OPEN

How Hospitals Can Save Lives and Themselves

Lessons on Patient Flow From the COVID-19 Pandemic

Eugene Litvak, PhD,✉ Shaf Keshavjee, MD, MSc, FRCSC, FACS,†*
Bruce L. Gewertz, MD,‡ and Harvey V. Fineberg, MD, PhD§

COVID-19 has strained hospital capacity, detracted from patient care, and reduced hospital income. This article lays out a tested strategy that surgical and hospital leaders can use to overcome clinical and financial strain, emphasizing the experience at 2 leading North American medical centers. By classifying the time and resource needs of surgical patients and smoothing the flow of surgical admissions over all days of the week, hospitals can dramatically improve hospital efficiency, the quality of care and timely access to care for emergent and urgent surgeries. Through and beyond the time of COVID, smoothing the flow of surgical patients is a key means to restore hospital vitality and improve the care of all patients.

Keywords: COVID-19, elective surgeries, emergent surgeries, hospital finances, patient access, patient flow, quality and safety

(*Ann Surg* 2021;274:37–39)

Hospitals that strive to save patients' lives are themselves in jeopardy from COVID. In multiple areas where the pandemic is gaining ground, hospitals strain to provide intensive care beds, ventilators, and trained nursing and medical staff to manage severely ill patients. Since the beginning of the pandemic, many hospitals have cancelled or deferred elective surgeries. The dramatic reduction in elective surgery endangers patients and cuts off the financial lifeblood of the hospital. In May, the American Hospital Association reported losses of >$50 billion a month.[1] Now, with the winter surge of the pandemic, hospital occupancy in some areas is more strained than in April-May of last year.

Many hospitals face a trade-off between treating COVID patients and reducing their backlog of elective surgical patients.[2] Neither of these options is morally or financially palatable. Unless sufficient hospital resources (caregivers, personal protective equipment, ICU beds) are available, canceling elective surgeries during peaks in the pandemic is inevitable. However, as soon as demand for care of COVID patients subsides, hospitals will require a practical, tested solution for resuscitating hospital finances.

From the *President and CEO, Institute for Healthcare Optimization, Adjunct Professor of Operations Management, Harvard T.H. Chan School of Public Health; †Surgeon-in-Chief, Sprott Surgery, UHN James Wallace McCutcheon Chair in Surgery Director, Toronto Lung Transplant Program Director, Latner Thoracic Research Laboratories Professor, Division of Thoracic Surgery & Institute of Biomedical Engineering, Vice Chair Innovation, Department of Surgery, University of Toronto.; ‡Surgeon-in-Chief, Chair, Department of Surgery, H and S Nichols Distinguished Chair, Vice Dean, Academic Affairs, Vice President, Interventional Services, Cedars-Sinai Health System; and §President, Gordon and Betty Moore Foundation.

