgraduate teaching of anesthesiologists and found a steep depreciation in the quality and quantity of academic activities (57.47%), cessation of clinical rotations (73.61%) and inability to conduct thesis-related cases (55.29%). Not only anesthesia training, but also trainees of other clinical and nonclinical specialties and super specialties have felt that Covid-19 had a detrimental effect on surgical, clinical and educational activities, and that virtual educational approaches may be more relevant in the future after the pandemic.

Though nothing can replace hands on training, collaboration of improved technology in remote teaching has mitigated training-related issues. For academic activities, resident-led, faculty-moderated sessions were continued through online platforms in many institutes from the very beginning of the pandemic. The educational curriculum has now included clinical topics and emerging Covid-19 literature. These resident-led education sessions have created an opportunity for them to get access to rapidly evolving scientific development, a flexibility to work during a saturated workforce schedule, simultaneously ensuring a close collaboration between residents and core education leadership. These sessions also represent a novel opportunity for the development of residents as educators. For hands-on practices, some institutes have started simulation-based learning and training of safety precautions. To prepare residents to work in critical care units, some institutes and societies have also organized online, interdisciplinary, interactive airway training courses to improve the ability of critical care and noncritical care health professionals in airway management of critically ill Covid-19 patients.

Obstacles Faced by Anesthesia SubSpecialties

When elective cases were stopped to reduce the chances of infection, anesthesia subspecialties like pain services, cardiac, pediatric, and neuro-anesthesia also faced a dearth of patient volume. All these fellowship programs are obligatory time-framed courses of one to 3 years. Due to the pandemic, fellows could not undergo the required basic and advanced rotations nor the minimum required numbers of clinical cases in their respective specialties. These fellows were being redeployed to intensive/intermediate care units of the hospitals to cater to the increasing demand of COVID-19 services. Most fellows felt quite apprehensive about their future client base during the pandemic. In many centers, the course period was extended for fellows so that they could fulfill the required competency. But this step has some issues with logistics as many centers could not provide them a salary...
due to the global economic crisis, adding to the stress of the extended course duration.

Pain Fellowship programs are among the first few to start telemedicine to continue care-delivery and the fellows studying pain management overcame unforeseen problems like the barriers to gathering complete patient information via telehealth, fine-tuning of skills in the last years of fellowship, lost opportunities of communication due to social distancing and reduction in specialized procedures like spinal cord stimulation and so forth.[18] However, highly specialized hands-on training got compromised initially, leading to anxiety about performing these procedures unsupervised as attending consultants in the future without any faculty oversight. Critical care fellows were also over-burdened with the ever increasing case load.

Academic institutes conducting these courses also considered moving toward a competency-based curriculum rather than a time-based one. Institutes encouraged fellows to undergo online learning activities to improve their knowledge in the specialty.[23] In the postpandemic world, timing of surgeries are prioritized and essential surgeries are conducted as per the institution protocol with minimum OR traffic and Level III protection and vigilance measures.

**Consequential Repercussions on Thesis and Research**

Thesis is an essential part of postgraduate (PG) training which introduces the residents to academic research. Thesis emphasizes on the importance of bio-statistics, research methodologies and the practice of evidence-based medicine. Due to reduced cases in OR at the start of pandemic, PG students found it difficult to come up with a study protocol where sample size is attainable. Elective surgeries were being postponed and this reduced the wide variety of study topics which were available to be picked earlier.

The impact of Covid-19 on this aspect of PG training led to strategic repurposing[8] which can make thesis and research work possible in the postpandemic era. Having said that, this pandemic brought along a tsunami of research-work related to it as doctors worldwide began gathering and assimilating data into significant, impact-making articles. On the one hand, research labs are working day and night to develop vaccines and medicines for prevention and treatment of this deadly disease; on the other hand educational institutes and corporate hospitals are publishing original research work and surveys on the clinical, psychological, and economic impact of the disease.[16] while also identifying the current limitations and knowledge gaps. Further research is going to be multidisciplinary and trans-national.[27] Apart from vaccine and treatment, some important areas which warrant further research are equipment of healthcare and personal protection, revolution in information technology, online workshops and simulation for training, awareness and capacity building, occupational hazards, psychological impact and importance of a family support, futuristic biological warfare, sustainable medical supply chain and public health policy and social, economic and environmental impact.

Thus, Covid-19 has broadened the research avenues. When facing difficulty in choosing a topic for thesis and research, many new and unconventional topics for thesis can be taken up and pursued.

**Spin-off Effect on Examinations and Future Prospects**

With the advent of Covid-19, exam-going residents faced an unanticipated challenge when they were at the peak of their hard work and clinical knowledge but had no intimation of an exam date. However, national boards which conduct examinations and regulate medical education became innovative and flexible. They conducted exams with new modified patterns like computer-based simulation, paper case discussions and viva on video-conference or healthy volunteers as patients. External examiners and certification exams ensure quality and play a role in protecting future patients thus these amended assessment[9] measures aim to ensure demonstration of competence, knowledge and understanding. This new pattern caused considerable anxiety among examinees, but like all other challenges, was aced.

Even after clearing exams, many remain apprehensive about future prospects and concerned about the demands in job market. Many doctors who had planned on going abroad were left stranded with an uncertain future causing tremendous stress. These changes sound minor with respect to the overall global impact of the pandemic but it could be drastic when it comes to one’s career decisions.

