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Original Contribution

Strategies for daily operating room management of ambulatory surgery centers following resolution of the acute phase of the COVID-19 pandemic

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A B S T R A C T

We performed a narrative review to explore the economics of daily operating room management decisions for ambulatory surgery centers following resolution of the acute phase of the Coronavirus Disease 2019 (COVID-19) pandemic. It is anticipated that there will be a substantive fraction of patients who will be contagious, but asymptomatic at the time of surgery.

Use multimodal perioperative infection control practices (e.g., including patient decontamination) and monitor performance (e.g., *S. aureus* transmission from patient to the environment). The consequence of COVID-19 is that such processes are more important than ever to follow because infection affects not only patients but the surgery center staff and surgeons.

Dedicate most operating rooms to procedures that are not airway aerosol producing and can be performed without general anesthesia. Increase throughput by performing nerve blocks before patients enter the operating rooms. Bypass the phase I post-anesthesia care unit whenever possible by appropriate choices of anesthetic approach and drugs. Plan long-duration workdays (e.g., 12-h).

For cases where the surgical procedure does not cause aerosol production, but general anesthesia will be used, have initial (phase I) post-anesthesia recovery in the operating room where the surgery was done. Use anesthetic practices that achieve fast initial recovery of the brief ambulatory cases.

When the surgical procedure causes aerosol production (e.g., bronchoscopy), conduct phase I recovery in the operating room and use multimodal environmental decontamination after each case. Use statistical methods to plan for the resulting long turnover times. Whenever possible, have the anesthesia and nursing teams stagger cases in more than one room so that they are doing one surgical case while the other room is being cleaned.

In conclusion, this review shows that while COVID-19 is prevalent, it will markedly affect daily ambulatory workflow for patients undergoing general anesthesia, with potentially substantial economic impact for some surgical specialties.

1. Introduction

We recently published a narrative review of infection control and operating room management for the care of patients undergoing surgery during the Coronavirus Disease 2019 (COVID-19) crisis and who are not thought to have COVID-19 [1]. In the current article, we consider these topics for the period when surgery transitions from urgent to essential procedures and, progressively, as queues resolve, to elective surgery [2]. From the many studies published in the intervening weeks, it is apparent that some of the recommendations made can be relaxed for many patients [1].

We limit consideration to ambulatory surgery, expecting that for a considerable time following the peak of SARS-CoV-2 infection, hospital beds often will be occupied with COVID-19 patients [3,4]. The

scheduling of surgery requiring inpatient admission will need to consider the constraint of limited intensive care unit and ward beds and the risk to such patients of nosocomial COVID-19 infection [5,6]. There also will be considerations related potentially to the exclusion of visitors, unreliable availability of blood products, and a reduction in the healthcare workforce due to the consequences of the pandemic. However, ambulatory surgery accounts for 74.7% of surgical cases performed on regular workdays (i.e., non-urgent) [7,8]. Essential and high-priority elective surgery that can expand earliest comprise procedures that can be performed safely in free-standing buildings, whether in hospital outpatient departments or at facilities unaffiliated with hospitals [9]. Although we refer to ambulatory “surgery,” our intention is for the principles to apply fully to all procedures, whether or not an anesthesia provider is involved in the care of the patient (e.g., includes

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brief interventional pain procedures with known efficacy [e.g., single transforaminal epidural steroid injection for new-onset pain]) [10].

2. Ambulatory surgery: considerations related to presymptomatic and asymptomatic patients

We assume that RT-PCR nasopharyngeal testing of all ambulatory surgery patients would not be combined with screening computerized tomography of the lung [11,12]. There are patients infected with SARS-CoV-2 and presymptomatic or asymptomatic [13–19]. A presymptomatic patient has virus present but is not yet manifesting any signs or symptoms of COVID-19. In the asymptomatic patient, radiographic changes (in the lung) are present, but the patient lacks any symptoms or has symptoms attributed to a different process (e.g., occasional cough in a patient with thoracic disease) [15–19]. Recognizing this potential hazard, the “American Association of Nurse Anesthetists, American Society of Anesthesiologists, Anesthesia Patient Safety Foundation, and American Academy of Anesthesiologist Assistants recommend as optimal practice that all anesthesia professionals should utilize personal protective equipment appropriate for aerosol-generating procedures for all patients when working near the airway” [20,21]. We presume that all operating room staff (i.e., anesthesia providers, surgeons, and nurses) would be using some version of droplet precautions for all such patients [20,21]. Other authors have discussed the implementation of barrier protection strategies, such as the use of traditional surgical mask and face shield, well fit N95 mask and face shield, etc. For our purposes of considering the economics of ambulatory surgery in the COVID era, we correspondingly partition ambulatory surgery into three categories: (Section 3) no aerosol production by both the surgical procedure and the anesthetic, (Section 4) aerosol production by tracheal intubation and extubation, and (Section 5) aerosol production by the surgical procedure and general anesthetic.

