



Getting back to work: A framework and pivot plan to resume elective surgery and procedures after COVID- 19



Oscar K. Serrano, MD, MBA, FACS ^{a,b,*}, Rocco Orlando, MD, FACS ^{a,b}, Pavlos Papisavas, MD, FACS ^{a,b}, Mitchell H. McClure, MD ^{a,c}, Ajay Kumar, MD ^{a,c}, Adam C. Steinberg, DO, FACS ^{a,d}, Jeffrey L. Cohen, MD, FACS ^{a,b}, Steven J. Shichman, MD ^{a,e}, Rekhinder K. Singh, MD, FACS ^{a,b}, William V. Sardella, MD, FACS ^{a,b}, Bret M. Schipper, MD, FACS ^{a,b,f}

^a Hartford HealthCare, Hartford, CT

^b Department of Surgery, University of Connecticut School of Medicine, Farmington, CT

^c Department of Medicine, University of Connecticut School of Medicine, Farmington, CT

^d Department of Obstetrics and Gynecology, University of Connecticut School of Medicine, Farmington, CT

^e Department of Urology, University of Connecticut School of Medicine, Farmington, CT

^f Department of Surgery, Frank H. Netter M.D. School of Medicine at Quinnipiac University, North Haven, CT

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ABSTRACT

Introduction: The COVID-19 pandemic has compelled a majority of hospital systems to reduce surgical and procedural volumes in an attempt to preserve resources. Elective surgery and procedures resumption has proven to be a calculated risk between COVID-19 exposure and resource depletion and patient morbidity and mortality from surgical deferral.

Methods: Within a few days of halting elective surgery and procedures, our 7-hospital (2427 in-patient beds, 26,647 inpatient surgeries) healthcare system developed a multidisciplinary Pivot Plan with the primary outcome of a phased resumption of elective surgery and procedures. The plan entailed the integration of our electronic medical record, order entry automatization, perioperative staff utilization, partnering with primary care providers, and a stepwise COVID-19 testing algorithm based on a predetermined hierarchy of case acuity and timeliness of patient care.

Results: The Pivot Plan was instituted on May 10, 2020. Since then, 22,624 patients have been tested for COVID-19 in anticipation of an elective surgery and procedures; 140 (0.62%) tested positive for COVID-19 and had their procedure deferred. As our testing capability has increased, we have been able to increase our added elective surgery and procedures capacity from 13 cases per day to 531 cases per day. In turn, we have seen the case volume increase by 52%.

Conclusion: Our academic healthcare system located in one of the initial COVID-19 hotspots in the United States has successfully resumed elective surgery and procedures in part due to a receptive and supportive culture based upon nimbleness, agility, and rapid integration of multiple resources from a cohort of diverse disciplines applied to the perioperative services workflow.

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INTRODUCTION

The COVID-19 pandemic resulting from the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has radically transformed every aspect of daily life. As of July 15, 2020, SARS-CoV-2 has infected over 13 million individuals and claimed over 550,000 lives, spanning 188 countries across the globe [1]. The magnitude with which the disease has

upended everyday life is staggering. Daily reports about how COVID-19 patients have overwhelmed even the most sophisticated public healthcare systems in the world paints a sobering picture on emergency preparedness and public health efforts during a pandemic.

Justifiably, the COVID-19 pandemic has compelled a majority of hospital systems to reduce surgical volumes in an attempt to preserve resources—operating room (OR) personnel, personal protective equipment (PPE), medical equipment, supplies and medications, blood products, and physical space, to name a few—for the progressively rising COVID-19 census. Shortly after the World Health Organization declared COVID-19 a pandemic, the Centers for Disease Control and Prevention and the American College of Surgeons distributed guidelines on surgical

* Corresponding author at: Hartford Hospital Transplant & Comprehensive Liver Center, 85 Seymour Street, Suite 320, Hartford, CT 06106. Tel.: + 1 860 972 4219; fax: + 1 860 549 1476.

E-mail address: Oscar.Serrano@hhchealth.org (O.K. Serrano).

resource management during the pandemic [2,3]. Consequently, many hospitals ceased elective surgeries and procedures (ESP) and significantly reduced the volume of operations that could be deferred with nonsurgical adjuvant options.

In response, hospitals and healthcare systems have had to rapidly develop protocols to deliver surgical care in the most efficacious and safe manner. The rapid integration of telemedicine into established practices has become paramount for many healthcare systems [4,5] facilitated by the 1135 Waiver from the Center for Medicare and Medicaid Services [6]. As a result of a progressive deferral of cases during the pandemic, it has been estimated that some surgical practices may need to work in excess of 200% of a monthly baseline volume to clear the backlog of deferred cases in a time frame between 2 and 8 months, depending on resource and personnel availability [7]. As the number of COVID-19 cases has declined and with an increasing understanding of the nature of the disease, hospitals have had to develop detailed plans to provide needed surgical care—both the backlog of cases and de novo cases—and a schedule for surgery.