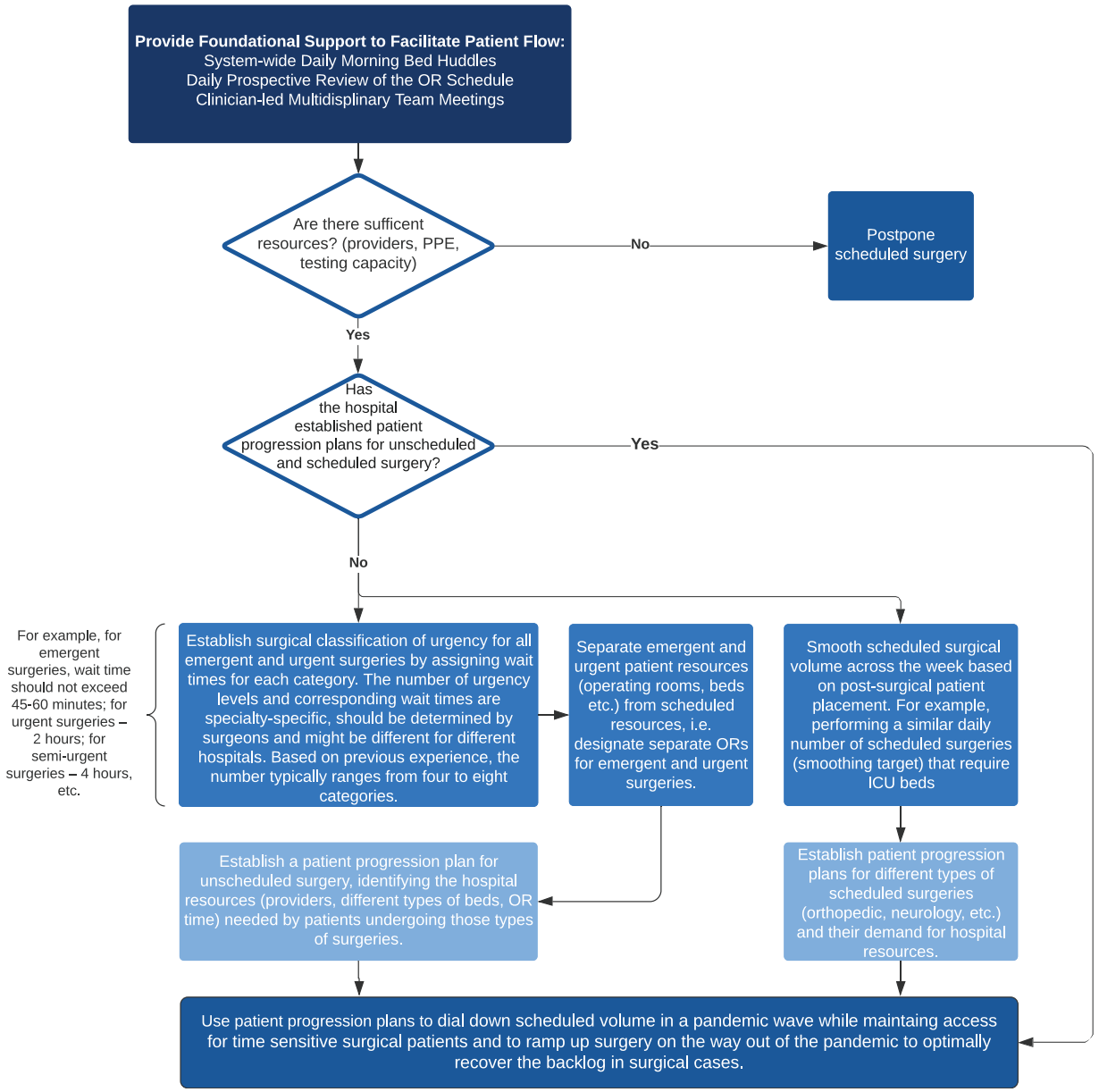
✉elitvak@ihoptimize.org.

ISSN: 0003-4932/21/27401-0037
DOI: 10.1097/SLA.0000000000004871

The key opportunity lies in smoothing surgical case volume across all weekdays (and, ideally, across 7 days a week where possible).[3] If one looks at the pre-pandemic, daily number of surgeries at a typical hospital, the graph would resemble an EKG with numerous daily peaks and valleys. The reason for this pattern is that most surgeons and hospitals prefer to operate at the beginning of the week, so most of their patients would be discharged before the weekend. This common pattern creates an artificially induced and uneven demand for hospital resources (ORs, personnel, beds, emergency department capacity) and results in emergency unit overcrowding,[4] which is especially dangerous during the pandemic, as well as excessive patient wait times and increased patient mortality.[5] In addition, this uneven scheduling practice creates periodic artificial shortages of the scarcest resources—ICU beds.[6]

Hospitals that have streamlined their patient flow have enjoyed multimillion-dollar annual savings and substantial improvements in patient care.[5] Examples include a potential increase of over $100 million in the annual revenue and $125 million in averted capital cost without adding staff, beds or Operating Rooms at the Cincinnati Children's Hospital, and only partial implementation of streamlining surgical flow at the Ottawa Hospital resulted in annual $9 million savings and an almost 23% increase in lives saved (40 lives).[5] Detailed guidance on streamlining patient flow and thereby freeing up hospital resources is available.[5] Here, we list a few major steps that any hospital can accomplish, also illustrated in the flow chart.