There not only are patients infected with SARS-CoV-2 who are presymptomatic but also asymptomatic patients with radiological changes pathognomonic for COVID-19 [13–19]. Therefore, we expect that all patients undergoing anesthesia will have RT-PCR testing the day before surgery. Early in the disease, viral load is predominantly that of the upper airway (nasopharynx, oropharynx) [22,23]. RT-PCR testing of the oropharynx (subsequently referred to as “COVID-19 testing”) has high sensitivity [22,23]. The negative predictive value probably is effectively 99.9%, and patients would be receiving topical viral decolonization preoperatively (see Section 3). Therefore, we expect limited economic effects of COVID-19 from presymptomatic and asymptomatic patients not undergoing general anesthesia. However, during progression of the disease, there is a substantive false negative rate of oropharyngeal testing observed clinically [24–27]. Bronchoalveolar lavage specimens have detectable SARS-CoV-2 for more samples (93%) than sputum (72%), and much more than oropharyngeal swabs (32%) [28]. Consequently, as we address in Sections 4 and 5, we expect large economic effects of COVID-19 from patients receiving general anesthesia.

3. Ambulatory surgery without aerosol production, without general anesthesia

This section applies to patients (a) undergoing procedures without airway aerosol production (e.g., excluding interventional pulmonary and upper gastrointestinal endoscopy) [29–31] and (b) receiving local anesthesia, monitored anesthesia care, and/or regional anesthesia including peripheral and spinal blocks with moderate sedation. Consequently, there would not be a need for airborne precautions [31]. Restricting many operating rooms from aerosol producing surgical procedures and general anesthesia would be practical because ambulatory surgery visits in the USA in 2006 were performed without general anesthesia for 69% of visits [32]. Anesthetics performed without general anesthesia accounted for 72% (SE 2%) of the anesthesia

minutes among ambulatory surgery procedures performed in the USA in 2010 with an anesthesiologist and/or nurse anesthetists [33]. These statistics are functional overestimates because some aerosol producing procedures (e.g., upper gastrointestinal endoscopy) [30] are coded as being monitored anesthesia care even though the patient is “deeply” sedated for at least a portion of the procedure. Nevertheless, the point is that more than half of ambulatory surgery is performed without general anesthesia. There also are many common interventional procedures performed with local anesthesia alone, again with interventional pain procedures as examples [34,35]. For this review, we reanalyzed the 2010 national survey data to find that 18% (SE 2%) of the ambulatory procedure room time was performed without an anesthesiologist or nurse anesthetist [36].

During anesthesia, bacterial and viral contamination of the anesthesia workspace routinely occurs, largely due to activities of the anesthesiologist and/or nurse anesthetist caring for the patient throughout the case [1,37–40]. Multiple steps can be followed to mitigate this risk, as follows. (a) Decolonize patients using preprocedural chlorhexidine wipes, two doses of nasal povidone-iodine [41] within 1 h of incision, and chlorhexidine mouth rinse [42–47]. In the unlikely event of an upper respiratory sample for COVID-19 being false negative among patients with presymptomatic disease, SARS-CoV-2 will have been inactivated [48]. (b) Designate and maintain clean and dirty areas [49]. (c) Place alcohol-based hand rubs on the intravenous pole to the left of the provider – spatial orientation matters [50]. (d) Place a wire basket lined with a zip closure plastic bag on the intravenous pole to the right of the provider, for deposit of contaminated instruments (e.g., laryngoscope blade and handle) [49]. (e) Create a closed lumen intravenous system and use hub disinfection [51,52]; prevent bacterial infection and coronavirus viremia [53]. (f) Double glove before touching the patient’s nose/mouth and remove the outer glove following contact (e.g., placement of a nasal cannula) [54–56]. (g) After patient positioning, wipe down equipment and high-touch surfaces with disinfection wipes that contain a quaternary ammonium compound and alcohol [40,49,56–59]. (h) Provide data feedback by surveillance of *Enterococcus*, *Staphylococcus aureus*, *Klebsiella*, *Acinetobacter*, *Pseudomonas*, and *Enterobacter* spp. (ESKAPE) transmission to provide feedback on the application of these basic preventive measures [60–62]. These processes (a–h) are known because they significantly reduce the transmission of pathogenic bacteria and viruses [37–40,42–45,49–52,54,55,63]. They are important, but not unique to COVID-19. As an illustrative example, orthopedic surgery under spinal blockade neither produces aerosol from the nose/throat nor uses general anesthesia, yet patient nasal decontamination reduces surgical site infections [46]. The consequence of COVID-19 is that they are more important than ever to follow, because infection affects not only the patients but also the ambulatory surgery center staff and surgeons.

