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# The Acute Care Surgeon in Pandemics – Lessons from COVID-19

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## Key Words:

- pandemic,
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- COVID19,
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## Abstract

The pandemic in 2020 has had economic, health, social, and cultural impacts on the entire world's population. At the time of writing the coronavirus disease 2019 (COVID-19), a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) had infected over 65 million people causing 1.5 million deaths with ongoing exponential growth in case numbers in many parts of the world. The impact of surgical care delivery has been profound. Initial orders to cancel elective surgery preserved inadequate stockpiles of personal protective equipment and prevented exposures of surgical patients to asymptomatic COVID-19 infected persons in the face of insufficient testing. However, this led to a backlog of elective surgery. There were also delays in presentation of acute surgical conditions, probably due to patient fears of contracting COVID-19 at hospitals. Surgeons were required to develop processes such as creation of dedicated COVID-19 operating rooms to prevent nosocomial spread of the disease and infection of the operating room team. Surgeons have provided surgical and critical care to COVID-19 patients during the current pandemic despite initial shortages of ventilators, PPE and information. Surgeons are now successfully managing acute surgical complications of COVID-19 as well as COVID-19 patients presenting with trauma and non-COVID-19 related acute surgical conditions, despite early reports of poor outcomes. Lessons learned included issues in preparation, training, planning, provider wellness, burnout, surgical disparities, testing, PPE, operating rooms, cancellations of elective surgery, regional coordination, and information technology. Surgeons should be now ready to engage in advocacy efforts to ensure that the next pandemic can be better handled by the healthcare system.

# Introduction

A pre-pandemic survey of acute care surgeons performed by the American Association of the Surgery of Trauma (AAST) Disaster Committee in the summer of 2019 indicated that they felt significantly less prepared to deal with pandemics as compared to mass trauma events. (1)

At the time of writing the coronavirus disease 2019 (COVID-19), a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) had infected over 65 million people causing 1.5 million deaths with continued exponential growth in case numbers in many parts of the world. The front line of hospitals' defense against COVID-19 is staffed by anesthesiologists, pulmonologists, infectious disease physicians, epidemiologists, and allied nursing and technologist disciplines. However many surgeons have been involved in the management of COVID-19 patients, either using their experience in looking after critically ill patients, or in managing complications of COVID-19 disease.

Surgeons may anticipate responding to man-made disasters such a terrorist bombings or mass shootings, where the acute disruption to local trauma system processes may last several hours, or natural disasters such as earthquakes or cyclones, where regional disruptions may last for weeks or months. However, pandemics are global by nature and last for years. The COVID-19 pandemic has had economic, health, social, and cultural impacts on the entire world's population. The impact of surgical care delivery has been profound. Surgeons have been called on to perform leadership roles in reorganizing surgical care in the face of shortages of personnel and equipment and increased risks of disease transmission to perioperative staff.

## Surgical Considerations

### Aerosol Generating Procedures

In the first months of the pandemic, there were significant gaps in knowledge of COVID19 disease effects, diagnostic testing, therapeutics and outcomes. Even whether the disease was transmitted by droplet or airborne spread remained a public controversy for months. As in the 2003-4 SARS outbreak, inadequate use of personal protective equipment (PPE) or inadequate PPE was blamed as the cause of many healthcare workers contracting COVID19. (2) (3) This has now again been a principal cause of transmission of COVID-19 to healthcare workers (HCW). (4) An area of great concern was aerosol generating procedures (AGPs) such as intubation, tracheostomy, endoscopy, laparoscopy and use of electrocautery, which were known since the 2003-4 SARS outbreak to have significant risk of transmission of coronavirus to HCWs. In general, those performing and assisting in AGPs require higher levels of PPE.

