Within neurosurgery, the national mandate of the 2003 duty hour restrictions (DHR) by the Accreditation Council for Graduate Medical Education (ACGME) has been controversial. Ensuring the proper education and psychological well-being of residents while fulfilling the primary purpose of patient care has generated much debate. Most medical disciplines have developed strategies that address service needs while meeting educational goals. Additionally, there are numerous studies from those disciplines; however, they are not specifically relevant to the needs of a neurological residency. The recent implementation of the 2011 DHR specifically aimed at limiting interns to 16-hour duty shifts has proven controversial and challenging across the nation for neurological residencies—again bringing education and service needs into conflict.

In this report the current literature on DHR is reviewed, with special attention paid to neurological residencies, discussing resident fatigue, technical training, and patient safety. Where appropriate, other specialty studies have been included. The authors believe that a one-size-fits-all approach to residency training mandated by the ACGME is not appropriate for the training of neurological residents. In the authors’ opinion, an arbitrary timeline designed to limit resident fatigue limits patient care and technical training, and has not improved patient safety.

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KEY WORDS resident education; duty hours; Accreditation Council for Graduate Medical Education; neurological residency

On resident duty hour restrictions and neurological training: review of the literature

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Within neurosurgery, the national mandate of the 2003 duty hour restrictions (DHR) by the Accreditation Council for Graduate Medical Education (ACGME) has been controversial. Ensuring the proper education, training, socialization, and psychological well-being of residents while fulfilling the primary purpose of patient care has generated much debate. Most medical disciplines have developed strategies that address service needs while meeting educational goals. Additionally, there are numerous studies from those disciplines; however, they are not specifically relevant to the needs of a neurological residency. The recent implementation of the 2011 DHR specifically aimed at limiting interns to 16-hour duty shifts has proven controversial and challenging across the nation for neurological residencies—again bringing education and service needs into conflict.

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Each medical specialty is unique—although there is overlap in ideology and there is commonality in that all are composed of physicians. With this uniqueness come needs and demands that are not transposable across specialties. We believe that a one-size-fits-all approach to residency training mandated by the ACGME is not appropriate for the training of neurological surgery residents. In our opinion, an arbitrary and artificial timeline designed to limit resident fatigue limits patient care and technical training of neurological residents, and has not improved patient safety. We will touch upon the topics of fatigue, technical training, and patient safety relative to the DHR as they specifically regard neurological training, and review the literature relevant to these issues as they pertain to neurological training, in the first review on this topic since the implementation of the 2011 DHR. Novel studies reviewed...
in this article are summarized in Table 1 (a review of studies pertaining to the DHR in nonneurosurgical specialties) and Table 2 (a review of studies pertaining to the DHR specific to neurosurgery training).

Fatigue

The underlying premise of resident work hour restrictions is that new physicians, given sufficient time to rest, will make fewer errors because their thought processes will be clearer. This is based principally on mainstream media coverage of the unfortunate case of Libby Zion in 1984 and the implementation of the 1989 adoption of “405 (Bell) Regulations” in New York State due to growing and vocal public concern that fatigued residents were the major cause of medical errors in academic institutions. There is a fallacious assumption hidden in the argument that medical errors are caused by fatigue alone. Were that true, it should follow that reducing resident fatigue will decrease medical error; however, that has not been borne out in studies following the implementation of DHR.11,19,24,28,38,40 These concerns of fatigue being a major factor in errors came out of a variety of studies demonstrating the impact of fatigue on a variety of skills—cognition, technical skills, driving, and so on—tested in residential sleep laboratories; the extrapolation of the results of these studies to physicians is questionable.9 The reality is that medical errors that impact patients directly arise from a complex system—of which residents play only a part and in which fatigue plays a minor role.

With New York State serving as the first proving ground of DHR in the US, it serves as an early example of the failure of DHR to improve patient safety. In a 2005 study, well after the implementation of the nationwide restrictions by the ACGME, no significant reduction in medical errors was noted for surgical patients in New York State’s academic hospitals.32 This study in fact demonstrated an increase in some intraoperative complications, namely accidental puncture or laceration, and in postoperative complications such as deep venous thrombosis and pulmonary embolus. The authors conclude that DHR in their intended fatigue reduction strategy do not improve patient safety, but they do mention that with the imposition of DHR, a culture-wide awareness of complications and medical errors has come into common parlance and consciousness. Essentially, more eyes are watching.