Procedures performed without general anesthesia can be facilitated to increase daily surgical caseload and therefore reduce surgical queues. Management strategies include case scheduling for surgeons to have days with only monitored anesthesia care or regional anesthesia [64]. Using block areas with registered nurses trained to assist with regional anesthesia reduces operating room time and increases throughput [65–72]. The use of peripheral regional anesthesia reduces how long patients stay in the phase I post-anesthesia care unit [69,73,74] and their time to discharge [75]. Monitored anesthesia care also facilitates bypass of the phase I post-anesthesia care unit [76–78]. This quicker discharge and greater throughput can thereby facilitate surgeons completing more cases per day and thereby provide care to more patients.

There may be constraints on performing ambulatory surgery due to inadequate supplies of personal protective equipment. Potentially, some anesthesia machines may be out of service awaiting terminal decontamination due to their use for COVID-19 patients who developed respiratory failure. However, sedation, peripheral nerve blocks, and spinal anesthetics can be performed safely, although not ideally, in the

absence of an anesthesia machine. Regardless, essential surgery needs to be completed. To reduce the progressively growing surgical queues, shifts should be as long as reasonable (e.g., 12 h) [1]. Considerable data show that with this approach, ambulatory surgery centers have underutilized capacity; extending working hours to 5 PM or 7 PM would contribute substantively to reducing the national surgical queues, which are progressively growing. The United States' 2010 national ambulatory surgery survey included outpatient surgery performed at hospitals and unaffiliated free-standing surgery centers [36]. There was 64% (SE 1%) of all operating room time completed before 12 noon, and 90% (SE 1%) before 3:00 PM [36]. Data for all surgery in hospitals in Iowa 2013 through 2015 were studied [79]. Among the 117 hospitals, on days when a surgeon performed at least one ambulatory surgery case, they performed only 1 or 2 cases total for 77% (SE 2%) of such days and just 1 case for 54% (SE 2%) [79]. This shows available capacity for more surgery because those single cases were of brief duration (e.g., the most common being "repair initial inguinal hernia, age 5 years or older, reducible") [79].

4. Ambulatory surgery without aerosol production, with general anesthesia

As context, from above, general anesthesia was provided in 31% of ambulatory surgery visits in the USA in 2006 [32]. General anesthetics accounted for 28% (SE 2%) of the anesthesia minutes among ambulatory surgery procedures performed in the USA in 2010 with an anesthesiologist and/or Certified Registered Nurse Anesthetist [33]. This section does not apply to surgical procedures with airway aerosol production (e.g., thoracic surgery).

The infection control steps summarized in Section 3 apply. After tracheal intubation, deposit the laryngoscope blade and handle in the designated wire basket [49]. Double glove before intubation and remove the outer glove after depositing the blade [54–56]. Because a multimodal bundle alone (a–g) is insufficient for infection control, monitor *S. aureus* transmission for data feedback and to mitigate intervention fatigue [40]. Use a standard behavioral methodology [63] that works in the high task density and fast-paced operating room environments [50,80], and provide feedback that further reduces transmission events [40]. The optimization of this sampling is known [81].

SARS-CoV-2 is transmitted through respiratory droplets (e.g., coughing, sneezing), causing environmental contamination [82]. There are patients with minimal or ambiguous symptoms (e.g., occasional cough) but harboring SARS-CoV-2 in their respiratory system based on radiological imaging [13–19]. Estimated false-negative rates of oropharyngeal testing, based on patients with disease diagnosed by chest computerized tomography, are 17% (6/35) [24], 29% (15/51) [25], 41% (413/1014) [26], and 63% (384/610) [27]; pooled 48% (818/1710). The estimates are heterogeneous because upper airway involvement declines as the disease progresses [22,23]. Bronchioalveolar lavage (93%) and sputum samples (72%) have lower false-negative rates than oropharyngeal samples (32%) [28]. Asymptomatic patients will cause environmental contamination not only during tracheal intubation [83] but also after tracheal extubation.