Connecticut has been described as a microcosm of America because of its diverse demographic composition [8]. The COVID-19 pandemic has affected the state of Connecticut especially hard. As of July 15, 2020, Connecticut had 47,636 confirmed cases of COVID-19 and 4380 deaths [9]. In terms of case fatality, Connecticut had the third highest death rate from COVID-19, only behind New York and New Jersey, with 107 deaths per 100,000 people [10]. As one of Connecticut's largest healthcare system, Hartford HealthCare (HHC) rapidly recognized the need to establish a containment plan. Once the curve had been flattened, we identified that resuming operational and surgical services was going to take a methodical and comprehensive plan with cautious and malleable objectives to ensure the safe delivery of surgical care in uncharted territory with unknown evidence-based guidelines. We report on our Pivot Plan to resume ESP after COVID-19.

MATERIALS AND METHODS

HHC is Connecticut's largest integrated healthcare system with 30,000 employees, 7 acute care hospitals, the state's longest-running air-ambulance service, 3 behavioral health and rehabilitation services, a large physician group (496 physicians) and clinical integration organization (400 primary care providers), skilled-nursing and home health services, and a comprehensive range of services for seniors, including senior-living facilities. The 7 HHC acute care hospitals account for 2427 in-patient beds, 446,813 emergency department visit, and 26,647 inpatient surgeries.

On March 10, 2020, the state of Connecticut recorded its first case of COVID-19 at Danbury Hospital in Danbury, CT [11]. On March 13, 2020, HHC identified its first COVID-19 patient. Shortly thereafter, Gov. Ned Lamont ordered nonessential businesses in Connecticut to stay closed [12]. Although the Governor's Executive Orders did not specifically prohibit ESP, HHC and Connecticut's other health systems elected to suspend all ESP in anticipation of the surge of COVID-19 patients beginning on March 19, 2020. The move dramatically decreased the work of hundreds of OR personnel, including surgeons from all specialties. ESP were defined as those procedures which were not time sensitive and could be safely deferred without causing harm to the patient. Within days of ESP suspension, a multidisciplinary planning committee comprised of surgeons, OR nurses, operational and facilities management staff, infectious disease and cardiopulmonary specialists, anesthesiologists, proceduralists, and other clinical leaders at HHC was assembled to triage surgical volume, allocate OR resources, and construct a framework for resuming ESP while ensuring the safe delivery of surgical and procedural care once COVID-19 restrictions had been lifted in the state of Connecticut. The team worked for weeks on a plan known as our Pivot Plan to resume ESP after COVID-19, leveraging the existing HHC culture and operating model, How Hartford HealthCare Works (H3W). H3W has 4 fundamental principles: (1)

high reliability training, (2) the agility and adaptability of our teams, (3) the ability to use innovation and analytics to foresee and solve problems, and (4) the collaboration and dedication of our colleagues.

To understand the magnitude of the resources involved, aerosol-generating procedures (intubation, extubation, noninvasive ventilation, high-flow nasal cannula, tracheostomy, bronchoscopy, CPR, surgeries involving transoral or transnasal approach) at HHC require strict contact and droplet precautions with an N-95 respirator, gown, gloves, face shield, and procedure mask over the N-95 respirator. In addition, all patients having these procedures for the purposes of ESP have a COVID-19 test performed.

Pivot Plan. The Pivot Plan was a logistical framework for the safe delivery of ESP care in the COVID-19 era. Much of the initial focus of the planning committee's work was spent on the automatization of reliable COVID-19 testing for any patients expected to have ESP (Fig 1). The Pivot Plan was created using guidance from a Joint Statement by the American College of Surgeons, American Society of Anesthesiologists, Association of periOperative Registered Nurses, and American Hospital Association [14]. The document provided recommendations for criteria that needed to be met to safely resume ESP, namely, a decreasing COVID-19 inpatient census, a clearing of the postanesthesia care unit (PACU) as an overflow area for ICU patients, and a greater capacity—in terms of PPE, personnel, blood products, and physical space—of the OR to be a COVID-19–safe area. The Pivot Plan also called for establishing regional oversight of the scheduling process for deferred surgeries. Regional oversight occurred under the direction of the surgical chiefs and the perioperative leaders.