This problem is not unique to New York State or the US. Duty hours for trainees in Europe have also been steadily reduced in the past 2 decades. In the United Kingdom and in Switzerland, the European Working Time Directive recommended a 50-hour weekly limit with some limited exceptions. In Canada, the National Steering Committee on Resident Duty Hours has made recommendations to avoid 24-hour periods of duty without sleep.44 Despite these efforts, according to a Swiss study of surgical residents, although their performance on laboratory tasks improved after the reduced work hours, the end goal of improving patient safety did not materialize,5 and another study of postoperative care following the implementation of reduced work hours demonstrated an increase in the incidence of complications.22 This is of great concern and it highlights the fact that DHR, despite best intentions, are not effectively addressing the issues of patient safety.

The 2011 updates to the 2003 DHR ACGME guidelines were intended to promote intern well-being and to decrease fatigue and burnout, with the ultimate goal of increasing patient safety; however, according to Antiel et al.1 the 2011 guidelines have not sufficiently addressed the continuing issue of resident fatigue, and neither have they addressed the attrition and burnout associated with surgical practice (for a discussion and study regarding the impact of intern DHR in nonsurgical specialties, see Sen et al.38). In their study of 213 surgical interns (both categorical and preliminary) from 11 general surgery residencies in the US, they found that prior to starting their internship, a large majority of residents believed that the 2011 DHR would decrease their fatigue. At the end of their intern year, less than half, 44%, believed that the DHR reduced fatigue. This is an impressive change opposite to the intended direction. Not only did less than half of the surveyed interns believe that their fatigue was reduced, the majority perceived that their time in the operating room (OR) was decreased, whereas their time caring for patients in the hospital did not decrease as anticipated. This presents a problem unique to surgical training—one that is specifically relevant to neurosurgical training, given the complexities of neurosurgical patients and of neurosurgical operations—that of balancing the development of surgical skills with the fine-tuning of clinical reasoning.1

Technique/Training

One of the original intentions of the ACGME in its initiation of DHR was to eliminate technical errors, which were presumed to be occurring as a result of fatigue.25,31,34 Also, there has been significant interest in the impact of fatigue on surgical skills. Much of the literature supporting a decrease in physical skill and ability cited by the ACGME in the initiation of DHR was based on studies conducted in nonsurgeons (military personnel and college-aged volunteers) in the self-promoted sleep science literature.2,0,15,31,43 Two studies of note tested the hypothesis of surgical technical errors occurring due to fatigue. This includes 1 study published prior to the DHR, which demonstrated only marginal reductions in surgical skills following a 24-hour call period in general surgery residents. A more recent, similar study of neurosurgery residents showed a marginal reduction in surgical skills in fatigued neurosurgical residents.34,16 Clearly the impact of fatigue on medical and technical error, in neurosurgery residents at least, is not as drastic as once feared, and these fatigue-related technical errors may have been traded for technical errors caused by lack of experience.

Fatigued or not, the neurosurgical trainee must master a variety of skills to complete training. Typical neurosurgical practice continues to evolve, with complex tasks including microsurgical and microendovascular skills that are not requisite in all surgical specialties. As neurosurgery advances, residents must master an increasing number of a wide variety of technical skills to practice independently; finding the time for this training in an already tight program timeline becomes increasingly difficult.
The DHR have forced neurosurgical residents to choose how to spend their weekly allotment of 80 work hours. Because patient care and safety must be prioritized, the result for most residents may mean a sacrifice in operative experience. Studies demonstrate that with the decrease in time available to train—a maximum of 88 hours per week with the 10% exception—the area feared to suffer most is OR time,\(^1\),\(^2\),\(^20\),\(^27\),\(^42\) lengthening the time needed to meet the

