

Will the Local ACGME-Trained Surgeon be Adequately Prepared? An Estimate of the Impact of Duty Hour Restrictions on Operative Experience

Dear Editor,

The General Surgery residency programme was introduced in Singapore in 2010, and is evaluated and accredited by the Accreditation Council for Graduate Medical Education (ACGME). This takes the place of the traditional British-based system, and has several main differences, as shown in Table 1.

Table 1. Comparison Between Traditional British-Based System and ACGME Residency

Traditional System	ACGME Residency
Eligible to apply only after postgraduate year 1 (PGY-1).	Can enter into residency from PGY-1 onwards.
PGY-1 year spent doing housemanship comprising 4-monthly rotations through Internal Medicine and 2 of Orthopaedics, General Surgery, Paediatrics, and Obstetrics and Gynaecology.	Year 1 residents do monthly rotations, 8 months in General Surgery, and 4 months in Internal Medicine.
Comprises a minimum of 2 years of Basic Specialist Training (BST) as Medical Officer with 6-monthly rotations to other specialities e.g. Orthopaedics, Anaesthesia etc. which is unstructured.	Year 2 and 3 residents undergo structured rotations comprising a total of 14 months in General Surgery, and 10 months in various other specialities.
Followed by 4 years of Advanced Specialist Training (AST) as Registrar consisting of 6-monthly rotations purely in General Surgery.	Years 4 and 5 residents undergo 3-monthly rotations purely in General Surgery.
Progression between BST and AST not guaranteed i.e. requires fresh application and acceptance into the next stage.	Progression between years is guaranteed i.e. "through-train" programme.
Minimum of 7 years from the point of graduation.	5 years from the point of graduation.

ACGME: Accreditation Council for Graduate Medical Education

Currently, General Surgery residents in their 5-year residency are projected to perform the duties and responsibilities equivalent to those performed by registrars in the old system in their 4th and 5th year of residency, including the same on call, clinical and operative responsibilities. Traditionally, it was during the period of

Advanced Specialist Training (AST) that surgical registrars learned and honed their surgical skills, operative technique and clinical acumen under close supervision, progressively becoming more and more independent, before graduating and becoming competent specialist surgeons.

Concerns regarding the adequacy of the shortened training period (5 cf. at least 8 years) have been thus intensified by the fact that residents will spend only 2 years performing at the same level as registrars in the old system, who have twice as much time to train and practise under supervision before taking full responsibility for the care and treatment of patients, some of whom have complex medical and surgical problems. These concerns are further amplified by the prescribed limitations on duty hours set up by the ACGME, which were not present in the old system. These are laid out in Table 2.

Table 2. ACGME Duty Hour Requirements

1.	Duty hours must be limited to 80 hours per week, averaged over a 4-week period, inclusive of all in-house call activities.
2.	Residents must be provided with 1 day in 7 free from all educational and clinical responsibilities, averaged over a 4-week period, inclusive of in-house call.
3.	Adequate time for rest and personal activities must be provided. This should consist of a 10-hour time period provided between all daily duty periods and after in-house call.
4.	In-house call must occur no more frequently than every third night, averaged over a 4-week period.
5.	Continuous onsite duty, including in-house call, must not exceed 24 consecutive hours. Residents may remain on duty for up to 6 additional hours to participate in didactic activities, transfer care of patients, conduct outpatient clinics, and maintain continuity of medical and surgical care. No new patients may be accepted after 24 hours of continuous duty.

We therefore set out to estimate the impact these regulations and calculate the loss of operative time and volume for a registrar functioning as part of the "old" system over a 1-year period if subjected to the new training hour regulations. This in turn would allow an estimation of the impact of these regulations on the already shortened training time brought about by the residency system.

Materials and Methods

The operative logbooks and call rosters of 3 first-year registrars, who were concurrently accepted into the training programme were reviewed for the period of 3 May 2010 to 2 May 2011. These individuals were selected as they entered the AST programme at the same time as the General Surgery residency was initiated.

A work schedule was then proposed for each of the registrars in compliance with ACGME residency duty hour guidelines (Table 2). Each registrar would be assumed to work from 6 am to 8 pm on weekdays, and 8 am to 12 pm on weekends, with one weekend off every week. When on call, they were assumed to not work past 12 pm on the postcall day, i.e. not more than 30 hours of continuous onsite duty. This schedule provided for the stipulated 10 hours rest between workdays, compulsory one off-day a week as well as a limitation of duty hours to a maximum of 80 hours a week, and did not allow for call duties more frequently than every 3 days.