For example, to apply these results to the University of Iowa's phase I postanesthesia care unit, approximately 1.3% of the > 1000 pre-symptomatic or asymptomatic patients screened for essential procedures have been SARS-CoV-2 positive by RT-PCR. (As context, between March 31 and April 7, there were 33 of the 49 other US states with a greater weekly increase in the incidence per capita of COVID-19 infection [84].) Using a 0% false-positive rate and a 29% false negative rate observed clinically [25], less than the pooled value of 48%, 1 patient in 182 would be expected to test negative yet be infected.¹ SARS-

¹ The 1 in 182 patients = $1/(1 - \text{negative predictive value})$. The negative predictive value is $99.45\% = (1 - \text{prevalence}) \times (\text{specificity of } 1.0)/(1 -$

CoV-2 is detected on plastic and stainless steel surfaces (e.g., in the phase I post-anesthesia care unit) for 4 days [48]. The University of Iowa's ambulatory surgery center has 12 operating rooms. Based on 4 cases per day per room and 50% of cases being general anesthetics, approximately 41% of 4-day periods would be expected to have at least one exposure event.¹

Viral pathogen survival on environmental surfaces extends for several days; SARS-CoV-2 can survive for at least 3 days on a variety of materials commonly encountered in ORs (e.g., stainless steel, plastic) [85]. COVID-19 infectivity cannot be accounted for, population-wise, without including environmental contamination [86]. The necessary environmental cleaning [58,59] applies to the area around the patient, including the phase I post-anesthesia care unit. We do not think that ambulatory surgery centers will be able to sustain reporting and contact tracing for all providers and patients exposed to a nurse or anesthesia provider who develops COVID-19 several days after their shift. (For COVID-19, the mean days from infection to symptom onset is 5 days [95% confidence interval 4 to 7] with 95th percentile 12 days [9 to 18]) [87]. The economic implication is that patients should have their initial (phase I) post-anesthesia recovery in the operating room where they had surgery; by "initial" we mean the period of coughing, disorientation, and sometimes bronchospasm right after tracheal extubation [1].

The cost of having patients undergoing initial phase I recovery in the operating room need not be as large as it may seem. Apropos this recommendation, there are very few phase I post-anesthesia care units in Japan [88]. Even for long-duration cases, patients in Japanese hospitals spend vastly less time in the operating room than do patients at hospitals spend in phase I post-anesthesia care units [89]. Ambulatory surgery cases with an anesthesiologist and/or nurse anesthetist are brief, averaging 61 min (SE 2 min) of operating room time by national US survey [36]. The incidences of prolonged times to extubation, meaning end of surgery to tracheal extubation, are negligibly small for cases of such brief duration [90,91]. There are multiple studies from the late 1990s and early 2000s on the use of different anesthetic techniques to achieve faster initial recovery for the patient to have a very brief phase I post-anesthesia recovery time [76,92–97]. Anesthesia providers might need to alter some of their routine anesthetic practices accordingly. Regardless, having patients initially recover in operating rooms is a considerable change administratively for ambulatory surgery centers in North America that do not routinely bypass the phase I post-anesthesia care unit among their patients undergoing general anesthesia.

5. Ambulatory surgery with aerosol production, with or without general anesthesia

For many otolaryngology, gastroenterology, general surgery, oral surgery, interventional pulmonary and thoracic surgery cases, etc., the changes described in the preceding two sections would be necessary. Additionally, there would be multimodal environmental decontamination after each case [1]. This process includes treating operating rooms using a source generating ultraviolet-C [98,99] or equivalently fast technology to supplement personnel cleaning. Usual operating room and recovery cleaning practices, especially for noncritical items, are often inadequate [58,59,100,101]. For many ambulatory surgery centers, this will increase turnover times considerably. Regardless, nearly all operating rooms are positively pressurized with respect to the external environment, meaning that contamination is spread *away* from the operating room table to the walls and exterior, even when doors are

(footnote continued)

prevalence] $\times 1.0 + \text{prevalence} \times \text{false negative rate } 0.2941$). The prevalence = 1.3% incidence of positive tests/ $(1 - \text{false negative rate})$. The 41% probability of at least one COVID-19 patient due to false positive RT-PCR = $1 - (0.9945)^{(120 \text{ general anesthetics per week})}$.

open [102–105].