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>Specialty</th>
<th>Summary</th>
<th>Focus</th>
<th>Positive or Negative for DHR</th>
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</thead>
<tbody>
<tr>
<td>Wilkinson, 1963</td>
<td>Not medical</td>
<td>Sleep-deprivation experiments in US military</td>
<td>Fatigue, task ability</td>
<td>Positive</td>
</tr>
<tr>
<td>Haslam, 1982</td>
<td>Not medical</td>
<td>Effects of sleep loss on military performance</td>
<td>Fatigue, task ability</td>
<td>Positive</td>
</tr>
<tr>
<td>Asken &amp; Raham, 1983</td>
<td>Surgery</td>
<td>Insufficient study to truly determine impact of sleep deprivation on resident performance</td>
<td>Fatigue, resident safety</td>
<td>Neutral</td>
</tr>
<tr>
<td>Samkoff &amp; Jacques, 1991</td>
<td>All medical specialties</td>
<td>Resident sleep deprivation and performance</td>
<td>Fatigue, safety</td>
<td>Positive</td>
</tr>
<tr>
<td>Laine et al., 1993</td>
<td>Internal medicine</td>
<td>DHR may increase complication rates</td>
<td>Safety</td>
<td>Positive</td>
</tr>
<tr>
<td>Haynes et al., 1995</td>
<td>Surgery</td>
<td>Sleep deprivation does not statistically impact complication rates</td>
<td>Safety, fatigue</td>
<td>Negative</td>
</tr>
<tr>
<td>Howard et al., 2004</td>
<td>Internal medicine, ICU</td>
<td>DHR have no statistical impact on inpatient M&amp;M for CHF, PNA, or AMI</td>
<td>Safety</td>
<td>Neutral</td>
</tr>
<tr>
<td>Landrigan et al., 2004</td>
<td>Internal medicine, ICU</td>
<td>DHR for interns have reduced serious medical errors in ICUs</td>
<td>Safety</td>
<td>Positive</td>
</tr>
<tr>
<td>Irani et al., 2005</td>
<td>Surgery</td>
<td>Perception among general surgery residents that DHR have not improved quality of care</td>
<td>Safety, fatigue</td>
<td>Negative</td>
</tr>
<tr>
<td>Poulouse et al., 2005</td>
<td>All medical specialties</td>
<td>DHR in NY State did not improve surgical patient outcomes and are associated with increased DVT and accidental puncture</td>
<td>Safety</td>
<td>Negative</td>
</tr>
<tr>
<td>de Virgilio et al., 2006</td>
<td>Surgery</td>
<td>DHR do not adversely impact outcomes or education with adoption of novel schedule and increased operational costs</td>
<td>Training, safety</td>
<td>Neutral</td>
</tr>
<tr>
<td>Schneider et al., 2007</td>
<td>Surgery</td>
<td>DHR have not impacted general surgery residency in training examination scores with program reorganization</td>
<td>Training</td>
<td>Neutral</td>
</tr>
<tr>
<td>Occhino et al., 2011</td>
<td>Ob/Gyn</td>
<td>DHR have not impacted Ob/Gyn case volumes with novel schedule and patient handoffs</td>
<td>Training</td>
<td>Neutral</td>
</tr>
<tr>
<td>Businger et al., 2012</td>
<td>Surgery</td>
<td>DHR do not improve surgery patient safety in Switzerland</td>
<td>Safety, training</td>
<td>Negative</td>
</tr>
<tr>
<td>Kaderli et al., 2012</td>
<td>Surgery</td>
<td>Effects of 50-hr DHR in Switzerland</td>
<td>Safety, training</td>
<td>Negative</td>
</tr>
<tr>
<td>Typpo et al., 2012</td>
<td>Pediatrics</td>
<td>Impact of DHR on Pediatric ICU safety and practice patterns</td>
<td>Safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Veazey Brooks &amp; Bosk, 2012</td>
<td>Surgery</td>
<td>Impact of DHR on socialization of surgical residents</td>
<td>Fatigue, training</td>
<td>Negative</td>
</tr>
<tr>
<td>Antiel et al., 2013</td>
<td>Surgery</td>
<td>DHR have not addressed patient safety, resident fatigue, and burnout in general surgery residents</td>
<td>Fatigue, training, safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Cooke et al., 2013</td>
<td>Psychiatry</td>
<td>Impact of DHR on psychiatry resident-in-training examination scores</td>
<td>Fatigue, training</td>
<td>Negative</td>
</tr>
<tr>
<td>Sen et al., 2013</td>
<td>Surgery</td>
<td>DHR have not impacted resident sleep or fatigue but have increased rate of self-reported medical errors</td>
<td>Fatigue, training</td>
<td>Negative</td>
</tr>
<tr>
<td>Curtis et al., 2014</td>
<td>ENT</td>
<td>Impact of DHR on ENT case volumes</td>
<td>Training, safety</td>
<td>Neutral</td>
</tr>
<tr>
<td>Lindeman et al., 2014</td>
<td>Surgery</td>
<td>Impact of DHR on intern competence</td>
<td>Training, safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Pepper et al., 2014</td>
<td>Internal medicine, ICU</td>
<td>DHR have led to fewer ICU transfers and to a significant decrease in in-training examination scores</td>
<td>Training, safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Scally et al., 2014</td>
<td>Surgery</td>
<td>Novel rotation system implemented to preserve operative volumes in surgical residency</td>
<td>Training</td>
<td>Neutral</td>
</tr>
<tr>
<td>Silber et al., 2014</td>
<td>Internal medicine</td>
<td>DHR have had little significant negative impact on internal medicine in-training examination scores</td>
<td>Training</td>
<td>Neutral</td>
</tr>
<tr>
<td>Wu et al., 2014</td>
<td>All medical specialties</td>
<td>Impact of DHR on Canadian health care system</td>
<td>Training, safety</td>
<td>Negative</td>
</tr>
</tbody>
</table>