We devised a process and order set in Epic (Verona, WI), HHC's electronic health record, which would initiate the encounter for the patient (Ambulatory COVID Test Order). The initiation of the algorithm is assigned to the surgeon or proceduralist who books the case. Once this occurs, the case is triaged as inpatient emergent (needs to be performed in <1 day) or urgent (2–7 days) or outpatient (>7 days). For inpatient emergent or urgent cases, the workflow is streamlined through our clinical laboratory for a <24 h (Cepheid Rapid) or a 24–36-hour polymerase chain reaction (PCR) in-house test, respectively. The results are delivered to the physician placing the order via TigerConnect (Santa Monica, CA) messaging as a critical finding.

The outpatient algorithm is much more intricate and the focus of resuming ESP. The order set is initiated by the surgeon or proceduralist after the patient had their preoperative visit, ideally >7 days before the proposed ESP. For providers without Epic access, we created a Red Cap (Nashville, TN) web address (www.hhchealth.org/testorder) to give these providers an alternative option for testing order placement. Once the orders had been placed, registration would call the patient to schedule testing at one of many options through the HHC system based on the patient's preference. We initially instituted a central process with an Advanced Practice Registered Nurse monitoring the results of the preoperative PCR tests. This responsibility was then transferred to the surgeon's or proceduralist's office and became part of the routine preoperative evaluation, like cardiopulmonary testing.

In developing this testing protocol, it was very important to delineate which COVID-19 testing would be available for which priority cases. The <24-hour test was scarce and rationed based on acuity, whereas the 24–36-hour test was more readily available. Therefore, we sought a more systematic method for rationing this scarce resource. In anticipation of rolling out the Pivot Plan, the Department of Surgery asked all section chiefs to submit a list of cases that had been deferred as a result of the COVID-19 stoppage. With this list, departmental and hospital leadership made a rank order list that prioritized ESP based on a variety of factors that included morbidity of waiting, availability of nonsurgical alternatives, acuity of patient condition, and consequences of further postponement, to name a few. Each chief was responsible for tallying these cases for their division and submitting them to the Chair of Surgery. The Chair was