Initial advice on AGPs and surgery was sometimes contradictory or changed rapidly – for instance the American College of Surgeons (ACS) in March 2020 had first recommended avoidance of laparoscopic surgery, or any surgery in COVID-19 patients This included IV

antibiotic management of appendicitis and percutaneous cholecystostomy for acute cholecystitis not responding to non-operative management. This was surprising news to many surgeons as percutaneous cholecystostomy actually has worse outcomes with longer stays and simply shifts the risks and use of PPE from the operating room to interventional radiology suite.(5) Within two days, after feedback from acute care surgeons some responding via social media, the ACS policy was revised with the understanding that AGP risks were manageable, early surgery and discharge would avoid prolonged hospital stays and was a better use of resources. Paranoia about AGPs led to many initially perceived “good ideas” such as construction and distribution of intubation boxes, which actually made endotracheal intubation more difficult without any proven risk reduction, and while possibly increasing risk to the HCW.(6) (7) (8) Similarly, much effort was expended on creating devices to allow two patients to use one ventilators, or to create expedient ventilators, neither of which saw significant use in the US.

Tracheostomy is another example where several studies attempted to address fears over AGP by modifying usual techniques or creating physical barriers such as plastic tents to improve the safety of the procedure. Others advocated delay or complete avoidance of tracheostomy in intubated COVID-19 patients, despite known benefits of early tracheostomy over prolonged ventilation. (9) Over 230 articles on tracheostomy in COVID-19 were published in 2020. In actual fact, most of these mitigation attempts actually made the procedure more difficult. Subsequently a clinical study in 164 patients showed, independent of the severity of COVID-19 illness, that 30-day survival was higher and ICU stay shorter receiving standard early tracheostomy, without any HCW infections occurring. (10)

In a similar fashion, there was concern regarding laparoscopic procedures on COVID-19 patients. Theoretically, laparoscopic port exhaust gases and smoke could contain infectious particles. Editorials appeared for and against laparoscopy in COVID-19. (11, 12) The controversy erupted despite no prior reports of transmission of disease to HCWs from laparoscopic smoke or gases. Several reviews have subsequently suggested there is no apparent increased risk of laparoscopic versus open surgery for COVID-19. (13-15) It is recommended to use filtered smoke and gas evacuation systems, especially for desufflation to avoid smoke exposure according to guidelines, but there is no prohibition of laparoscopic procedures in COVID-19 patients. (16)

The AGP procedures most associated with risk of COVID-19 transmission are intubation and endoscopic procedures such as bronchoscopy, which are procedures performed in the operating room and intensive care unit by anesthesiologists and surgical intensivists. In the 2003-4 SARS outbreak, transmission of coronavirus to HCWs was significantly associated with performance of intubation. (17) However, with appropriate PPE and technique, there have been a least one series of intubations of COVID-19 patients without any nosocomial infection of proceduralists. (18) Guidelines exist for the safe performance of endoscopy for COVID-19 patients with considerations what appropriate PPE should be worn, when immediate versus delayed procedures should be done. (19, 20) Unfortunately, in many regions there have been severe shortages of required PPE, which increases risks for HCW infection.(21)

## COVID-19 Surgical Presentations

The typical illness produced by SARS-CoV-2 is a viral upper respiratory infection, sometimes complicated with pneumonia. However, predominantly gastrointestinal presentations of COVID-19 have been described. About 61.5% of hospitalized COVID-19 patients had gastrointestinal symptoms at hospital admission, and 14.5% had abdominal pain. (22) There was also a significant association between anosmia and gastrointestinal symptoms at presentation. In some cases, the gastrointestinal symptoms of COVID-19 may mimic surgical conditions such as acute cholecystitis, requiring careful evaluation and preoperative SARS-CoV-2 testing to avoid a non-therapeutic procedure and increased risk of post-operative complications due to COVID-19. (23)

Increased post-operative morbidity and mortality in COVID-19 surgical patients was noted early in the pandemic when testing for SARS-CoV-2 was not available or timely. A review of 4 studies showed 14 post-operative deaths in 51 asymptomatic surgical patients (27.5%) and severe, mostly pulmonic complications. (24) In another series of 34 asymptomatic elective surgical cases, there was a 20% postoperative death rate, 44% ICU admission rate and 100% rate of postoperative pneumonia. (25) These alarming results led to calls to delay elective surgery and obtain screening tests for SARS-CoV-2 for asymptomatic adult preoperative cases whenever possible. (26) However, safe performance of urgent EGS procedures, even with positive SARS-CoV-2 tests is possible, especially when operating room workers are properly trained and have appropriate PPE. Most facilities designated at least operating room as a COVID-19 OR to avoid exposing patients to SARS-CoV-2 contaminated spaces and equipment.