1. If patient demand exceeds or approaches hospital capacity (providers, beds, PPE, testing capacity), elective surgeries should be postponed, as done currently by most hospitals.
2. When patient demand subsides and, assuming sufficient supply of PPE and other resources, hospitals should undertake the following actions (summarized in the flowchart).
   - Establish surgical classification of urgency for all emergent and urgent surgeries by assigning allowable wait times for each category. For example, for emergent surgeries, wait time should not exceed 45 to 60 minutes; for urgent surgeries—2 hours; for semiurgent surgeries—4 hours, among others. The number of urgency levels and corresponding wait times are specialty specific, should be determined by surgeons and might be different for different hospitals. Based on previous experience, the number of categories typically ranges from four to eight.
   - Separate emergent and urgent patient resources (operating rooms, beds, among others) from scheduled patient resources, that is, designate separate ORs for emergent and urgent surgeries.
   - Smooth scheduled surgical volume across the week based on post-surgical patient placement. For example, performing a similar daily number of scheduled surgeries (smoothing target) that require ICU beds.
   - Establish a patient progression plan for unscheduled surgery, identifying the hospital resources (providers, different types of beds, OR time) needed by patients undergoing those types of surgeries.



- Establish patient progression pathways for different types of scheduled surgeries (orthopedic, neurosurgery, and so on) and their demand for hospital resources.

3. These same principles can be used to dial down in a pandemic wave and to ramp up surgery on the way out of the pandemic to optimally recover the backlog in surgical cases.

The experience of 2 hospitals (one completed the project before the pandemic, another initiated it during the pandemic) during the COVID crisis illustrate the benefits of applying these principles.

In the Sprott Department of Surgery at University Health Network (UHN), University of Toronto, pre-pandemic adoption of each of above principles allowed a rapid and calculated response to the pandemic and a nimble response to recovery of activity as the pandemic subsided. The surgical staff had already pre-classified all unscheduled cases by degree of urgency (emergent, urgent, semi-urgent, and so on) for 13 surgical specialties into 8 urgency categories ranging from 45 minutes to 14 days. These applied to 140 faculty surgeons and approximately 35,000 cases/year (see table).

Surgical Urgency Level
Level 1–0–45 minutes
Level 2–0 to 2 hours
Level 3–2 to 4 hours
Level 4–4 to 8 hours
Level 4E–< 12 hours
Level 5–8 to 24 hours
Level 6–24 to 48 hours
Level 7–< 7 days
Level 8–≤14 days

The urgent/emergent stream of surgical care delivery was separated from the scheduled with the provision of "Emergency ORs" and "Scheduled ORs" in 2 separate streams. The peaks and valleys of bed utilization on the surgical wards were "smoothed" by implementing daily smoothing targets for case booking finalized the week prior.

When the oncoming COVID pandemic was inevitable, capacity for COVID patients was not yet ready and PPE was in short and uncertain supply, administrative leaders decided to restrict surgery to emergent cases and patients who would be harmed if their surgery was not performed within 14 days. This meant only level 8 and higher levels of urgency would be performed, already defined, known by all and implementable within 48 hours. This allowed urgent surgical cases to be managed and gave the hospital time and resources to care for COVID patients and to stock up on supplies, staff, and PPE. The hospital status was reassessed by the leadership team every 2 days.

Once the need for COVID capacity subsided, the Sprott Surgery team turned their efforts towards surgical patients—the backlog recovery. Staff that had been deployed away from surgical services were returned. In the Ontario Health Care System, there are priority categories for most surgeries—cancer, cardiac care, vascular surgery, orthopedic surgery, and so on. All the backlogged cases were listed by urgency in UHN's Surgical Wait Time Management System. The team went on to open the ORs for each subsequent level of urgency. The quantitative link between patient demand and hospital capacity laid the foundation to develop a Backlog Calculator—to calculate ORs needed, nursing and anesthesia staff, total OR hours, and bed days required. At times ambulatory surgery, although less urgent, was prioritized because they did not require beds, thus avoiding idle OR capacity. With carefully calculated prediction models, the team could estimate the time to full recovery depending on how quickly the hospital could rise to normal working levels and model, for example, how many days at 120% capacity it would take to recover sooner. Because of the implementation of the smoothing strategy and models, recovery was predictable, measurable, and achieved with enhanced efficiency.

Implementing all these steps at UHN allowed the hospital to do more emergent and urgent surgeries as this project created the opportunity for UHN to perform over 3000 additional elective surgeries. There was also an improvement on an already high compliance with wait time for urgent/emergent surgeries by an additional 13% to 20% for UHN hospitals. Reducing wait times has been demonstrated to significantly reduce patient mortality and length of stay.

