Operating room use for emergency general surgery cases: analysis of the Patterns of Complex Emergency General Surgery in Canada study

Michael T. Meschino, MD
Kelly N. Vogt, MD, MSc
Laura Allen, MSc
Maisa Saddik, MSc
Rahima Nenshi, MD, MSc
Rardi Van Heest, MD
Fady Saleh, MD
Sandy Widder, MD, MSc
Samuel Minor, MD
Emilie Joos, MD
Neil G. Parry, MD
Patrick B. Murphy, MD
Chad G. Ball, MD, MSc
Morad Hameed, MD, MPH
Paul T. Engels, MD
on behalf of CANUCS (Canadian Collaborative on Urgent Care Surgery)

Presented in part as a poster at the American Association for the Surgery of Trauma Annual Meeting, Sept. 18–21, 2019, Dallas, Tex.

Accepted Apr. 8, 2022

Correspondence to:
P. Engels
6 North Wing, Room 617, Hamilton General Hospital
237 Barton St E
Hamilton ON L8L 2X2
engelsp@mcmaster.ca

Cite as: *Can J Surg* 2023 January 3; 66(1). doi: 10.1503/cjs.008120

Background: Access to the operating room (OR) is variable among emergency general surgery (EGS) services, with some having dedicated EGS ORs, and others only a shared queue. Currently in Canada, only a limited number of acute care surgery services have dedicated daytime operating room (OR) access; hence, we aimed to describe the burden of after-hours EGS operating in Canada and differences associated with OR access.

Methods: In this multicentre retrospective cohort study, we used data from a previously conducted study designed to evaluate nonappendiceal, nonbiliary disease across 8 Canadian hospitals. We performed a secondary analysis to describe booking priorities and timing of operative interventions, compare sites with and without access to a dedicated EGS daytime OR, and identify differences in morbidity and mortality based on timing of operative intervention.

Results: Among 1244 patients, operations were performed during weekday daytime in 521 cases (41.9%), in the evening in 279 (22.4%), on the weekend in 293 (23.6%) and overnight in 151 (12.1%). Operating room booking priority was more than 2 hours to 8 hours in 657 cases (52.8%), more than 8 hours to 24 hours in 334 (26.9%) and more than 24 hours to 48 hours in 253 (20.3%). Substantial variation in booking priority was observed for the same preoperative diagnoses. Sites with dedicated EGS ORs performed a greater proportion of cases during daytime versus overnight compared to sites without dedicated EGS ORs (198/237 [83.5%] v. 323/435 [74.2%], $p = 0.006$). No significant differences in outcome were found between cases performed during the daytime, evening and overnight.

Conclusion: We found considerable variation in OR booking priority within the same preoperative diagnoses among EGS patients in Canada. Sites with dedicated EGS ORs performed more cases during weekday daytime compared to sites without dedicated EGS ORs; however, this study showed no evidence of compromised outcomes based on OR timing.

Contexte : Tous les services de chirurgie générale d'urgence (CGU) n'ont pas le même accès aux blocs opératoires (BO). Certains ont des BO dédiés, d'autres doivent se placer dans une file d'attente partagée. À l'heure actuelle, au Canada, seul un nombre limité de services de chirurgie d'urgence disposent de BO dédiés accessibles durant le jour. Nous avons donc voulu décrire le fardeau imposé aux services de CGU qui doivent opérer en dehors des heures régulières au Canada et les différences d'accès aux BO.

Méthodes : Dans cette étude de cohorte multicentrique rétrospective, nous avons utilisé les données d'une étude précédente qui a porté sur des cas non liés à l'appendicite ou à la cholécystite dans 8 hôpitaux canadiens. Nous avons procédé à une analyse secondaire afin de décrire les priorités d'inscription et le moment des chirurgies, comparer les établissements pourvus ou non d'un accès à des BO dédiés pour les CGU durant le jour, et établir les différences de morbidité et de mortalité selon le moment des interventions.