AMI = acute myocardial infarction; CHF = congestive heart failure; DVT = deep venous thrombosis; ENT = ear, nose, and throat; M&M = morbidity and mortality; Ob/Gyn = obstetrics and gynecology; PNA = pneumonia.

* Included are the studies reviewed that reported data about fatigue, safety, and training in medical and surgical specialties that are not neurosurgical in nature. In the last column, the data presented in each paper are classified as in support of (positive), neutral, or detracting from (negative) implementation of duty hours.
TABLE 2. Literature review of data-driven, neurosurgery-specific studies concerning the impact of DHR*

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>Summary</th>
<th>Focus</th>
<th>Positive or Negative for DHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jagannathan et al., 2009</td>
<td>DHR have led to decreased productivity from neurosurgery residents</td>
<td>Training</td>
<td>Negative</td>
</tr>
<tr>
<td>Babu et al., 2012</td>
<td>DHR have led to increased patient handoffs, which may contribute to increased medical error</td>
<td>Safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Dacey, 2012</td>
<td>DHR have led to an increase in postop complications for neurosurgery patients</td>
<td>Safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Dumont et al., 2012</td>
<td>Effects of DHR on M&amp;M for meningioma in teaching vs nonteaching hospitals</td>
<td>Safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Ganju et al., 2012</td>
<td>Post-call fatigue does not diminish neurosurgery resident skills at tasks</td>
<td>Fatigue</td>
<td>Negative</td>
</tr>
<tr>
<td>Hoh et al., 2012</td>
<td>DHR have led to increased complications and no change to M&amp;M in neurosurgery patients</td>
<td>Safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Babu et al., 2014</td>
<td>M&amp;M and costs have increased for spine patients after implementation of the 2003 DHR</td>
<td>Safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Dacey, 2014</td>
<td>DHR have not met goals of improved patient outcomes</td>
<td>Training, safety</td>
<td>Negative</td>
</tr>
<tr>
<td>Ragel et al., 2014</td>
<td>Night float system has eliminated duty hour violations for a neurosurgical training program</td>
<td>Fatigue</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

* Included are the studies reviewed that reported data about fatigue, safety, and training from the neurosurgical literature. In the last column, the data presented in each paper are classified as in support of (positive), neutral, or detracting from (negative) implementation of duty hours.