Statistical methods to help the ambulatory surgery center determine how many housekeepers are needed have been developed and validated [106–109]. These methods are useful in part because they are non-intuitive. First, determine the times of the workday when there are the largest number of unusually long turnovers, using one-hour epochs [106]. Making graphs or tables of the counts by hour will be helpful because the workdays should be far longer than typical before COVID-19 for ambulatory surgery centers [36,79]. This increase in the length of the workday will occur because long-shifts reduce the amount of personal protective equipment used and reduce patient queues for care [1]. The graphs and tables help managers determine the times when the largest numbers of housekeepers are needed [106]. Next, each increase in the number of housekeepers and/or turnover teams will be associated with less overall mean minutes that teams work later than planned [107,109] and lesser probability of prolonged turnovers [107,108]. However, the relationship is asymptotic such that each increase in the numbers of housekeepers or teams has progressively lesser benefit [107,109]. A useful statistic to use for managerial decisions is the mean daily minutes when the number of simultaneous turnovers is exceeding the number of housekeepers or teams [107]. The statistic is related directly to the minutes that teams will work later than planned [107]. The difference is taken in the statistic calculated with and without the addition of 1 more housekeeper or team [107].

As we think will be apparent, the economic effect of COVID-19 on daily operating room management of ambulatory surgery centers after the acute crisis period likely will be for those operating rooms being used for surgery with aerosol production to have the sometimes frustratingly slow performance of hospitals' surgical suites. We think that a good analogy would be the management of cases on Saturdays. The reason is that among US surgical suites on Saturdays, anesthesia and nursing teams often can have each team working in 2 operating rooms, allowing cleaning and setup while they are caring for another patient [8]. We previously published a review article for making operating room management decisions to reduce the hours that staffs work late for use by surgical suites with long (≥ 10 h) workdays [110]. The methods apply directly. In the current paper, we do not repeat this extensive and fully covered topic [110]. Rather, we make three points useful as ambulatory surgery centers learn how to apply the science.

First, a common challenge in applying principles to achieve maximal operating room utilization balanced versus preventing the hours that teams work late ("over-utilized time") is that different operating room managers reasonably disagree about how much time is worth saving to warrant moving a case from one room to another (e.g., 15 min or 30 min) [111,112]. Such heterogeneity of perspective on decisions can be neglected because turnover times will be 45 min or longer for most cases.

Second, usually making decisions to reduce the hours that staff work late, while filling the operating rooms, depends on calculating the operating room allocations, meaning the hours into which cases are scheduled [110,113,114]. That characteristically would be done by the combination of service and day of the week [110,113,114]. This usually is important because there are substantial differences among combinations of service and day of the week [115]. After the peak of the COVID-19 pandemic has subsided, at facilities with a nearly unlimited queue of patients for surgery and with staff working at most 12 h daily, this mathematics can be skipped. These dual objectives will need to be met while relying on few historical data [116–120] for cases' operating room times by procedure because previously phase I post-anesthesia care was not in the operating rooms. Ambulatory surgery centers (i.e., facilities performing many brief cases) [36] should schedule cases into operating room hours selected by policy (e.g., 11 h) calculated for the end of the day to finish reliably by 12-h [121,122]. Case scheduling would pack as much as possible into those hours while not causing over-utilized time [110,112,123].

Third, decision-making to maximize productivity is both difficult

and counter-intuitive because of the conditions that will apply for these operating rooms: long workdays, long-duration cases (i.e., including phase I recovery in the room), and long turnover times [110]. Physicians and non-physicians tend to make operating room management decisions based on rules of thumb. Such heuristics perform poorly, and people do not realize the extent to which their case scheduling decisions are suboptimal [108,124–128]. The knowledge and problem-solving skills to make those decisions well are not learned on the job by experience [108,124–128], but rather by study (e.g., a formal course in operating room management) [129–134].