Résultats : Sur un total de 1244 cas, les opérations ont été effectuées un jour de semaine et durant le jour dans 521 cas (41,9 %), le soir dans 279 cas (22,4 %), un jour de fin de semaine dans 293 cas (23,6 %) et la nuit dans 151 cas (12,1 %). La priorité d'inscription aux BO était de plus de 2 heures à 8 heures dans 657 cas (52,8 %), de plus de 8 heures à 24 heures dans 334 cas (26,9 %) et de plus de 24 heures à 48 heures dans 253 cas (20,3 %). On a observé une variation substantielle des priorités d'inscription pour de mêmes diagnostics préopératoires. Les hôpitaux pourvus de BO dédiés pour les CGU ont pris en charge un plus grand nombre de cas durant le jour plutôt que la nuit, comparativement aux établissements dépourvus de BO dédiés aux CGU (198/237 [83,5 %] c. 323/435 [74,2 %], $p = 0,006$). On n'a observé aucune différence en ce qui concerne l'issue des interventions selon qu'elles avaient eu lieu le jour, le soir ou la nuit.

Conclusion : Nous avons constaté une variation substantielle des priorités d'inscription aux BO pour les mêmes diagnostics préopératoires dans les cas de CGU au Canada. Les établissements pourvus de BO dédiés pour les CGU ont opéré un plus grand nombre de cas les jours de semaine durant le jour que les établissements dépourvus de BO dédiés aux CGU; par contre, cette étude n'a mis au jour aucune complication associée au moment d'utilisation des BO.

Despite widespread implementation of the acute care surgery (ACS) model, after-hours emergency general surgery (EGS) care accounts for a sizeable proportion of the ACS workload in Canada. Although the ACS model may reduce overnight operating for appendicitis and biliary disease,[1] a recent national review of complex EGS in Canada showed that 47% of all cases occurred between 1700 and 0800.[2] This represents a substantial burden to the health care system, with potential impacts on patient safety, hospital costs, surgeon burnout and resident education.

The impact of after-hours operating has been studied extensively over the last decade, with the majority of studies showing an association between after-hours operating and worse outcomes.[3,4] In response to these findings, surgical subspecialties with high after-hours workloads (general, vascular, orthopedic, transplantation) began to investigate the impact of operative timing within their respective fields. Although the first studies in liver transplantation suggested increased mortality among patients who underwent surgery at night, subsequent reviews of patients who underwent thoraco-abdominal surgery or renal transplantation showed no difference in outcomes.[5–7] In orthopedics, publications have shown increased morbidity from after-hours operating and subsequently a reduction in morbidity and mortality after implementation of a dedicated daytime trauma room.[8,9] Multiple investigators have evaluated the impact of after-hours operating on appendectomy and cholecystectomy outcomes, with mixed results.[10–14] Zapf and colleagues[15] reported increased rates of complications and morbidity in patients undergoing EGS procedures (88.2% of which were appendectomy or cholecystectomy) on weekends versus weekdays. Despite the substantial burden of after-hours operating in EGS, little has been published outside of biliary and appendiceal disease.

Currently in Canada, only a limited number of ACS services have dedicated daytime operating room (OR) access.[2] To our knowledge, the potential impact of this lack of OR access on EGS patient care has not been evaluated. Our study aimed to describe the burden of after-hours EGS operating in Canada. The primary objective was to identify differences in the timing of EGS operative care delivery among Canadian centres, comparing centres with and without dedicated daytime OR access, and to evaluate the potential impact on patient outcomes. We hypothesized that centres with dedicated daytime OR access have fewer operations overnight than centres without such access. We further hypothesized that variation in booking priority would be identified between centres for similar disease types.

Methods

We recently published a multicentre retrospective cohort study evaluating EGS patients with medically complex needs at 6 different sites (8 hospitals) across Canada, and its study methodology has been previously described.[2] All sites received institutional ethics board approval before commencement of the study.

Using this patient cohort, we performed a secondary analysis of adult (age > 18 yr) patients who underwent nonelective operative intervention for nonbiliary, nonappendiceal disease for whom data regarding their operation booking time and starting time were available. For diseases that may not be mutually exclusive (e.g., hernia and bowel obstruction), the data collectors were instructed to select the diagnosis most responsible for the need to operate (i.e., if the hernia was causing bowel obstruction requiring intervention, "bowel obstruction" would be selected as the diagnosis). Nationally, sites use differing time cut-offs to assess the urgency of operative intervention (i.e., booking priority); however, for the purposes of analysis, the booking priority identified from the OR database or booking form was standardized to within 2 hours, within 8 hours, within 24 hours or within 48 hours. Trauma cases were excluded, as these are typically high-priority cases, and, thus, regional variation in their management is not expected. Similarly, we excluded EGS cases booked with the highest priority (≤ 2 h), as these patients have pathophysiology that precludes any delay in OR access. This represented 17% of the total cohort and ranged from 10% to 41% (interquartile range [IQR] 13%–23%) by site.