10,000-hour rule for proficiency. This leads to the concern among surgical faculty that training programs under the new DHR are not providing sufficient technical training and that patient safety is another cost.41 This concern has not changed since 2003, when identical concerns were voiced by both attending and resident physicians regarding surgical training as are expressed now.41

Teaching technical skills with the 2011 DHR then becomes a balancing act as OR time and continuity of care are the first to be reduced when hours are restricted. Neurosurgery programs are implementing strategies to improve technical skill training within the confines of the DHR; many programs are including simulators as an integral portion of their training. A large percentage (83%) of US program director respondents believe that simulation, as fidelity and complexity increase, will play a large role in training in the future, especially for preparation in complex cases and in early training.13,26,31 We believe that simulators are an excellent adjunct to surgical training, but cannot replace operative experience, which requires time that is diminishingly available to trainees as a result of the DHR.

The implementation of the 2011 DHR has required changing practice patterns and implementing unusual float systems to maintain intern operative case volumes that may limit quality care. There have been some studies published examining the operative case volumes for residents in surgical subspecialties,2,28 but these studies only examine operative volumes prior to the implementation of the 2011 DHR. In general surgery, there has been no overall decrease in the operative experience for junior and senior residents who started training prior to the 2011 changes; however, maintaining operative experience for interns was only feasible with the implementation of a novel call system.35 The same has not been true for neurosurgical residents, excepting for programs adopting unusual night float systems, which as a tradeoff may increase patient handoffs and so potentially compromise patient care. It seems that the predicted decrease in technical training due to the 2011 intern guidelines may not be borne out, but maintaining intern case volume has necessitated new systems of duty hours (night float, naps) and increased use of midlevel providers,18 which reduces the exposure of residents to practice. These limitations are becoming evident as neurosurgical residents who started under the 2011 DHR are now maturing from junior resident status to senior status. There are no studies to date comparing the technical skills between the cohort of residents matriculating prior to the 2011 DHR and those matriculating after, but we suspect that such a study may display further limitations of training at least partially attributable to the DHR.

Other consequences of limited duty hours on neurosurgical training are becoming evident. Not only has there been an increase in handoffs,3 there has also been a decrease in educational time, indirectly measured by a decrease in mean scores on the American Board of Neurological Surgery self-assessment boards and by a decrease in the number of resident-presented abstracts at national meetings.21 Although there are limited data available on the impact of resident board performance and participation in research, other specialties have reported statistically significant decreases in training examination scores as well, including internal medicine.30 In contrast to these findings, in some institutions there was no meaningful impact on mean board scores after the implementation of the 2003 DHR for internal medicine,39 psychiatry,5 or general surgery;10,36 however, these were single-institution studies and did not examine national data.

Safety

A decade after the implementation of the DHR, there has been no clear decrease in the incidence of medical errors. A decrease in duty hours must, by definition, lead to an decrease in continuity of care and a commensurate increase in patient handoffs—a practice that is fraught with perils in and of itself. There is speculation that medical errors have increased secondary to the increased number of patient handoffs. In a study published in Neurosurgery in 2012, Dumont and colleagues1 report an increase in complication rates for neurosurgical patients undergoing
Craniotherapy and the Demand for Competence in Neurosurgery

R. W. Bina, G. M. Lemole Jr., and T. M. Dumont

Craniotherapy for meningioma collected from the National (formerly known as Nationwide) Inpatient Sample. Their data were collected from 2003, when DHR were instituted in teaching hospitals, and demonstrated that the increased rate of complications in teaching hospitals after the institution of DHR was not met with a commensurate increase in complications in nonteaching hospitals. The authors conclude that this increase in postoperative complications is probably due to a decrease in continuity of care in teaching hospitals due to an increased number of patient handoffs. Another study follows in the same vein for neurosurgical trauma patients, and a third for neurosurgical patients undergoing spinal procedures. It appears that the intent of the DHR is not having the desired effect.

Babu, Nahed, and Heary’s 2012 study reported results from their survey of neurosurgical residents about patient handoffs. They found that at the 98 programs they surveyed, a majority of residents (64% of respondents) had little or no formal instruction in the format or mechanism of a patient handoff, highlighting the concerns about handoffs being fertile soil for communication errors and increased potential for sentinel events. They also report that multiple interruptions are frequent during handoffs (55% of respondents reported 3 or more interruptions) and that there is little formal feedback about handoffs (47% of respondents). Their study demonstrates that the current practice is insufficient. They go on to provide 4 best-practice suggestions for neurosurgery handoffs to minimize risks to patient safety: 1) specific identification of follow-up tasks; 2) formal handoff education training; 3) minimization of interruptions; and 4) clear, specifically delineated identification of neurosurgical management issues.