## COVID-19 and Emergency General Surgery

Given the high prevalence of COVID-19 cases, it should not be surprising that some COVID-19 positive patients will present with acute abdomens and other acute surgical issues, including burns and trauma. In these cases, delay of surgery is usually not feasible.

An early international cohort study of 235 hospitals in 24 countries included all patients undergoing surgery who had SARS-CoV-2 infection confirmed within 7 days before or 30 days after surgery. It included 1128 patients, 835 (74.0%) had emergency surgery and 280 (24.8%) had elective surgery. SARS-CoV-2 infection was confirmed preoperatively in 294 (26.1%) patients. 30-day mortality was 23.8% overall. Pulmonary complications occurred in 577 (51.2%) patients; 30-day mortality in those patients was 38.0%, accounting for 81.7% of all deaths. The authors recommended that thresholds for surgery during the COVID-19 pandemic should be higher than during normal practice, particularly in men aged 70 years and older. (27)

Such results could lead to fears of performing EGS during the pandemic, however later published results indicate that conventional approaches to EGS can lead to reasonable survival. A U.K. retrospective study of 103 EGS patients aged 17-88, 49% of whom had a preoperative COVID-19 test, all negative, had only 1 death (1%). Morbidity was 16%, with 11/16 having non-pulmonary complications. Post-operatively, 7% tested COVID-19 positive, these patients had longer lengths of stay.



A study of 141 patients with severe ARDS and COVID-19 showed that they were more likely to develop gastrointestinal complications compared with those without COVID-19 (74% vs 37%;  $P < .001$ ; OR 2.33 [95% CI, 1.52-3.63]). (28) 4 patients (3.8%) developed bowel ischemia, 3 went for laparotomy and pathology findings demonstrated fibrin thrombi in the microvasculature underlying areas of necrosis of the intestine. Patients with severe COVID-19 disease develop a highly inflammatory and prothrombotic state that leads increase death and complications, including thrombotic complications. A metaanalysis of thromboembolism (TE) in COVID-19 patients identified 42 studies enrolling 8271 patients. The overall venous TE rate was 21%, the deep vein thrombosis rate (DVT) was 20%, the pulmonary embolism rate was 13%. Arterial TE rate was seen in 2%. The mortality rate among patients with TE was 23% versus 13% among patients without TE. Clinical trials are underway to determine the impact of thromboprophylaxis on TE and mortality risk of COVID-19. (29) Careful assessment of coagulation status and stratification of VTE risk with appropriate prophylaxis is prudent in perioperative COVID-19 patients.

Trauma surgery has been successfully performed, before and after the availability of rapid preoperative SARS-CoV-2 testing. A trauma patient with persistent fever, thrombocytopenia, elevated transaminases or diarrhea could be SARS-CoV-2 positive, as the usual leukopenia and hypoxia may arrive in a delayed fashion. (30) Universal testing should be done for all trauma patients and appropriate PPE worn until tests return negative. Rapid (<1 hour) RNA amplification tests for SARS-CoV-2 unfortunately have limited availability in many areas, and may suffer from somewhat decreased sensitivity (80-90%) compared to batched reference RT-PCR tests (97%).(31)

Cancer surgery cannot be delayed indefinitely during the pandemic but can be completed successfully. A series of 520 cancer procedures, 494 of which were elective, was accomplished in March and April 2020 in an area of moderate COVID-19 prevalence in India without any deaths. (32)

## Systems of Surgical Care

### Impact on Trauma Center/EGS Access

An unfortunate phenomena in many US cities during the 2020 pandemic was an increase in trauma center admissions due to interpersonal violence, including gun violence. (33) While many types of elective surgery were on hold to allow hospitals to deal with COVID-19 admissions, the spike in gun violence cases was tragic and most unhelpful. Possible reasons for the escalation include increased unemployment, increased alcohol consumption, and increased gun sales. The initial shutdown of many surgical services and lockdown orders was accompanied by a significant decrease in overall trauma admissions during March – June, 2020 in many US cities, especially for elderly falls, road-traffic accidents and non-intentional mechanisms. (34) (35) However trauma admissions increased to pre-pandemic levels in most US centers by September, 2020. Any hope that later lockdowns would decrease utilization of hospital resources by trauma patients during the November-December 2020 surges has not been realized.