Consistent with the existing literature,[1] we defined distinct operative timing periods for analysis as follows: daytime (weekdays, 0800 to 1659), evening (weekdays, 1700 to 2259), weekend (Saturday and Sunday, 0800 to 2259) and overnight (any day, 2300 to 0759). We categorized cases according to OR start time.

Statistical analysis

We performed 3 main analyses. First, after aggregating the data from participating sites, we compared the booking

priorities of each disease type. Second, we compared OR start times stratified by case booking priority across hospitals with (n = 3) and without (n = 5) dedicated daytime OR access. Last, we compared outcomes across booking priority cohorts.

Baseline demographic characteristics, OR timing and perioperative details were presented as means with standard deviations or frequencies with proportions, as appropriate. We stratified OR booking priority by both preoperative diagnosis and OR timing, and presented it using frequencies and proportions. We further examined booking priority by stratification into sites with and without a dedicated daytime OR, and compared frequencies using χ^2 tests. We directly compared proportions of daytime versus overnight ORs using χ^2 and Fisher exact tests. We stratified perioperative outcomes (overall length of stay [LOS], intensive care unit [ICU] admission rate, ICU LOS, in-hospital mortality rate and complication rate) by OR start time and described them using medians and IQRs for continuous variables, and frequencies with proportions for binary outcomes. We further stratified outcomes by OR booking priority and compared them using Kruskal–Wallis and χ^2 tests, as appropriate. We analyzed the data using SPSS Version 24 (IBM Corp.), with a p value < 0.05 considered significant.

Results

A total of 1244 patients from the original study cohort were included for analysis. More than half of the patients had at least 1 comorbidity, and nearly 70% were classified as having an American Society of Anesthesiologists score of 3 or higher at the time of first operation (Table 1). The most common preoperative diagnoses were small bowel obstruction (309 patients [24.8%]), hernia (299 [24.0%]), colonic neoplasm (168 [13.5%]) and large bowel obstruction (74 [5.9%]). The most common operations performed included bowel resection (533 cases [42.8%]), hernia repair (327 [26.3%]), adhesiolysis (211 [17.0%]) and ostomy creation (206 [16.6%]). The mean LOS was 9 (IQR 5–17) days, with 11% of patients admitted to an ICU (average ICU LOS 4 [IQR 2–9] d). The complication rate was 34%, and the in-hospital mortality rate was 6%. Additional patient demographic characteristics are shown in Table 1.

The OR booking priority was more than 2 hours to 8 hours in 657 cases (52.8%), more than 8 hours to 24 hours in 334 cases (26.9%) and more than 24 hours to 48 hours in 253 cases (20.3%) (Table 1). There was substantial variation in booking priority for patients with hernia (> 2–8 h: 53.6%; > 8–24 h: 27.4%; > 24–48 h: 20.1%), small bowel obstruction (66.8%, 20.2% and 14.6%, respectively) and diverticular disease (50.2%, 31.1% and 19.8%, respectively) (Figure 1). In contrast, perforation, mesenteric ischemia and peptic ulcer disease were more uniformly booked as high-priority cases.

Table 1. Characteristics of emergency general surgery patients with medically complex needs

Characteristic	No. (%) of patients* n = 1244
Age, mean ± SD, yr	61.9 ± 17
Male sex	619 (49.8)
Comorbid disease	
Any	704 (56.6)
Hypertension	366 (29.4)
Diabetes	195 (15.7)
Current smoker	143 (11.5)
Metastatic cancer	119 (9.6)
Coronary artery disease	90 (7.2)
Chronic obstructive pulmonary disease	65 (5.2)
Congestive heart failure	35 (2.8)
Dialysis	24 (1.9)
Bleeding disorder	23 (1.8)
Cirrhosis	15 (1.2)
ASA score at first operation	
1	59 (4.7)
2	256 (20.6)
3	488 (39.2)
4	359 (28.9)
5	19 (1.5)
Missing	63 (5.1)
Urgency of operation, h	
> 2–8	657 (52.8)
> 8–24	334 (26.9)
> 24–48	253 (20.3)
Operative timing	
Daytime	521 (41.9)
Evening	279 (22.4)
Weekend	293 (23.6)
Overnight	151 (12.1)
Preoperative diagnosis	
Small bowel obstruction	309 (24.8)
Hernia	299 (24.0)
Colonic neoplasm	168 (13.5)
Large bowel obstruction	74 (5.9)
Diverticular disease	64 (5.1)
Peptic ulcer	42 (3.4)
Bowel/gastric perforation	37 (3.0)
Mesenteric ischemia	20 (1.6)
Postoperative bleeding	16 (1.3)
Stomach neoplasm	13 (1.0)
Small bowel neoplasm	13 (1.0)
Lower gastrointestinal tract bleed	10 (0.8)
Ulcerative colitis	9 (0.7)
Soft-tissue infection	9 (0.7)
Clostridium difficile colitis/infectious colitis	7 (0.6)
Upper gastrointestinal tract bleed	6 (0.5)
Anastomotic leak	5 (0.4)
Hepatic neoplasm	2 (0.2)
Other	3 (0.2)
Missing	138 (11.1)
Operation performed†	
Bowel resection	533 (42.8)
Hernia repair	327 (26.3)
Exploratory/diagnostic	301 (24.2)
Adhesiolysis	211 (17.0)
Ostomy creation	206 (16.6)
Incision and drainage	34 (2.7)
Repair of ulcer	30 (2.4)
Feeding tube placement	17 (1.4)
Gastric resection	13 (1.0)
Breast procedure	6 (0.5)