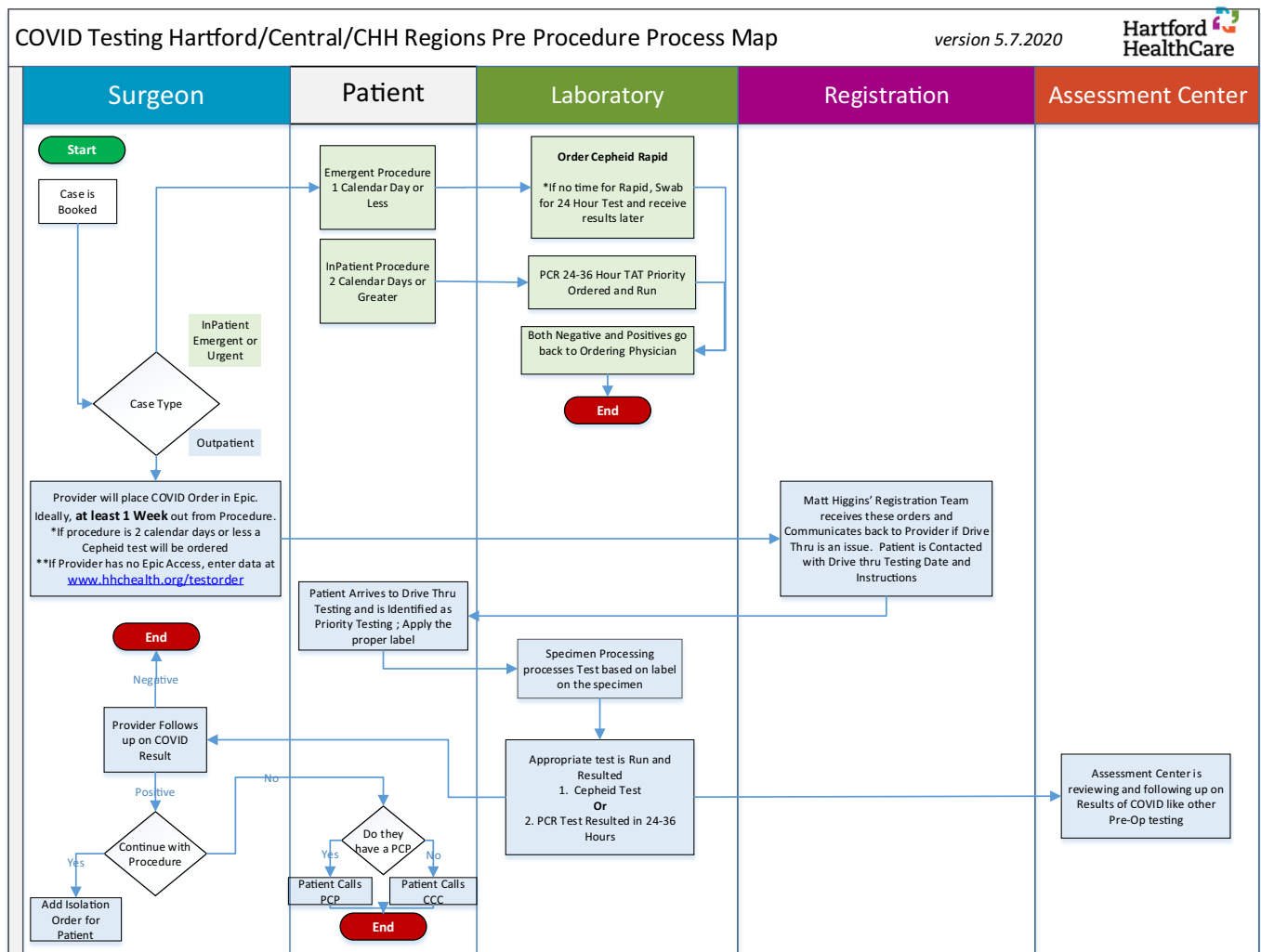


Fig 1. Schematic process diagram for preprocedural COVID-19 testing at Hartford HealthCare. The initiation of the algorithm is assigned to the surgeon or proceduralist who books the case. Once this occurs, the case is triaged as inpatient emergent (needs to be performed in <1 day) or urgent (2–7 days) or outpatient (> 7 days). For inpatient emergent or urgent cases, the workflow is streamlined through our clinical laboratory for a <24-hour (Cepheid Rapid) or a 24–36-hour PCR in-house test, respectively. The results are delivered to the physician placing the order via TigerConnect messaging as a critical finding. The outpatient algorithm is initiated by the surgeon or proceduralist after the patient had their preoperative visit, ideally > 7 days before the proposed ESP. Once the orders had been placed, registration calls the patient to schedule testing. The hospital’s preoperative assessment center performs a final check of the test results before proceeding with surgery.

ultimately responsible for the priority designation and also the arbiter for an appeal. Each surgeon’s previously scheduled but deferred cases were entered into the data tool. Surgeons were asked to enter additional deferred cases not yet scheduled. Required fields included time sensitivity (yes/no) and patient/procedural risk (low, moderate, high). High-risk factors included high-risk patient/frailty, high-risk procedure, likelihood of requiring ICU, need for transfusion, ≥2 surgical specialties involved in the case, and anticipated transition to a facility other than home upon discharge. A 4-square Prioritization Matrix was created: tier 1, time sensitive, low/moderate risk; tier 2, time sensitive, high risk; tier 3, not time sensitive, low/moderate risk; and tier 4, not time sensitive, high risk.

Finally, the Pivot Plan included aspects of patient and caregiver education. Along with preoperative testing processes, we designed an informed consent module to give providers an opportunity to educate their patients and caregivers about the risks of having ESP during the COVID-19 pandemic. In addition to providing informed consent, this educational component enabled the provider to give real-time updates about knowledge and recommendations on COVID-19 among HHC, Connecticut, and New England. For many self-restricted patients, this provided realistic and practical knowledge about whether it was safe to proceed with SEP given the steps that we had taken to mitigate the

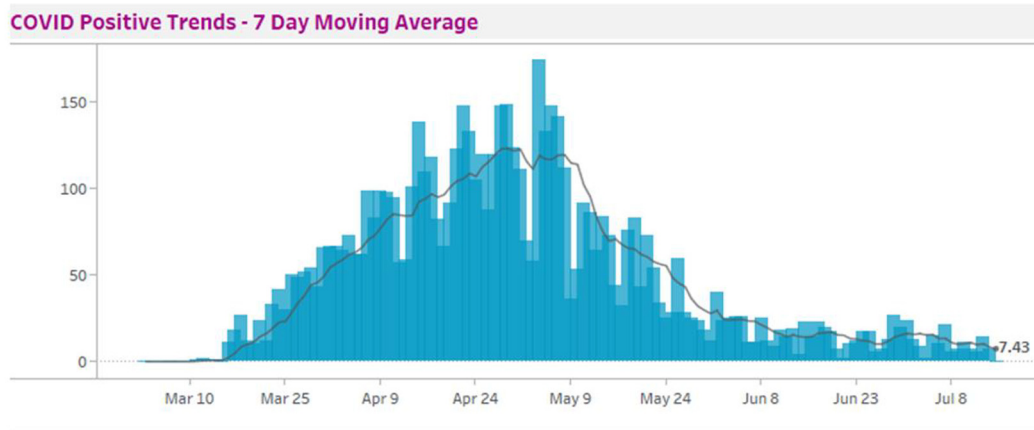
spread of COVID-19 in our facilities. Furthermore, patients were asked to quarantine between the dates of COVID-19 testing and their proposed ESP.

