In this issue, Zygourakis and colleagues address the timely topic of patient outcomes after concurrent surgery. Concurrent, or overlapping, surgery—in which a single attending surgeon has responsibility for more than 1 operation simultaneously—has come under close scrutiny after newspaper coverage of several individual cases at Massachusetts General Hospital, prompting an inquiry by the US Senate Finance Committee. In response, the American College of Surgeons (ACS) has recently (April 2016) amended its Statements on Principles to address the performance of concurrent or overlapping operations. In addition, the US Center for Medicare and Medicaid Services has tacitly recognized the existence of overlapping surgery by establishing conditions under which surgeons will be reimbursed for it.

For several reasons, overlapping surgery is a difficult issue to study. First, the terminology for operations that occur in part or in whole at the same time is confusing. The ACS now defines “concurrent or simultaneous” operations as those in which the “critical or key components” of the 2 operations occur at the same time, and “overlapping operations” as those in which the key portion of 1 operation overlaps with a noncritical portion of a second case, or when the overlapping portions of the cases are both noncritical. Because the definition of the key portion of an operation has usually been left to the surgeon to define, few clinical or administrative databases will contain information about which operations are concurrent, overlapping, or have no conflict according to these definitions. Databases built to track operating room scheduling typically do not cover these major conflicts, instead making possible still more subtle definitions of minor conflicts: overlap of procedure time, anesthesia time, or time when the patient is awake in the operating room before induction of anesthesia or after extubation. Some of these “conflicts,” such as 2 patients who are both in operating rooms and both awake—one before induction and the second after extubation—would seem to many surgeons to be no conflict at all. In fact, we have little way of knowing how prevalent either serious or trivial degrees of overlap between operations are in our hospitals. Anecdotally the practice appears common, although not universal.

Second, having defined the type of overlap we wish to study in relation to patient outcomes, we face the usual difficulties of comparing 2 widely accepted forms of standard surgical practice. A randomized trial of concurrent surgery, while feasible in concept and probably ethical, would likely face a significant practical barrier in accruing patients. Zygourakis et al. compare outcomes after operations performed by a single academic vascular neurosurgeon, based on a nonrandomized assignment, to either overlap with the procedure time of a second case or not. This definition of overlap matches the broadest definition of overlapping surgery as defined by the ACS Statement on Principles, “overlapping,” but some case pairs may have been “concurrent,” i.e., overlap of 1 procedure’s key portion with a second case. For a variety of endpoints, there was no significant difference between patient outcomes after cases that did or did not overlap; operative time was about 30 minutes longer in cases that overlapped. Cases that did or did not overlap differed in several important ways, generally suggesting that patients selected for overlapping surgery were lower risk: more likely to be elective, lower American Society of Anesthesiologists classification, lower severity of illness, and lower estimated risk of mortality. A mixed-effects multivariate model was used to adjust for these differences, and after adjustment there were no detected adverse effects of overlap except for slightly longer operative time. A propensity score model, in which patients are balanced on factors predicting assignment to surgery with overlap, would be another appropriate way to analyze similar data.

The implied counterfactual element in this analysis—

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what “would have happened” if the surgery had been performed without overlap—was posited in this study as surgery completed by the same attending surgeon during normal elective hours. Surgeons will immediately recognize that this is not what really happens. More likely, to avoid overlap, these operations would need to be assigned to a different surgeon, or else performed by the index surgeon outside normal elective hours. Surgeons are not exchangeable, and in many cases a substitution would introduce a less experienced practitioner, with predictable results. Changing attending surgeons also curtails patients’ free choice about their care. Performing elective operations after normal weekday hours, or on a weekend, is known to predispose strongly to poor outcomes. Elective surgery after normal operating hours has been shown to be followed by a 3-fold higher complication rate in laparoscopic cholecystectomy, increased unplanned reoperations (27% vs. 3%) after femoral fracture repair, and 2-fold higher operative mortality in nonurgent cardiac surgery. Within neurosurgery, failure to extubate after multilevel spine fusions was highly correlated with time of day at the conclusion of the case, resulting in a 3-fold higher rate of postoperative pneumonia in nonextubated patients. The risks of weekend elective surgery have come under intense review after recent proposed work-hour policy changes in the United Kingdom. Risk-adjusted mortality rate after weekend elective surgery was 82% higher over 3 years in all English public hospitals, a result that has been replicated in the US, Canada, and other countries.