ASA = American Society of Anesthesiologists; SD = standard deviation.
*Except where noted otherwise.
†Some patients had more than 1 operation.

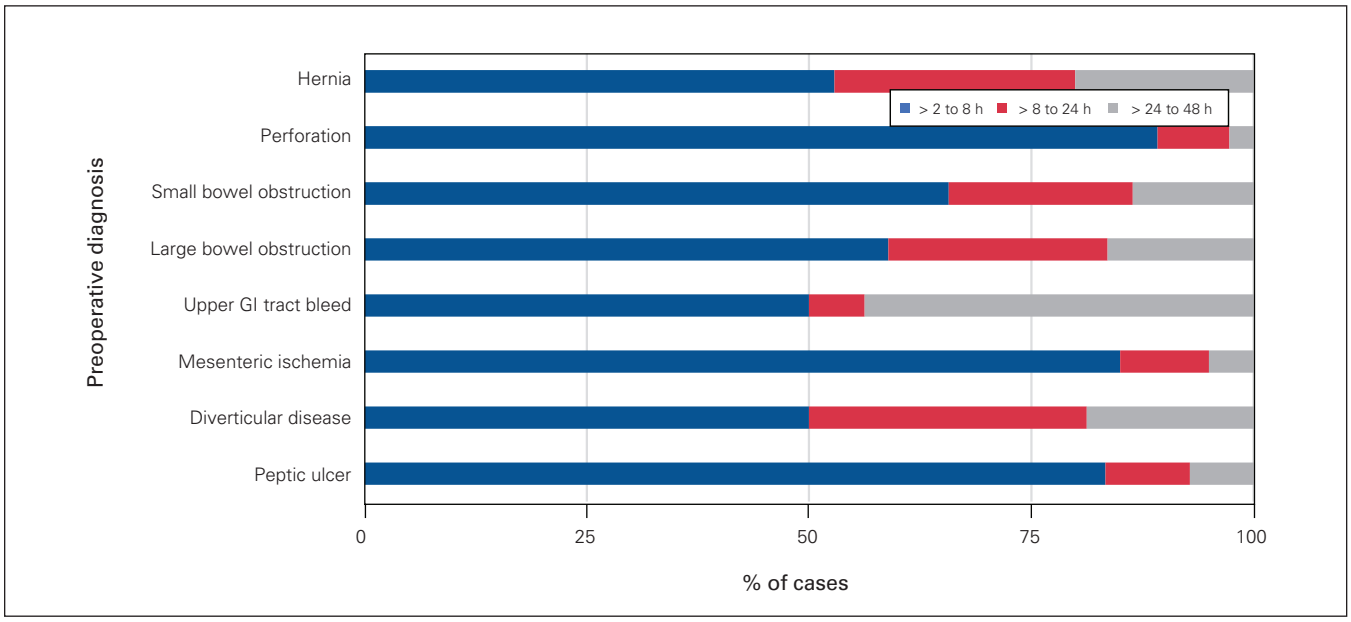

Fig. 1. Distribution of operating room booking priority stratified by preoperative diagnosis. GI = gastrointestinal.