RESULTS

During the period between March 1, 2020, and July 17, 2020, HHC has performed 118, 747 COVID-19 PCR tests on 98,271 patients; 6264 tests yielded a positive result for a test positivity rate of 5.3%. HHC had its COVID-19 peak on April 28, 2020, based on the 7-day moving average of positive test results (Fig 2, A). The Pivot Plan was instituted on May 11, 2020. Since then, 22,624 patients have been tested for COVID-19 in anticipation of an ESP. As our testing capability has increased, we have been able to increase our added testing ESP capacity from 13–50 cases per day to 334–531 cases per day (Fig 2, B). Of these, 140 (0.62%) tested positive for COVID-19 and had their procedure deferred.

The weekly case volume at HHC facilities during the COVID-19 pandemic is listed on Fig 3. Our case volume prior to March 16, 2020, was approximately 2000 cases per week. Soon after we suspended ESP, this fell to an average of 487 to 600 cases per week. Immediately after institution of our Pivot Plan, the weekly case volume rose from 780 to 958 cases per week in the first week (22.8% increase), 1398 cases per

A



B

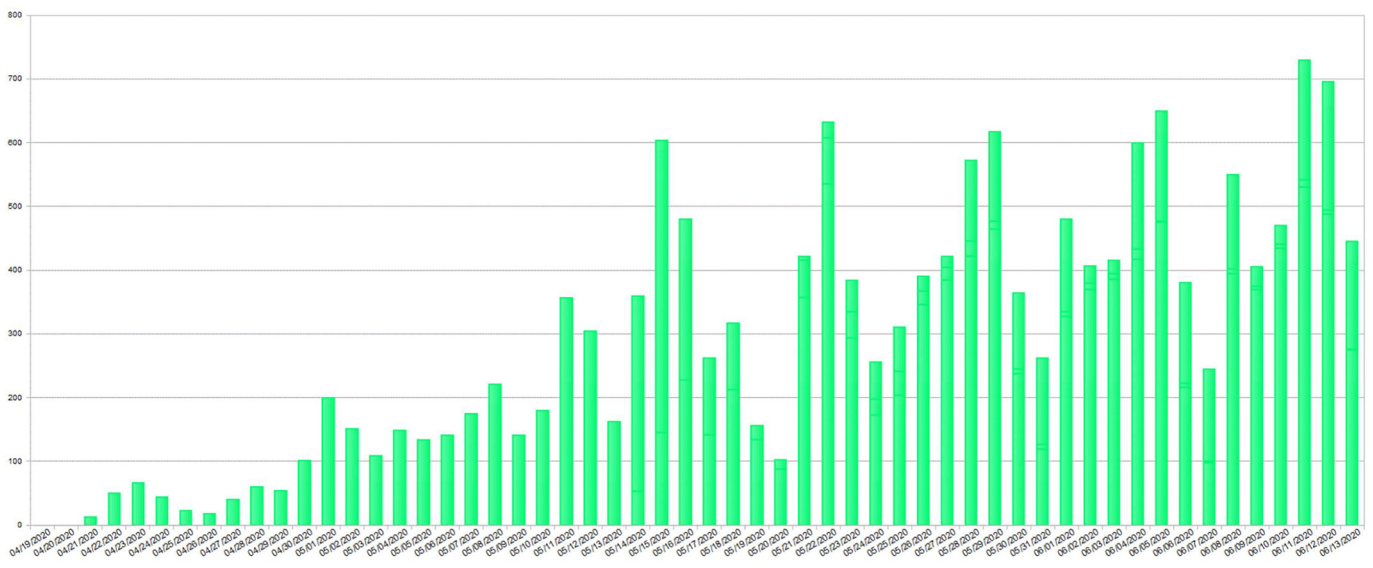


Fig 2. Trend of COVID-19 cases at Hartford HealthCare from March 4, 2020, to July 15, 2020. HHC achieved its COVID-19 peak on April 28, 2020, based on the 7-day moving average of positive test results (A). Trend of COVID-19 testing in anticipation of an elective surgery or procedure. The Pivot Plan was instituted on May 11, 2020. Since then, 22,624 patients have been tested for COVID-19 in anticipation of ESP. As our testing capability has increased, we have been able to increase our added ESP testing capacity from 100 tests per day to > 500 tests per day (B).

week in the second week (45.9% increase), 1036 cases per week in the third week (25.9% decrease), 2007 cases per week in the fourth week (157% increase), and 1855 in the fifth week (138% increase).