The schedules were superimposed on the operative records of the registrars to determine the estimated degree of loss in operative experience that would have come with compliance to the ACGME resident duty hours.

Operations that began earlier than 6 am or later than 8 pm were excluded. Operations that began within the working hours but ended beyond those hours were allowed, but the operations on the following day would only be included in the analysis if they were more than 10 hours beyond the end of the operation the night before—it was assumed that the registrar would adjust his non-operative duties accordingly to meet the work hours limit otherwise. Operations during postcall time were allowed up to 12 pm, and those that extended beyond 12 pm were excluded altogether as it was assumed that the registrar would leave the operating theatre at 12 pm sharp and therefore not complete the case.

The total operating time, number of cases (both major and minor) was computed for the actual operative record and the record that would have been in compliance with ACGME guidelines, with operations coded as Table 4A and above classified as major cases.

Results

The 3 first-year registrars performed an average of 360 operations over the course of a year, 300 of which were major cases. Table 3 shows the variance in case load, as well as the estimated effect of the adoption of the ACGME duty hours on operative volume.

The loss in operative volume—whether estimated in terms of time or number of cases—was relatively consistent. However, it is seen that Registrar A performed proportionally fewer major operations “after hours” as well fewer majors as a proportion of total operations compared to his counterparts. Nonetheless, the absolute loss of operative volume and time over the period of a year ranged from 12% to 22%.

When the number of major cases was analysed separately, there was a trend towards a smaller magnitude of effect of the residency duty hours on loss of operative volume. This could be due to logistical reasons—more major surgeries are scheduled on elective lists, and “stable” emergency cases are done during working hours to ensure adequate perioperative support. However, it could also be argued that as the registrars progress through their training and increase in competency, they would be performing more majors independently, and hence the proportion of such surgeries performed “after hours” would correspondingly increase.

It should be noted that the figures used in this estimation include only operative volume in the major operating theatres, and exclude endoscopic procedures and invasive bedside procedures e.g. chest tubes and central line placement, data for which was not easily retrieved for the purposes of this study. Moreover, surgical training is not merely limited to procedural training—the true loss of experience in terms of patient follow-up, management and assessment is difficult to estimate, somewhat intangible, but assuredly adds an order of magnitude to the true loss in training.

From our series, the mean annual operative volume for Registrars A, B and C is 35,545 minutes. Assuming an average loss of operative time of 15% annually, an ACGME resident in his 4th and 5th year of training would have a deficit in operative time of 81,753 minutes or 1362 hours

Table 3. Estimation of Loss of Operative Training under ACGME Resident Duty Hours

Registrars	Operative Time (Mins)	ACGME Operative Time (Mins)	Loss (Mins) (%)	No. of Cases	ACGME No. of Cases	Loss (%)	No. of Majors	ACGME No. of Majors	Loss (%)
A	34,535	29,100	5435 (15.7)	390	325	65 (16.7)	206	192	14 (6.8)
B	37,889	33,334	4555 (12)	367	320	47 (12.8)	217	193	24 (11.1)
C	34,210	26,650	7560 (22.1)	322	254	68 (21.1)	180	143	37 (20.6)

ACGME: Accreditation Council for Graduate Medical Education

(i.e. (15% x 2 years' operative time) + (2 years' operative time)) compared to a registrar undergoing a full 4 years of training in the AST system.

Discussion

The ACGME duty hour restrictions were first enforced nationally in the United States (US) in 2003, and are based on the recommendations of the Bell Commission, which came into effect in the state of New York in 1989. The original Bell commission recommendations—which aimed to improve patient safety, resident wellbeing and resident education—consisted of 2 portions; the limitations in duty hours, as well as a requirement that an attending physician be physically present in hospital at all times.