Elimination of surgery with overlap would have systemic-wide effects that should also be considered, although they are difficult to model for formal study. Inpatients would have longer wait times for surgery, increasing bed occupancy, decreasing efficiency, and causing delays for patients waiting for transfer from other facilities. Operating after normal hours can cause surgeon sleep deprivation, increasing surgical risks for the next day’s patients, and with a higher risk over time of surgeon depression and burnout. Finally, overlapping surgery may in some cases facilitate surgical progress. Many of the premier surgeons of the last 50 years routinely ran multiple rooms. Pioneering cardiac surgeons such as Michael DeBakey and Denton Cooley were known to perform up to 25 open heart operations each day, attaining unprecedented levels of surgical skill, slashing mortality rates, and throwing open fields such as valve replacement and cardiac transplantation as practical realities for the entire community. Similar examples within neurosurgery will occur to every reader. Two of the iron laws of surgery—the learning curve and the volume outcome effect—predict that by placing an artificial ceiling on the operative experience of leading surgeons, we risk delaying the progress of operative neurosurgery in the broadest sense.

Zygourakis and colleagues documented equivalent outcomes after surgery for overlap, even against the optimistic comparator of an equally skilled surgeon operating without overlap during prime surgical hours, and the considerations outlined above suggest that for many patients the real-world alternative to surgery with overlap may be demonstrably inferior to this scenario. These findings should motivate further studies of outcomes after overlapping surgery. One focus of such studies will be generalizability. Not all types of surgery may be equally safe for overlap; not all surgeons may be equally prepared for the increased complexity of overlapping surgery. Broader study may require changing existing databases such as the ACS National Surgical Quality Improvement Program (NSQIP) and the Quality Outcomes Database (formerly NQOD) to categorize operations at the time of surgery by degree of overlap. Importantly, hospitals and surgical coordinating committees will need to set guidelines for adequate informed consent, for which surgeons and cases are appropriate for overlap, and for adequate backup by a second attending surgeon when overlapping surgery is scheduled. Existing research on quality and informed consent when surgical trainees participate in an operation may help us in thinking through the issues surrounding overlapping surgery. The information on the safety of overlapping surgery provided by Zygourakis et al. provides a good foundation for this ongoing work.

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References

clearly recorded in the medical record, and may reclassify an overlapping case to a concurrent one. In our study, the vast majority of our surgeries were overlapping, but we were unable to differentiate those cases that might have been considered concurrent with simultaneous critical portions of 2 cases. Nonetheless, the study shows that “running two rooms” can be performed safely and that the general public’s concerns can be answered scientifi-cally with data. The study shows that overlapping surgery must be performed with careful patient selection and case pairings, assistance from residents and fellows, attending-level backup, and patient awareness through informed consent.

Dr. Barker highlights harmful repercussions of banning overlapping surgery, namely after-hours operations with less experienced operating room teams and tired surgeons. Overlapping surgery enables neurosurgeons to treat patients expeditiously and allows patients to be treated by expert subspecialists with high-volume practices. This is an important point, because of the direct relationship between surgeon volume and patient outcomes. Concentrating case volume in specialized centers with dedicated surgeons fosters technical excellence, and overlapping surgery is an important method of achieving this. Subspecialty surgeons who amass vast experience, as Dr. Barker points out with the examples of DeBakey and Cooley in cardiac surgery, are positioned to make surgical advances and pioneering work. Among the 15 faculty neurosurgeons operating at our main hospital, we found a positive correlation between the percentage of overlapping surgeries in their practice and publications (Fig. 1), which substantiates the impact of case volume on surgical expertise and progress.

Another important byproduct of overlapping surgery is that it creates unique learning opportunities for residents and fellows. Trainees learn through observation, observed operation, and unobserved operation. With the first method, the resident observes and assists the instructor, who then safely and quickly completes the surgery. With the second method, the instructor observes and coaches the resident, which may slow the surgery but still ensures safety and educational value. With the third method, the resident operates independently, which is a coveted learning opportunity for him or her, while the instructor works in a second room and maximizes productivity. Autonomy is critical in training the next generation of young neurosurgeons to develop their manual dexterity, make intraoperative decisions on their own, and confront pathology firsthand. Learning requires a combination of these 3 methods, and overlapping surgery fosters this independent learning.

Disclosures

The author reports no conflict of interest.

Response

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We thank Dr. Barker for his thoughtful comments on our paper. Differentiating concurrent from overlapping surgeries, as he notes, depends on the definition of the “critical portion of the case.” This definition is vague, not clearly recorded in the medical record, and may reclassify an overlapping case to a concurrent one. In our study, the vast majority of our surgeries were overlapping, but we were unable to differentiate those cases that might have been considered concurrent with simultaneous critical portions of 2 cases. Nonetheless, the study shows that “running two rooms” can be performed safely and that the general public’s concerns can be answered scientifically with data. The study shows that overlapping surgery must be performed with careful patient selection and case pairings, assistance from residents and fellows, attending-level backup, and patient awareness through informed consent.

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FIG. 1. Comparison of publications per year post-residency for neurosurgery attendings at the University of California, San Francisco, Parnassus hospital (n = 15) and percentage of overlapping surgeries performed. Figure is available in color online only.