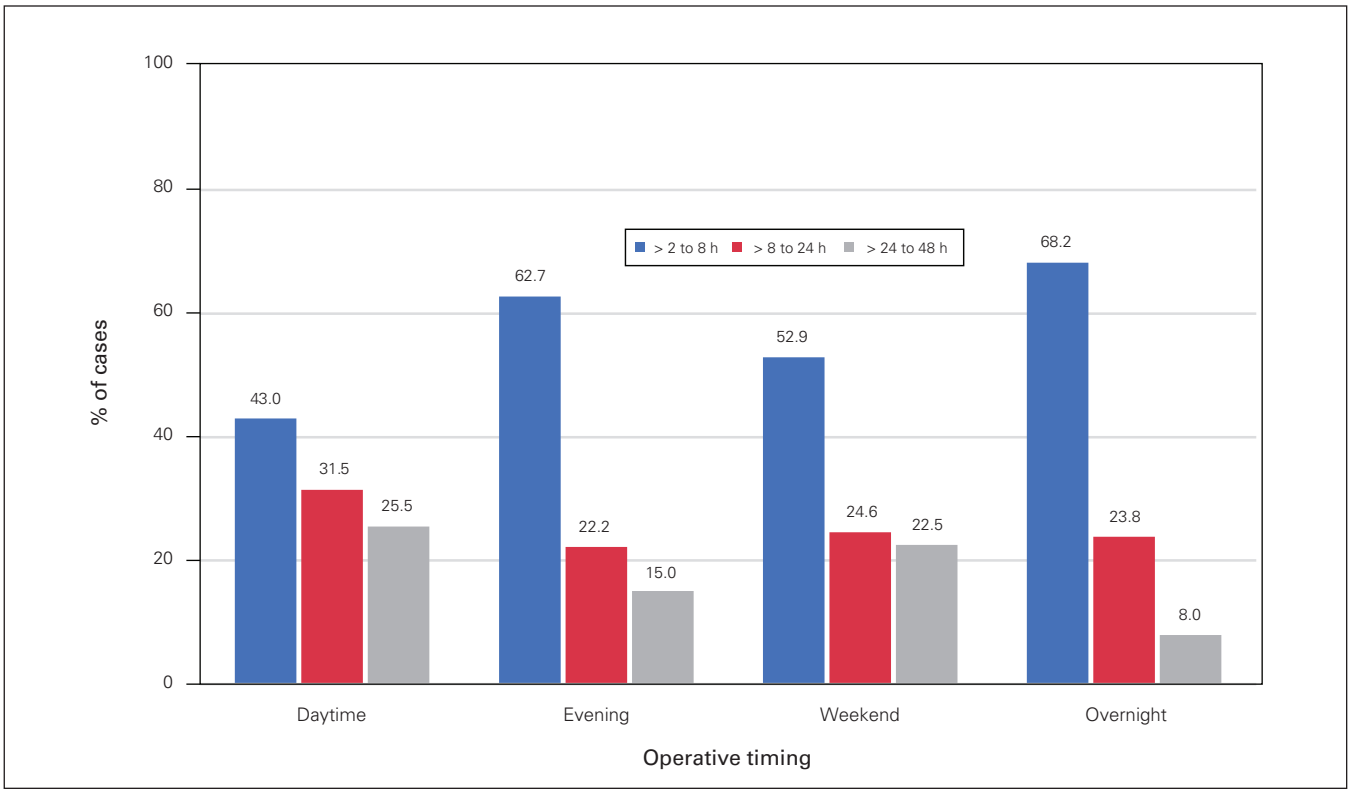

Fig. 2. Distribution of operating room booking priority stratified by operation start time.

Operations were performed during the daytime on a weekday in 521 cases (41.9%), in the evening in 279 cases (22.4%), on the weekend in 293 cases (23.6%) and overnight in 151 cases (12.1%) (Table 1). A greater proportion of cases with a booking priority of more than 2 hours to 8 hours were performed after hours (in the evening 175 [62.7%], overnight 103 [68.2%] or on a weekend 155 [52.9%]) than during the daytime (224 [43.0%]) ($p < 0.001$) (Figure 2).

Sites with dedicated EGS ORs performed cases in differing proportions according to the time of day than sites without dedicated EGS ORs ($p = 0.009$). This difference was significant only for cases with a booking priority of more than 8 hours to 24 hours ($p < 0.001$) (Table 2).