However, there is evidence that the current ACGME duty hour restrictions have failed to increase the amount of sleep and/or rest among surgical residents.¹ Evidence from in service examinations and board performance also does not support the notion that the additional free time is spent on study.²

Just as importantly, further reductions in duty hours have not brought about additional benefit. In a large cross-sectional study to elicit the effects of further duty hour restrictions,³ residents perceived worsened education, poorer preparation to assume more senior roles and no change in the amount of rest obtained. Furthermore, a recently published meta-analysis in the *British Journal of Surgery* which examined the effect of the ACGME duty hour restrictions in North America on mortality and morbidity in surgical patients found no significant improvements in patient outcomes after the adoption of these restrictions.⁴

In light of this, the oft-quoted claim that improved working hours lead to improved wellbeing of residents, better patient outcomes and improved safety must be re-examined. The care of surgical (and indeed all) patients is dependent not only on the alertness and freshness of the attending trainees, but also on their expertise and experience and previous exposure to a wide spectrum of cases. While no overt adverse trend in surgical morbidity and/or mortality has been documented thus far, it must be kept in mind that these duty hour restrictions have been in force in the US for less than a decade, and have been stringently enforced for even shorter. The bulk of complex case management may then be currently in the hands of experienced senior personnel, graduates of the “old” Halstedian system, and the true effect of less experienced trainees may lag behind. Indeed, in a very recent study of patients undergoing elective craniotomy for meningioma, postoperative complication rates increased significantly at teaching hospitals, but not at non-teaching hospitals over the 5-year epochs before and after 2003, even after accounting for variances in patient

populations through multivariate analysis.⁵

In our study, which is the first of its kind to examine the impact of the ACGME duty hours on surgical training in Singapore, we have demonstrated that a significant loss in operative volume amongst surgical trainees as a result of these guidelines is to be expected. While we fully acknowledge that the numbers presented here are but rough and somewhat simplified estimations, the fact that there will be a significant and substantial change in the amount of operative experience obtained by products of the ACGME system is indisputable.

Documenting a difference in patient outcomes remains implausible at this point in time, mainly due to the short timespan since the inception and introduction of these new measures, and the fact that there is currently a dual system, where products of the traditional system still operate side-by-side with residents. Nonetheless, surgical training is at its core technical training, and in light of our data, it would be prudent to make plans in advance on how to surmount this problem.

Conclusion

In conclusion, while the new ACGME-accredited residency programme is an attempt to innovate the national specialist training landscape, the results presented here show that there will be an inevitable decrease in clinical and operative exposure, brought upon by the inherent reduction in the duration of the training programme and further exacerbated by restrictions placed on duty hours. While it may be argued that the time spent away from hospital could be utilised for self-directed theoretical learning, it should be noted that evidence from the literature does not support that this notion, and the question of whether or not “specialist” graduates of this system will be adequately prepared for the clinical responsibilities of a full fledged practitioner, while beyond the scope of this article to address, must receive serious consideration in order to ensure an adequately trained and adequately prepared healthcare force for the challenges ahead.

REFERENCES

1. Ulmer C, Miller-Wolman D, Johns MM, editors. Resident duty hours: enhancing sleep, supervision and safety. Washington DC: National Academies Press/Institute of Medicine, 2008.
2. The American Board of Surgery. 2008-2009 ABS Examination Statistics. Philadelphia: ABS News, 2009.
3. Drolet BC, Christopher DA, Fischer SA. Residents' response to duty-hour regulations — a follow-up national survey. *N Engl J Med* 2012;366:e35.
4. Jamal MH, Doi SA, Rousseau M, Edwards M, Rao C, Barendregt JJ, et al. Systematic review and meta-analysis of the effect of North American working hours restrictions on mortality and morbidity in surgical patients. *Br J Surg* 2012;99:336-44.
5. Dumont TM, Tranmer BI, Horgan MA, Rughani AI. Trends in neurosurgical complication rates at teaching vs. non-teaching hospitals following duty hour restrictions. *Neurosurgery* 2012;71:1041-6.

Jin Yao Teo, ¹MBBS,MRCs, Ser Yee Lee, ^{1,2}MBBS,FRCS,
Andy JK Chua, ¹MBBS, Wai Keong Wong, ¹MBBS,FRCS

¹Department of General Surgery, Singapore General Hospital, Singapore
²Department of Surgical Oncology, National Cancer Cancer, Singapore

Address for Correspondence: Dr Jin Yao Teo, Department of General Surgery,
Singapore General Hospital, Outram Road, Singapore 169608.
Email: the_gentleman82@hotmail.com