Another tragic effect on the pandemic seen in trauma centers was an increase in intimate partner violence (IPV). Nine US cities reported increases in IPV from 20-30% and as high as 60%. (36) There is serious concern about mental health issues during the pandemic and the risk of further health crisis including depression, suicide and homicides. Child abuse and neglect is another concern. With the prolonged closure of schools, children are often confined at home with potential abusers, and may not have access to teacher witnesses, nurses or school-based social workers. Increased vigilance by trauma surgeons and allies treating injured children is warranted. (37)

Delays in presentation of EGS patients were seen early in the pandemic and led to increased morbidity with increased post-operative complications. A Spanish study noted a monthly decrease in EGS presentations of 58.9% and an increase in time between symptom onset and presentation, with morbidity increasing from 34.7% to 47.1% of cases. (38) Many surgical patients expressed fear of going to the hospital due to a perceived risk of exposure to COVID-19. However, hospitals were quick to implement masking, social distancing and limited visitation resulting in a rather safe environment. As such, many centers performed outreach efforts in the media to encourage patients to feel safe seeking care.

Elective surgeries were canceled by public health agencies to preserve PPE and to allow for development of processes surrounding the operating rooms both in the inpatient and ambulatory setting. In many facilities, these areas have physical space overlap, and the operating rooms have common space where healthy and COVID-19 infected patients have potential to overlap. Active management was required to both cancel and track patients affected by OR shutdowns, to ensure post-operative care was delivered, new consultations were triaged, and canceled cases were rescheduled. Surveillance of cancelled cases was necessary re-evaluated to ensure no change in clinical status during the delay.

As clinics and elective surgery were re-established, prioritization of the backlog of cases needed to be addressed. Telehealth practices were developed in the clinic and post-operative environment, and surgeons began to utilize video-conferencing technologies for post-operative visits to assess wounds and clinical course. Selected patients also had Telehealth pre-operative visits via video visit. A potential advantage of Telehealth was the ability to evaluate the patient in their own home environment with family or caregivers present.

Many of the prior barriers for Telehealth, were removed by lifting of restrictive federal regulations and the allowance of billing for these services. Previous to COVID-19, these types of visits were not reimbursed or supported from hospital IT platforms. The urgent deregulation of these restrictions allowed expeditious response of hospital IT programs. Rapid training of large numbers of surgeons and physicians was necessary to adapt to this newly available outpatient care tool. (39, 40)

## COVID-19 and Social Disparities

There is a significant body of literature that indicates that there are significant disparities in outcomes in the US for trauma, EGS and cancer surgery patients due to racial, social and structural issues. It is also true that COVID-19 spread and outcomes are also affected by these same factors. Many comorbidities that lead to increased risk of COVID-19 complications and death, such as obesity, hypertension, diabetes and chronic kidney disease are more common in Black Americans and other groups. Overall, Black Americans have double the mortality of COVID-19 compared to Whites and Asians and Black Americans aged 35-44 have nine times the mortality from COVID-19 that their white peers. (41) The pandemic has placed a spotlight on these disparities. The data represents an overdue opportunity for surgeons to advocate to improve the access to care, strengthen our trauma and EGS systems, and remove barriers for these populations of patients.