During the initial 5 weeks of the Pivot Plan, the OR has been working at approximately 47.9% of our pre-COVID capacity in the first week, 69.9% in the second week, 51.8% in the third week, 100% in the fourth week, and 92.8% in the fifth week. The specialty breakdown of these ESP is as follows: General Surgery, 16.6%; Urology, 10.1%; Vascular, 6.6%; Dialysis Access, 3.5%; Cardiovascular, 6.0%; Gynecology, 8.7%; Plastic Surgery, 8.2%; Thoracic Surgery, 3.4%; Robotic Surgery, 5.7%; Neurosurgery, 3.1%; Ophthalmology, 5.8%; Otorhinolaryngology, 4.2%; Neurosurgery-Spine, 3.9%; Colorectal Surgery, 4.0%; Gynecologic-Oncology, 1.2%; Structural Heart, 1.4%; Transplant Surgery, 0.8%; Orthopedic Trauma, 0.4%; Oral Maxillo-Facial Surgery, 0.6%; Urogynecology, 2.7%; Orthopedic-Spine, 0.3%; Podiatry, 0.7%; Orthopedic Surgery, 0.2%; and Bariatric Surgery, 1.6%.

DISCUSSION

The COVID-19 pandemic has presented an unprecedented and uncharted territory for the modern-day surgeon working in a major

health system. It has been estimated that 28,404,603 operations were canceled during a 12-week COVID-19 peak period [15]. In the United States alone, more than 21 million surgeries are performed annually, with >90% considered elective [16]. At HHC, we felt caught between a rock and a hard place: we feared for our patients and colleagues and the ramifications of a COVID-19 infection; we feared for our patients and the consequences of delaying necessary surgical care.

COVID-19 taught us important lessons from which we grew as a team and became more efficient. The development of our Pivot Plan to ramp up ESP taught us and reinforced lessons about quality and safety, our journey of high reliability, and continuous improvement. Herein, we present our experience with the HHC Pivot Plan and data to demonstrate its effectiveness at restarting ESP. Most importantly, we present a practical framework, with its inherent lessons, pitfalls, and obstacles, for other institutions to utilize as they initiate their ESP practice in the post-COVID-19 era.

One of the lessons that this experience has brought about is the opportunity to reinforce certain practices and expedite long-overdue changes in others while putting new and improved processes into place, namely, infection prevention, an obsessive focus on quality and safety, identification and sharing of lessons from our failures, peer