These steps also allowed UHN Surgery to restart less-urgent scheduled surgeries sooner than other hospitals in Ontario by appropriately and optimally utilizing their scarce resources such as nurses and hospital beds and without limiting necessary access for COVID patients—a principle that is now being applied to the whole province of Ontario.[7]

Like most major referral centers, Cedars-Sinai Medical Center in Los Angeles had long been dealing with high census levels and perceived lack of availability of operating rooms. These issues were exacerbated in the spring of 2020 by the need to sequester a certain number of operating rooms and ICU beds for exclusive use of COVID positive or suspected positive patients. It soon became clear that this restriction in capacity for non-COVID operative care was likely to continue indeterminately. There was concern that it would adversely impact the surgical care within the community and virtually shut down tertiary services (eg, transplantation, neurosurgery, cardiovascular surgery) which draw on transfers from outside the primary service area and represent nearly one-third of hospital volume. This concern was unfortunately validated; of the initial 874 patients whose operations were deferred between March 15 and the restart of most scheduled services in late May, 10% suffered worsening of their conditions necessitating admission through the emergency department. The necessity for improving efficiency in the reduced number of operating rooms became the imperative and prompted careful review of the hospital's efficiency.

It soon became clear that perceived restrictions in capacity for both beds and ORs were due to uneven utilization rather than true lack of capacity. Operating rooms were highly booked with scheduled cases early in the work week, but less so toward the end. Although true emergencies were accommodated, less critical procedures were pushed toward the end of the week, requiring some patients to stay in hospital longer awaiting procedures and reducing the functional bed capacity. This inefficient utilization was clearly unacceptable since the option of adding beds is prohibitively expensive, particularly in California where the cost of each new hospital bed exceeds $3 million dollars due, in part, to the cost of seismic protections. Hence improving efficiency in the existing operating rooms and distributing caseloads more evenly became a compelling mandate, clear to all surgeons as well as hospital leadership.

The hospital effectively used the pandemic calamity as a motivator to fix a long-standing problem. Surgeon and anesthesiologist acceptance for this project was remarkable as all now appreciated the positive effects that better perioperative flow would have on their ability to serve their patients and improve their practice efficiency. After the severe restrictions of the COVID period, they were eager to get back to work and at the same time amenable to remediating past problems. Such consensus is a critical prerequisite for streamlining surgical flow in any hospital. For their part, hospital administration strongly supported retooling operating room flow in hopes of improved financial performance based on improved room utilization, decreased staff overtime, and shorter lengths of stay. The project is actively moving forward. Existing urgency classification is currently under revision; patient demand and access time data collection and collation were performed. A working group and PI team was formed to prepare for the next phases of the project.

A critical challenge will be sustaining improvements in patient flow after the COVID crisis abates. This can be supported by data systems and dashboards that describe real-time performance, and leadership prepared to act on the data.

Smoothing patient flow requires strong hospital leadership willing to face up to the inefficiencies and adverse consequences of uneven patient flow. Allowing peaks and valleys in planned admissions to persist during the COVID-19 pandemic produces a downward spiral: peaks in elective surgical volume → shortage of ICU beds during the peaks → cancelling scheduled surgeries due to the lack of beds → hospital financial losses → staff furloughs → exacerbated shortage of staffed hospital beds coupled with ED overcrowding → delays in resuming elective surgeries and intensified financial strain. The singular strategy of smoothing patient flow across every day of the week would simultaneously enable hospitals to save more lives and to remain financially viable.

REFERENCES

1. New AHA report finds financial impact of COVID-19 on hospitals & health systems to be over $200 billion through June. American Hospital Association. May 5, 2020.
2. Antkowiak PS, Cocchi MN, Chiu DT, et al. Who should we treat: elective surgical admissions or patients with COVID-19? *Am J Manag Care*. 2020;26:423–424.
3. Litvak E, Fineberg HV. Smoothing the way to high quality, safety, and economy. *N Engl J Med*. 2013;369:581–583.
4. Klasco R, Wolfe R. Sorry ER Patients. People with elective procedures get the hospital beds first. *The Washington Post*. 2019.
5. Litvak E, editor. *Optimizing Patient Flow: Advanced Strategies for Managing Variability to Enhance Access, Quality, and Safety*. Oakbrook Terrace, IL: Joint Commission Resources; 2018.
6. McManus ML, Long MC, Cooper AB, et al. Variability in surgical caseload and access to intensive care services. *Anesthesiology*. 2003;98:1491–1496.
7. Butler C. How surgical smoothing could help ease the medical backlog created by COVID-19, CBC, Canada, 2020 July 13.