## Impact of Trauma Center Processes

The impact of the pandemic on the typical US trauma center was significant. Trauma Medical Directors and the ACS faculty had to adapt to finding and using PPE for all admissions, and using rapid SARS-CoV-2 testing when available, and prioritizing tests when there was limited test availability. Each facility required designation of at least one dedicated operating room for suspected and known COVID-19 positive surgical patients. OR, ED and ICU rooms frequently required modification to control air flow, generate negative pressure and to create restricted access. ICUs had to be reorganized and redesignated for COVID-19 or non-COVID-19 cases. (42) Elective surgery was cancelled initially both to allow development of new processes and procedures and also to preserve PPE. However, increased demand pushed their reopening once these were created. (43) Staff, faculty, and residents all needed to learn proper use of PPE and how to perform procedures, including AGPs, safely. (44) Transferring suspect and known COVID-19 patients within the facility and designating spaces and corridors for their transport was another issue to be solved. In many locations, alternate ICU spaces had to be opened, such as in post-anesthesia care units or disused hospital wards.(45)

Acute Care Surgery teams in some institutions have used their intensive care skills to relieve pulmonologists, sometimes to run additional ICUs. In other centers, they formed central line insertion teams, performed tracheostomies, or assisted with prone positioning. Assistance in providing family communications became a critical task as families and visitors were largely banned from the hospital. Multi-disciplinary rounding on patients became more frequent during surges and a larger in-house presence for surgical and critical care services was required. Tele-presence and tele-critical care were used in some centers to avoid excess PPE use and room entries, especially in ICUs. (46)

Leadership by surgeons and their teams were needed to manage fatigue. Lack of adequate PPE, fear of infection, frequent decontamination, donning and doffing of PPE, lack of usual pastimes, isolation from friends and families, even being called a “hero” can take a significant emotional toll on HCWs. (47, 48) Burnout is a significant problem for surgical residents and surgeons dealing with this pandemic. (49, 50) Surgeons should anticipate these effects, be prepared to provide leadership and demonstrate care and concern for their colleagues, trainees and allies during the crises. In some cities, particularly in the northeast US early in the pandemic,

volunteer, military or federal HCWs were able to provide some relief to hospitals, but as more regions were affected, there were general shortages of many types of HCWs.

Other leadership skills needed by surgeons are those to negotiate with other departments and administration to ensure adequate staffing, space, testing, PPE, immunizations and budget to maintain the trauma center and acute care surgery services. Support of the overall mission of the institution by surgeons must also be evident to maintain good relations with senior administration.

Many physicians not involved with their hospital's emergency management committee are surprised by the appearance and role of the Hospital Incident Command System (HICS), which is required by federal mandate and is delegated the responsibility for the hospitals specific response to an emergency. A better understanding of HICS and its responsibilities can be accomplished by taking online Federal Emergency Management Agency (FEMA) courses or the ACS Disaster Management and Emergency Preparedness (DMEP) course. (51)

A concern about surges that threatened to overwhelm facilities with COVID19 patients was whether resource allocation of ventilators, extracorporeal membrane oxygenation (ECMO) or other devices would be needed. Under a crisis standard of care, a triage process is proposed to determine which patients would achieve benefit and which patients would be excluded from being allowed to being placed on a ventilator. (52, 53) This triage process would have to apply to all patients in the hospital, not just COVID-19 patients, and would need to be performed in a standardized manner by a committee and not the bedside clinicians. Federal and state guidelines indicated how this crisis standard of care would be applied, but as of December 1, 2020 no facility has had yet to allocate ventilators under such as scheme. Concerns existed over the criteria used to for resource allocation, including whether disabled persons, aged persons, patients with cancer and persons of color would be treated equitably.(54, 55)

Education of surgical trainees was disrupted during the pandemic, sometimes unnecessarily. Medical students from many schools were initially banned from hospitals out of an abundance of caution, but eventually were returned to the wards. Medical students can be involved in COVID-19 patient care, including trauma and EGS care, if properly trained and equipped.. Surgical residencies and fellowships were sometimes severely affected by the cessation of elective surgery. (56) Residency and fellowship interviews became virtual. (57) It is hoped that virtual learning, videoconferencing, social media and telemedicine can replace some lost educational opportunities. Consideration of trainees' mental health is an issue and is an area where surgeon leadership is needed.