Table 2. Distribution of cases performed during various periods according to booking priority and acute care surgery site operating room access

Booking priority; access	No. of cases (and % of total) according to operative timing					*p* value
	Overall	Daytime	Evening	Weekend	Overnight	
Overall						
ACS site with dedicated daytime OR	471 (37.9)	198 (42.0)	113 (24.0)	121 (25.7)	39 (8.3)	0.009
ACS site without dedicated daytime OR	773 (62.1)	323 (41.8)	166 (21.5)	172 (22.2)	112 (14.5)	
> 2–8 h						
ACS site with dedicated daytime OR	271 (41.2)	85 (31.4)	73 (26.9)	77 (28.4)	36 (13.3)	0.06
ACS site without dedicated daytime OR	386 (58.8)	139 (36.0)	102 (26.4)	78 (20.2)	67 (17.4)	
> 8–24 h						
ACS site with dedicated daytime OR	148 (44.3)	81 (54.7)	35 (23.6)	29 (19.6)	3 (2.0)	< 0.001
ACS site without dedicated daytime OR	186 (55.7)	83 (44.6)	27 (14.5)	43 (23.1)	33 (17.7)	
> 24–48 h						
ACS site with dedicated daytime OR	52 (20.6)	32 (61.5)	5 (9.6)	15 (28.8)	0 (0.0)	0.1
ACS site without dedicated daytime OR	201 (79.4)	101 (50.2)	37 (18.4)	51 (25.4)	12 (6.0)	

ACS = acute care surgery; OR = operating room.

Table 3. Perioperative outcomes according to operative timing

Outcome	Operative timing; no. (%) of patients*				
	Overall *n* = 1244	Weekday daytime *n* = 521	Weekday evening *n* = 279	Weekend daytime *n* = 293	Overnight *n* = 151
Overall LOS, median (IQR), d	9 (5.0–17.0)	9 (5.0–17.0)	9 (5.0–17.0)	10 (5.0–17.0)	7 (4.0–14.0)
ICU admission	139 (11.2)	56 (10.7)	38 (13.6)	27 (9.2)	18 (11.9)
ICU LOS, median (IQR), d	4 (2.0–9.0)	4 (2.0–8.0)	3 (1.5–9.5)	5 (2.0–13.5)	3 (2.0–7.0)
In-hospital mortality rate	73 (5.9)	34 (6.5)	14 (5.0)	12 (4.1)	13 (8.6)
Complication rate	420 (33.8)	185 (35.5)	86 (30.8)	105 (35.8)	44 (29.1)

ICU = intensive care unit; IQR =interquartile range; LOS = length of stay.
*Except where noted otherwise.

When we directly compared daytime versus overnight operations, sites with dedicated EGS ORs performed a greater proportion of cases during daytime hours than those without dedicated EGS ORs (198/237 [83.5%] v. 323/435 [74.2%], $p = 0.006$). This difference was most pronounced for cases with a booking priority of more than 8 hours to 24 hours (81/84 [96.4%] v. 83/116 [71.6%], $p < 0.001$), with no statistically significant difference for cases with a booking priority of more than 24 hours to 48 hours (32/32 [100.0% v. 101/113 [89.4%], $p = 0.1$).

There was no difference in perioperative outcomes based on operative timing (Table 3). Among cases with booking priorities of more than 2 hours to 8 hours and more than 8 hours to 24 hours, there were no significant differences in mortality rate, complication rate or LOS between cases performed during the daytime, evening or overnight (Table 4).

Discussion

Patients undergoing operative management account for some of the sickest patients in hospitals, with the most comorbidities and highest risk.[16] This highlights the need to better understand how to provide optimal care for this vulnerable population. Furthermore, as the specialty of EGS evolves, so too does our understanding of the optimal disease management, patient care and indicators of quality.[17] Our study identified clear variability in patient management with regard to operative booking priority within each disease type, decreased after-hours operating by EGS services with dedicated daytime OR access, and no differences in patient outcomes between the various booking priority cohorts.

Although one would expect patient factors and disease presentation to influence the time interval from hospital admission to operation, our study specifically examined the priority of the case once it was booked into the OR, i.e., after the decision to operate had been made. In addition, to avoid unfair comparisons between patients with the most acute disease presentations, we excluded all patients with a booking priority of 2 hours or less. We found that a substantial proportion of patients with a preoperative diagnosis of perforation, bleeding or ischemia were booked with a priority of more than 2 hours to 8 hours, with some booked with a priority of more than 8 hours. As has been shown in other fields of EGS research,[18] clinical factors are unlikely to be solely

Table 4. Perioperative outcomes according to operative timing and operating room booking priority