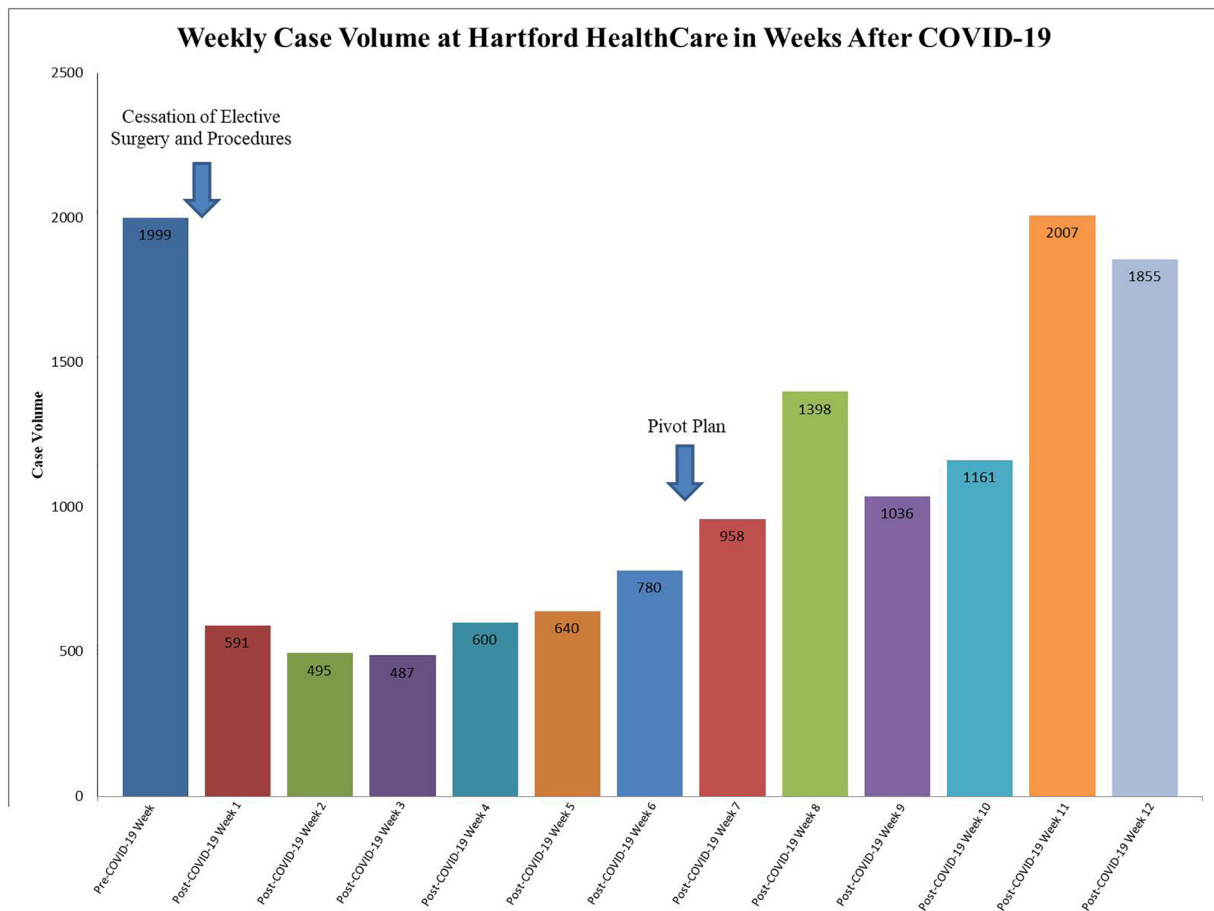


Fig 3. Weekly case volume at HHC facilities during the COVID-19 pandemic. Our case volume prior to March 16, 2020, was approximately 2000 cases per week. Soon after we suspended ESP, this fell to an average of 487 to 600 cases per week. Immediately after institution of our Pivot Plan, the weekly case volume rose from 780 to 958 cases per week in the first week (47.9% of pre-COVID-19 volume), 1398 cases per week in the second week (69.9%), 1036 cases per week in the third week (51.8%), 1161 cases per week in the fourth week (58.1%), 2007 cases per week in the fifth week (100%), and 1855 in the sixth week (92.8%).

accountability—holding each other accountable to reach common goals—and the management of throughput efficiently while creating capacity to accommodate patients who have delayed their care. In the early phases of the COVID-19 pandemic, much of our efforts were aimed at prioritizing the surgical work load with a deferment of nonurgent cases. The objective for this was to conserve critical care resources, namely, mechanical ventilators, PPE, blood products, and hospital beds. A secondary and equally important consideration was the personal health and stamina of hospital personnel. The literature is replete with how healthcare worker burn out is the next phase of the COVID-19 pandemic [17,18]. Finally, a third consideration was the well-being of uninfected vulnerable populations—the elderly; patients with respiratory problems, with cardiovascular disease, or who are chronically immunosuppressed; the marginalized—by limiting their exposure in the hospital.

Unfortunately, one of the unsettling aspects of our day-to-day activities and decision-making during the COVID-19 pandemic has been the lack of data-driven risk-benefit analyses to guide surgical care delivery. For instance, the triage of ESP is a conscientious evaluation of many factors—including OR capacity; ICU bed and mechanical ventilator availability; and a tally of PPE, blood products, and other supplies and available personnel—all in the background of local, regional, and national infection trends. These are all factors that we took into consideration as we instituted our Pivot Plan. We also acknowledge that a blanket policy with a one-size-fits-all attitude is not adequate for a healthcare system of our size, and thus, we advise caution when applying this model. Ultimately, the limiting factor at HHC to the safe resumption of ESP in our Pivot Plan was the availability of ICU beds and

capacity. Fortunately, as illustrated in Fig 2, A, the number of COVID-19 cases at HHC after our peak on April 28, 2020, declined rapidly and has remained low. Therefore, we have not been limited in the resumption of ESP. In fact, the deciding factor for initiating the Pivot Plan was the transfer to ICU patients that had been temporarily housed in the PACU back to the ICU. After this occurred, the PACU has only been utilized for postoperative care exclusively.