The aforementioned new models of assessment that this pandemic has unleashed are here to stay and require both the faculty and the residents to be acquainted with it. A survey conducted in Canada to assess the real-world impact on assessment of anesthesiology residents suggests that prompt documentation of clinical performance should be done in the OR itself as it is more accurate and effective with authentic scenarios.[28] A well-detailed feedback written by monitoring the residents in the OR is more useful for them and should be considered at the time of final assessment. A dashboard can be created as a visual tool to display their performance, can identify clinical gaps, help with personalized learning goals and create healthy competition.
Imparting Education – Digitally!

To continue training and didactics, many institutes have prepared a regular teaching schedule since lockdown and have started conducting online classes and webinars on platforms like Zoom, Skype, MS Team, and so on.

This inevitable imposition of technology into teaching could well be the future of medical education. However, some reservations remain as some synergy is lost when people communicate online. It is difficult for the presenter to gauge audience’s participation and there are more temptations to get distracted by other activities as some participants often just set down their phone and mic is muted to avoid disturbance from background noise. Pictures, texts and graphics is now complementing what we learn by hands-on practice for acquisition and refinement of new skills.\textsuperscript{[26,27]}

The vices could be many, but the virtues are no less. Classes, mostly conducted after working hours, have global outreach and can be accessed from anywhere with a steady internet connection without any risks of social gathering of course. A thorough understanding of a theoretical topic can be achieved and chat section can host a variety of constructive discussions. It is cost effective with zero room restrictions. It can be recorded and played at a later suitable time. People who have stage fright or social anxiety find online platform much more comforting.

This overhaul in curriculum can be dealt with efficiently. We need to address these changes in education with residents through a proper orientation. We need to change what we need to but keep whatever we can to maximize the clinical teaching.\textsuperscript{[3]} Safety of learners should also be a priority by working directly with residents and inviting their input, giving them a sense of control. We should find new ways to develop relationship building and collaborative experience and for this, social media platforms can be put to use.

Building a Future: Extending Artificial Intelligence (AI) to Covid-19 Critical Care

AI models are now being used in anesthesiology and critical care in fields like pediatric airway, difficult airway, sleep studies, precision medicine, developing diagnostic and prognostic algorithms in ICU, prognostic prediction of mechanical ventilation and tracheostomy and decision making in critical care.

In March 2020, Rao \textit{et al.}\textsuperscript{[29]} in Georgia, USA used AI by designing a mobile phone-based web survey with a machine learning algorithm to identify Covid-19 cases, when the population was under quarantine. Faster identification and risk stratification led to timely intervention as so many points could be collected through an AI framework.

In April 2020, Rahmatizadeh \textit{et al.} created a 3 stage model of input, process, and output for Covid-19 ICU. Epidemiological data along with clinical and paraclinical information was included in input. Process of AI included artificial neuronal network, deep learning, expert systems and machine learning. Output was diagnosis, prognosis, risk stratification and management. They concluded that efforts of healthcare workers can be supplemented with a decision-making system based on AI which can improve efficiency in Covid-19 ICU.\textsuperscript{[28]}

Li \textit{et al.} from China extended this AI to radiology to distinguish community-acquired pneumonia from Covid-19 pneumonitis.\textsuperscript{[29]}

AI models are being incorporated in genomics, predicting global spread, diagnostic system for pre-existing pulmonary pathologies, understanding mechanism and developing novel therapeutics; and with the on-going research in autonomous patient monitoring in ICU, “Big Data” and cloud computing, it’s going to be revolutionary.\textsuperscript{[30]}

Walking the Road Together and Adaptation within Constraints

This pandemic is like a research and development laboratory where innovation in anesthesiology, both theoretical and clinical, are being put to test. Video laryngoscope was earlier developed as a fallback option but now it’s the instrument of choice.

With digital metamorphosis of education, there is now a myriad of research articles available as open access with plenty of ongoing research work also to improve upon the existing knowledge. Eminent institutions can reach out to millions of doctors instantly without much difficulty through recorded lectures and live-streams\textsuperscript{[6]} and it thus serves as a global platform for exchange of ideas and cultivation of knowledge. Telemedicine is being increasingly explored as an avenue for future development.

Due to reduced time and limited exposure, the residents and faculty keep their minds focused as now every clinical encounter counts much more. Resident anesthesiologists across the nation are gearing up to face the situation confidently. They have taken Covid-19 duties as an opportunity to learn disaster management and mitigation training along with learning critical care. Not only do they know how to provide the best treatment and care with ever increasing work load but also how to utilize the given resources meticulously. Various areas of growth have been identified like workforce planning, capacity building,
pandemic and disaster education, inter-departmental co-ordination and stewardship in resources.

With increasing stress, residents take active efforts to keep their morale high. They are trying to become comfortable with autonomy once they complete training.[11] There is an emerging resilience and confidence among residents to face the pandemic and to learn about their chosen field of specialty as it is in very high demand.

To sum up, this pandemic has brought tectonic changes which are irreversible and are here to stay. Unarguably, professional and personal lives have become quite difficult and stressful for residents, but from day one, anesthesiologists are taught to stand tall in the line of fire and this is exactly what we are doing with the motto that “the show must go on” and with a hope that “we shall overcome.”

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There are no conflicts of interest.

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