Booking priority; outcome	Operative timing; no. (%) of patients*			*p* value
	Daytime	Evening	Overnight	
> 2–8 h				
Complication (*n* = 206)	108 (52.4)	72 (35.0)	26 (12.6)	0.2
Death (*n* = 52)	26 (50.0)	14 (26.9)	12 (23.1)	0.2
LOS, median (IQR), d	9 (5.0–14.0)	9 (5.0–18.0)	7 (4.0–14.0)	0.08
> 8–24 h				
Complication (*n* = 135)	90 (66.7)	30 (22.2)	15 (11.1)	0.5
Death (*n* = 16)	11 (68.8)	4 (25.0)	1 (6.2)	0.8
LOS, median (IQR), d	11 (5.0–19.0)	10 (5.0–21.0)	7 (4.0–13.5)	0.2

IQR = interquartile range; LOS = length of stay.
*Except where noted otherwise.

responsible for this wide distribution, which raises the question of system-based barriers such as OR access. We acknowledge that, with patients who have demonstrated clinical stability, factors beyond disease likely play a role in the chosen booking priority.

In our study, more than half of EGS cases were performed outside of regular daytime hours. Of the 8 hospitals with ACS services, only 3 had dedicated daytime OR resources. Not surprisingly, lack of access to dedicated daytime EGS ORs was associated with increased after-hours operating. Murphy and colleagues[1] reported that many of the disease-specific benefits of the ACS model are dependent on daytime OR access. For biliary and appendiceal disease specifically, they were able to show that implementation of the ACS model led to improved access to care, a reduction in complications and decreased LOS — but only when the ACS model in question included dedicated daytime OR resources.

Consistent with our experience, our study helps show that dedicated OR access for EGS services likely prompts the triaging of certain cases to being done during the daytime. For example, a patient assessed by the EGS surgeon as needing an operation within the next day may be booked with the operative priority of more than 8 hours to 24 hours at 1700 on a weekday. A hospital without dedicated daytime EGS OR may start that case at 2200 or 0100, whenever the OR becomes available; however, a hospital with dedicated daytime EGS OR may book that case to start first thing at 0800, thereby ensuring that the operation gets started within the priority window as well as being done during daytime hours. The existence of such clinical behaviour is further supported by the lack in the present study of a statistically significant difference in operation start time for cases with a booking priority of more than 2 hours to 8 hours (i.e., these patients were triaged as needing an operation, no matter what time of night, and their cases were not delayed). It should be acknowledged that pushing an operation to the following daytime could result in increased LOS, although for the cohort in our study there was no difference in LOS between groups according to operation start time.

The potential for worsened outcome owing to operative delay is very real and has been abundantly demonstrated in the literature.[19–22] We did not observe any difference in perioperative outcomes according to operation start time, which lends support to the credence of appropriate patient selection and triage by the EGS services. There has been much debate about the utility and efficiency of running a dedicated emergency surgery room during daytime hours. In 1993, the American College of Surgeons Committee on Trauma recommended that a dedicated OR for urgent trauma cases was necessary at all level I and II trauma centres.[23] Initial pushback against this recommendation focused on concerns about optimization of limited OR resources.[24] Most of the early work on OR use used computerized models, with some studies suggesting that dedicated emergency ORs might actually decrease efficiency and optimization (1 major centre in Europe subsequently closed their emergency department).[25] More recently, these models have been tested in real-life studies.[26–30] In 2013, Heng and Wright[26] showed that a dedicated OR for emergency cases reduced cancellations of elective procedures and overruns, and improved time to care for priority 3 emergency cases (defined as wait time ≤ 12 h). Similar studies in orthopedic emergencies have yielded comparable results.[27–29] In a 2016 Dutch study, van Veen-Berkx and colleagues[30] analyzed more than 450 000 emergency cases over an 8-year period and concluded that a dedicated OR was the preferred approach regarding use, overtime and case cancellations.

As ACS service models first emerged in Canada in academic health sciences centres,[31] the impact of these services on resident and medical student[32] education is important to consider. In addition to clinical benefits, the concentration of EGS cases — where appropriate — to daytime ORs may also create the benefit of increasing surgical training opportunities for residents.[33] Indeed, ACS models that do not include dedicated daytime OR access may be detrimental to general surgery residents scheduled on such

services.[34] As trainee education is a core mandate of academic health sciences centres, such impacts must be considered in these centres.[35]

Canadian ACS services are frequently composed of staff surgeons of varied subspecialties, and not necessarily a fellowship-trained trauma or acute care surgeon.[36] To our knowledge, the exact role this may play in the management of ACS patients has not yet been reported in the literature. However, Schuster and colleagues[37] recently examined the interaction of ACS surgeon experience with emergency surgery patient outcomes and suggested that an outcome benefit for more experienced surgeons may exist; all surgeons in that study were fellowship-trained acute care surgeons.