Efforts to ramp up surgical practices are guided by 3 fundamental principles according to Engelman et al.: (1) collaboration between local resources within the healthcare system; (2) prioritization of the most urgent cases; and (3) re-evaluation of local conditions, with the assistance of in-hospital infectious diseases experts, to monitor the real-time infectious risk [19]. Similarly, an international group of surgeons from a diverse group of healthcare institutions provides 7 practical tips to a stepwise progression toward initiating ESP: (1) know where you are on the epidemic curve; (2) ensure access to reliable and accessible COVID-19 screening; (3) understand hospital resources; (4) ensure appropriate case selection and prioritization; (5) optimize the patient's postdischarge planning; (6) start small, stay current, and be adaptable; and (7) be prepared for roadblocks ahead [20]. These are the principles that we used in creating our Pivot Plan using our institutional H3W culture foundation, which so far have yielded excellent results. Although we had set out the lofty goal of being operational at 25% pre-COVID-19 capacity in the first week after the Pivot Plan rollout, 50% in the second week, and 75% in the third week, our results demonstrate how difficult it has been to get the ESP capacity back to pre-COVID-19. Importantly, although in the first and second weeks, we observed a 47.9% and 69.9% pre-COVID-19 capacity, the third week

was characterized by a 51.8% capacity. This was likely a phenomenon of a surplus of cases that had been deferred, which were waiting until ESP were restarted. However, as we settled into a post-COVID-19 normal, it is likely that our decline in OR productivity was due, in part, to patients who may not have wanted to proceed with their ESP despite being able to.

Thus, the efforts we made at HHC in constructing the Pivot Plan revolved around restoring consumer confidence with a patient focus. Certainly, like the overwhelming majority of hospitals around the country, we implemented drastic policies such as restricting visitors in tandem with curtailing our SEP practices to balance the risks and benefits in the face of uncertain and evolving information. This extraordinary and sorrowing measure meant that many would have to endure hospitalization alone in one of the most stressful experiences of their life. Expectedly, this has not been well received by the community, especially minority populations [21,22]. One of the central tenets of the Pivot Plan has been complete transparency with the patient and their caregivers. Providing clear and effective communication is critical for demonstrating our efforts in advocating for patients and addressing their concerns and grievances.

Two aspects of the Pivot Plan have been the most successful features: first, the deployment of the OR staff to help with the testing verifications and preoperative administrative efforts. This clearly became a bottleneck for our testing capabilities. Thus, in establishing the infrastructure to test patients that had had their surgery deferred, it became critical to have personnel available who would be able to assist with placing orders; following up the test results; and acting as the interphase between the patient, the OR, and the providers placing the orders. Because the OR had been essentially suspended to nonemergent cases, there was a surplus of staff who were still coming in to work. Thus, this aspect of the Pivot Plan became critical. Second was coordinating the testing with the preoperative evaluation. The ability to create an order set that included COVID-19 testing which automatically linked this order with the preoperative event was critical for identifying the order for the test, which in the beginning was scarce and restricted, and the event for ESP.

Our Pivot Plan is not without its limitations. Certainly, as countries around the world are witnessing a second wave of the outbreak after easing the preventive measures [23,24], we remain vigilant of that possibility. As such, we fear PPE shortages and staffing deployment because of illness or burnout. We also acknowledge that patients may be reluctant to pursue ESP under the current or future circumstances based on information presented to them. Thus, it is incumbent upon us to establish an atmosphere where the hospital and the operating room are seen as safe havens. We realize that many patients in our system were previously but are no longer insured due to work or economic hardship. HHC remains cognizant of this barrier and strives to work with local and regional government bodies to provide care for the most underserved and needy. Finally, the goal of restarting ESP after COVID-19 is to learn to manage COVID-19, knowing that our new normal will be to deliver the highest level of care with COVID-19 patients in our healthcare system along with its challenges and risks.

Certainly, many institutions are considering restarting their ESP practice with trepidation. Reports of the potential devastating consequences for patients having ESP during the COVID-19 pandemic remain a warning sign of the potential implications [25]. However, as stated by Shao, “As new cases stabilize and life starts to resemble what now feels like a distant memory of ‘normalcy’, we must also have the humility and insight to know when to hold back” [16]. Our Pivot Plan, with its lessons, pitfalls, and obstacles, provides the flexibility to alter the course of its trajectory should modifications be necessary based on epidemiological and infectious disease data. Most importantly, the focus of the Pivot Plan provides a framework for high reliability, adaptability, and continuous improvement using innovation and analytics to foresee and solve problems with the collaboration and dedication of our colleagues.

In conclusion, the resumption of elective surgeries and procedures at a major academic healthcare system in one of the early COVID-19 hotspots in the United States has been successful and well organized, in part because of the rapid integration of multiple resources from a cohort of diverse disciplines applied to the perioperative services workflow.

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Conflict of Interest

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Author Contributions

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Data curation: Serrano, Orlando, McClure, Schipper.

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