## Trauma Systems Responses

Urban, Level-1 trauma centers are uniquely poised to be "command centers" for trauma care. It is essential trauma centers reach out to regional institutions by way of Trauma Medical Directors and Trauma Program Managers to provide resources and expertise, ensuring that regional trauma system's capacity is preserved. Level-1 trauma centers are also often Burn Centers and regional

centers for EGS. The trauma center is a component of the Trauma System, which itself has important interactions with the emergency medical system (EMS) and the public health system.

The trauma system is usually able to manage multiple casualty surges lasting a few hours. In some US states, the trauma system is also designated the disaster response system. However the COVID-19 pandemic is an event of broad geographic impact, lasting years, with multiple surges and that also provides direct risks to the HCWs themselves. Trauma systems are not specifically designed to manage pandemics alone. Instead, regional coordination of multiple hospitals is needed.

A regional medical operations center (RMOC) is a center that can provide situational awareness of hospital and EMS conditions, distribute patients, manage EMS resources, identify alternate care sites, ensure trauma and non-stroke emergencies are considered, provide consensus on crisis standards of care and identify outbreaks in high-risk populations. The RMOC can coordinate the response of the emergency management (disaster) system, public health system and acute care hospitals. The RMOC uses the framework of the EMS and Trauma systems to operate. Formal agreements are made to insure collaboration, and representatives of all stakeholders are present physically or virtually. The RMOC has robust communications, including to the Emergency Operations Center (EOC) for the region. It can monitor hospital capacity, EMS dispositions and distribute resources and patients across the system. The RMOCs in western Washington state and other areas have been successfully used to coordinate the health system's pandemic response. (58, 59) Unfortunately many parts of the US lack such a well-integrated system resource as the RMOC.

## Leadership and Advocacy for the next time

It is obvious that the health care system of the US was not optimally prepared for a pandemic such as COVID-19. There was initially poor intelligence about the nature of SARS-CoV-2. Despite many states' stockpiles and the federal Strategic National Stockpile (SNS), there was a prolonged shortage of PPE and ventilators. COVID-19 positive patients were returned to their nursing homes, ill-advisedly. Many members of the public were reluctant to wear masks or perform social distancing. Messaging from Public Health and governmental authorities about how to protect oneself from COVID-19 were sometimes inconsistent. Some facilities were overwhelmed during surges with state or federal help arriving too late or not properly utilized. Many members of the public are now mistrustful of potential COVID-19 vaccines, which may limit participation. Surgical patients had prolonged delays in receiving care, leading to worsened outcomes and vulnerable populations suffered disparately poor outcomes.

All these problems have been now been revealed, despite some prior efforts to prepare, plan and stockpile for pandemic. Surgeons have an opportunity to lead advocacy efforts to ensure the next pandemic or disaster will be better managed by our healthcare system:

Nationally:

- We should demand the SNS is properly equipped to manage pandemics and mass trauma events, including adequate PPE and ventilators.

- There needs to be national trauma and emergency response system, which can be created by integrating military and civilian trauma systems to achieve zero preventable deaths after injury, such as described by the National Academy of Medicine.(60)
- Provide support to states and regions to create RMOCs.
- A system to rapidly increase manufacture PPE.
- Improve communication and education with the public to understand the nature of viruses and how to control pandemic spread.
- Provide consistent public health messaging before, during and after pandemic.

#### Statewide:

- The state disaster stockpiles must be maintained to manage pandemics and mass trauma events, including adequate PPE and ventilators.
- Support for RMOCs to cover the state and coordinate disaster responses.
- Support for regional or hospital equipment caches for PPE and ventilators.

National professional organizations such as the American College of Surgeons and the American College of Physicians undertake significant advocacy efforts with state and federal governments. They can also provide advocacy training and opportunities to meet policymakers. Volunteer surgeons are a key component in advocacy for surgical patients. As surgeons are constituents and professionals who have worked on the front lines of this pandemic response, they have a credible message and can be effective in creating the needed changes in our health system for the next pandemic or disaster.