The components of care within a hospital that must be coordinated in order to provide urgent care to sick patients are numerous and complicated, and must occur within the resource constraints that exist within the Canadian health care system. The ACS surgeon must make multiple judgment calls as part of their multiple roles, best outlined by the Royal College CanMEDS framework.[38] Indeed, the role of the ACS surgeon as steward deserves further exploration. The heterogeneity of surgeon-of-the-week ACS models (patient census, resident or other health care provider staffing, number of on-call nights, daytime and after-hours OR access),[36] combined with a highly comorbid population at high risk for death,[2] means that successfully managing an ACS service is more often than not a high-stakes enterprise.[39]

The importance of the role of the ACS surgeons' decisions is certainly not captured by our study's data, but these decisions deserve acknowledgement as a driving factor for many patient outcomes. Surgeons make daily decisions on how to optimize the patient and situation: which patient needs an operation and when; how to work within their local OR availability and booking system to get the patient into surgery within a clinically acceptable time frame; how to be respectful of all health care practitioners' time and availability; and how to best use limited health care resources. The lack of differences in patient outcomes in our study suggests that, despite differences in ACS service models, the ACS surgeons are navigating their patients to the OR appropriately. It also suggests that appropriate patient care can be provided within an ACS model that focuses nonemergency surgery into the daytime hours. Considering the trauma quality-improvement paradigm of seeking to provide "the right treatment at the right time in the right place," our findings support the idea that there exists a significant cohort within the burden of EGS cases that can be safely shifted to daytime operative hours, while still maintaining quality patient care and responsiveness to patients with more urgent operative needs who require after-hours intervention. In addition, the importance of health care provider wellness must be recognized,[40,41] and innovations in clinical service delivery that improve both patient care and provider wellness must be prioritized.[41,42] A responsible shifting of EGS operative care into daytime hours is an important strategy to improve surgeon wellness. Indeed, the optimized ACS service may have the potential to achieve the "best of both worlds."[43]

Limitations

Limitations of this substudy echo those described for the parent study.[2] Specifically, the retrospective design and standardized but nonhomogeneous data sources across the participating centres are the major limitations. In addition, we could not control for important patient and centre characteristics such as local OR booking practices and nuances, local patient disposition approaches, and local patient disease severity at presentation, that may have influenced operative timing or patient outcomes. There may be important differences in case-mix and patient characteristics that explain why operative timing did not influence patient outcomes. Similarly, we do not know how many of the cases "expired" and were performed after their booking priority window ended. Finally, our study was not powered to identify differences in clinical outcomes, and all such findings should be considered hypothesis-generating for future work.

Conclusion

For many types of preoperative diagnoses among EGS patients, there existed considerable variation in OR booking priority. Sites with dedicated EGS ORs performed more of their cases during the daytime; however, we found no evidence of compromised outcomes based on operative timing in these settings. The study results support considering daytime OR access as part of the optimal ACS model.

Affiliations: From the Department of Surgery, McMaster University, Hamilton, Ont. (Meschino, Saddik, Nenshi, Engels); the Department of Surgery, Western University, London, Ont. (Vogt, Allen); the Department of Surgery, William Osler Health System, Brampton, Ont. (Van Heest, Saleh); the Department of Surgery, University of Alberta, Edmonton, Alta. (Widder); the Department of Surgery, Dalhousie University, Halifax, NS (Minor); the Department of Surgery, University of British Columbia, Vancouver, BC (Joos, Hameed); the Department of Surgery, University of Calgary, Calgary, Alta. (Ball); and the Department of Surgery, Indiana University, Indianapolis, Ind. (Murphy).

Competing interests: Chad Ball is a coeditor-in-chief for *CJS*; he was not involved in the editorial decision-making process for this article. No other competing interests were declared.

Contributors: K. Vogt, L. Allen, M. Meschino and P. Engels designed the study. All authors contributed to data acquisition. K. Vogt, L. Allen and P. Engels analyzed the data. M. Meschino, P. Engels, K. Vogt and L. Allen wrote the manuscript, which all authors critically reviewed. All authors gave final approval of the article to be published.

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