6. Discussion

We performed a narrative review of studies to predict the future economic effect of COVID-19 on daily operating room management of ambulatory surgery centers after the acute crisis period ends in their region, but COVID-19 remains prevalent. The review suggests the following targeted strategies for facilities using RT-PCR COVID-19 screening preoperatively but not chest computerized tomography [11,12,15–19]:

- Use multimodal perioperative infection control practices (e.g., including patient decontamination) and monitor performance (e.g., *S. aureus* transmission from a patient to the environment as a marker of behavioral performance). For details, see References [1] and [40], and infographic checklist and videos prepared by the Anesthesia Patient Safety Foundation [135]. These infection control recommendations are unchanged from our initial study [1].
- Dedicate most operating rooms daily to ambulatory procedures that are not airway aerosol producing and do not need general anesthesia [32–36]. Increase throughput of these cases by using block areas with registered nurses to assist in the performance of regional anesthesia [65–72]. Plan long-duration workdays (e.g., 12 h) to reduce the impact of personnel exposed to asymptomatic patients with COVID-19, and to reduce the large queues of patients needing essential surgery [1,136]. Bypass the phase I post-anesthesia care unit by appropriate choices of anesthetic approach and drugs [73–78]. These recommendations are relaxed from our initial study [1] because of the findings on the timing of viral load in the upper airway and the effectiveness of patient decolonization drugs for inactivating SARS-CoV-2.
- Until a low-risk cure or effective prevention for COVID-19 is discovered, or a safe and widely used vaccine is developed, surgical procedures that do not result in aerosol production, but for which general anesthesia is administered, should have initial phase I post-anesthesia recovery in the operating room where the surgery was performed. Consider following anesthetic practices that achieve fast initial recovery [89,92–97].
- When the surgical procedure results in aerosol production (e.g., bronchoscopy), have phase I recovery in the operating room and use multimodal environmental decontamination after each case [1]. Use statistical methods to plan for the long resulting turnover times [106–109]. Whenever possible, have the anesthesia and nursing teams work in more than one room so that they are doing one surgical case while the other room is being cleaned.

Although our paper is limited to ambulatory surgery, we do not think that this is an important limitation. Healthcare exists to provide care to the population of patients. Because one patient is not more important than another, brief duration essential procedures should take precedence over longer ones because more patients will receive care. Ambulatory surgery cases with anesthesiologist or nurse anesthetist are brief, averaging 61 min (SE 2 min) of operating room time and 72 min (SE 2 min) of total recovery time to discharge, by national US survey [36]. Thus, performing cases in ambulatory surgery centers, especially those without general anesthesia, serves the objective of increasing

societal utility.

When patients have initial phase I post-anesthesia care in the operating room, after general anesthesia or surgery with aerosol production, the anesthesia provider could staff the recovery. That would be logical if they would not go right away to another room to start a case. If they would start another case in another room, the post-anesthesia care unit nurse could come to the room, as done for some regional anesthetics [64]. That would, however, increase exposure of more healthcare workers to each patient during the period of airborne precautions and consume more personal protective equipment [1].

We have not addressed general anesthesia and/or airway aerosolizing surgical procedures among patients who had COVID-19 and subsequently had two negative tests (i.e., the current method to assess that an individual no longer is contagious). We are unaware of sufficient data on developed immunity and its influence on subsequent infection. We do not think that this lack of direct consideration would have an effect, however, on the principles (i.e., this does not represent a practical limitation to our work).

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CRediT authorship contribution statement

Franklin Dexter: Conceptualization, Methodology, Investigation, Resources, Writing - original draft, Writing - review & editing. **Mohamed Elhakim:** Investigation, Writing - review & editing. **Randy W. Loftus:** Writing - original draft, Writing - review & editing. **Melinda S. Seering:** Writing - review & editing. **Richard H. Epstein:** Writing - original draft, Writing - review & editing.

Declaration of competing interest

The Division of Management Consulting of the University of Iowa's Department of Anesthesia provides consultations to hospitals. Dr. Dexter receives no funds personally other than his salary and allowable expense reimbursements from the University of Iowa and has tenure with no incentive program. He and his family have no financial holdings in any company related to his work, other than indirectly through mutual funds for retirement. Income from the Division's consulting work is used to fund Division research. A list of all the Division's consults is available at https://FranklinDexter.net/Contact_Info.htm. Dr. Loftus reports research funding from Sage Medical Inc., B Braun, Draeger, and Kenall, has one or more patents pending, and is a partner of RDB Bioinformatics, LLC, and 1055 N 115th St #301, Omaha, NE 68154, a company that owns OR PathTrac, and has spoken at educational meetings sponsored by Kenall and B Braun. Drs. Elhakim, Seering, and Epstein have no disclosures.

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