## Conclusion

There were a number of lessons learned by acute care surgeons during the first year of the COVID-19 pandemic (Table 1). Challenges existed in providing both trauma, emergency and elective surgery during the early pandemic due to mandated closures and inadequate supplies of PPE, ventilators and tests. Acute Care Surgeons were challenged to provide surgical and critical care to COVID-19 patients despite these shortages, and also supported their fellow pulmonary intensivists in the ICU. Lessons learned for the next time included issues in preparation, training, planning, provider wellness, burnout, surgical disparities, testing, PPE, operating rooms, cancellations of elective surgery, regional coordination, and information technology. Surgeons should be now ready to engage in advocacy efforts to ensure that the next pandemic can be better handled by the healthcare system.

Table 1. Lessons learned by Acute Care Surgeons in COVID-19

Preparation:

- Surgeons will be involved considerably in response to pandemics.
- They must manage surgical complications of the pandemic disease.
- They must perform surgery on patients with active viral disease.
- They may need to assist pulmonary critical care teams by performing bedside procedures, or provide critical care for COVID-19 or non-COVID19 patients.

Training:

- Acute Care Surgeons previously reported lower levels of pandemic personal preparedness compared to mass trauma , they should obtain training in disaster management that includes pandemics.
- Future hospital exercises and plans should incorporate lessons learned from COVID-19'

Planning:

- Surgeons must be involved in surge capacity planning. The American College of Surgeons trauma center verifications standards requires that a surgeon be a member of the hospital disaster (Emergency Management) committee.
- Surgeons should assist efforts to augment health care workforce contingency plans, including emergency credentialing of surgical personnel across states, retiree, volunteer, and military.

Provider wellness/Burnout:

- Burnout, decreased wellness and poor self-care were observed by surgeons and trainees during the pandemic.
- Surgeon wellness and self-care must be a priority for the profession and hospitals, a need reaffirmed by the COVID-19 pandemic.

Surgical Disparities:

- The COVID-19 pandemic further exposed significant racial and social differences in disease prevalence, complications and death.

Testing:

- Preoperative testing for SARS-CoV-2 is essential to maintaining adequate surgical services, including elective surgery.
- Rapid tests for SARS-CoV-2 significantly improve the ability to safely perform emergent surgical procedures
- Employee/Physician testing for SARS-CoV-2 should be mandatory for surgical personnel and should be performed on a regular basis, i.e. weekly.
- Some regions were able to create successful public-private

PPE (personal productive equipment)

- Perioperative and surgical personnel must be given access to adequate PPE and training for appropriate PPE usage.
- Surgeons should be represented in decisions to allocate PPE resources within the hospital.

### Operating Rooms:

- The hospital should set aside at least one operating room for operating on COVID-19 positive and suspected cases.
- The COVID-19 operating room requires that the OR staff be educated in the safe performance of surgery on COVID-19 positive patients.

### Cancellation of Elective Surgery

- The decision in many regions to cancel elective surgery was made by public health officials, largely to maintain PPE stocks and reduce the number of persons entering hospitals.
- The cancellation of elective surgical cases during acute surges of COVID19 admissions reduced consumption of PPE, personnel requirements and permitted initiation of routine testing.
- However, cancellation of elective surgical cases also resulted in a backlog of cases and delays in surgery. This was associated with patients presenting with more advanced disease and worse outcomes.
- Preparation for pandemics should include describing clear triggers for halting elective surgery and identifying when elective surgery can be restarted.

### Regional Coordination

- Some regions benefited from regional medical operations centers (RMOCs) which provided situational awareness of hospital and EMS conditions, distribute patients, manage EMS resources, identify alternate care sites, ensure trauma and non-stroke emergencies are considered, provide consensus on crisis standards of care and identify outbreaks in high-risk populations

### Information Technology:

- Telehealth use by surgeons and their patients expanded considerably during the pandemic including preoperative and post-operative virtual visits, although many patients were unable to participate.

### Advocacy

- Surgeons and their professional societies should request that the Strategic National Stockpile performance be strengthened to be effective and efficient during a pandemic (e.g., expansion of ventilators, and other durable medical equipment antibiotics, intravenous fluids, and other medicines to sustain critical care).
- Surgeons and their professional societies should request telehealth and payment reforms, including across state borders.
- The racial and social disparities further exposed by the pandemic require significant efforts to improve health equity.

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