This is perhaps the crux of the failure of DHR for neurosurgical trainees: in our opinion, an arbitrary and artificial timeline designed to reduce resident fatigue actually limits quality patient care (by eliminating continuity of care), and it also limits technical training (by reducing the time available for operative experience). Additionally, these guidelines, which were intended to lessen fatigue and improve patient safety, have not, in our estimation, sufficiently done either.

Conclusions

For some specialties, both the 80-hour DHR and the 2011 DHR have been implemented with great success, with an increase in resident satisfaction and no impact on technical training. Unfortunately, this has not been true for neurosurgery training. The DHR were designed to reduce medical errors and improve patient safety in teaching hospitals by reducing resident fatigue. More than a decade after their sweeping implementation and 3 years after their first revision, this much-anticipated reduction in medical error has not borne out. Several studies, as previously mentioned, even suggest that the opposite may in fact be true due to the unforeseen increase in patient handoffs from shift to shift.

Under the current guidelines, training neurosurgeons adequately for competent independent practice then becomes a significant concern. The training is rigorous and demanding and unlike the training required in other medical disciplines. Neurosurgery demands unusual skills, both technical and cognitive, which are not easily obtained; Malcolm Gladwell’s book *Outliers* popularized the idea of an estimated 10,000 hours of training to achieve expertise in a field, which he surmised from a study demonstrating that expertise is gained through a minimum hours deliberate practice ranging from at least 50 to 60 hours weekly. Likewise, Dacey’s 2012 article points to the military for models of stress inoculation and sleep deprivation while training individuals in highly specialized skills. He mentions the “emotional and psychomotor stamina” required of a neurosurgical resident and a practicing neurosurgeon to maintain efficacy at odd hours when meeting the needs of their patients. It seems better to inoculate residents to such stresses in the safety of a training program with sufficient backup, than to introduce these stresses when practicing alone after graduation.

So, neurosurgical residents are left with increased educational demands, increased patient and hospital needs, and fewer hours within which to perform these duties. The answers to these problems do not lie in allowing the course of neurosurgical training to be dictated externally. Neurosurgeons train neurosurgeons. We must find what is essential to the socialization, cognitive development, and skill training of neurosurgeons and focus our efforts there, all the while maintaining our dedication to our patients. We are not advocating a return to the historical physical residential standard of Cushing and Halsted. We need to be thoughtful about sweeping, unilateral regulatory mandates—federalism of this sort is bound to be fraught with difficulty.

There are several solutions to this problem: 1) abolishment of DHR and a return to unregulated resident duty hours; 2) continuing the current standard; 3) abolishing the 2011 Intern DHR; or 4) increasing restrictions and further reducing resident duty hours, as has occurred in Europe and elsewhere. The results of the current ACGME study comparing surgical and medical intern duty hours under the 2003 guidelines and the 2011 update with the medical errors reported in each period is much anticipated. It may provide some insight into how we should then proceed. Certainly, if organized neurosurgery were to act in unison and determine what constitutes safe and effective training for our residents and the care of our patients, a potentially productive split from the ACGME could develop.

Whatever the long-term solution to the problem of medical errors, implementation of the DHR has highlighted several things that are beneficial to academic medicine. It has identified the need for cohesive team communication, including accurate, supervised handoffs. It has provided a foil to the old model of residency without DHR and unlimited, unregulated work. It has highlighted the need for supervision and the responsibilities of faculty with their resident teams to ensure patient safety. It has given a louder voice to ancillary staff—nursing and other allied health professionals—in many things, but particularly in patient safety. It has forced graduate medical educators to examine closely what is necessary and sufficient in medical training and has caused them to remove that which is not essential. It has fed the drive for meaningful use of electronic medical records, medical alerts, and other safeguards. It has fertilized the seed of simulation as part of technical training. Most of all, the debate over DHR has
brought out many voices from many corners of our great profession to find the truth, which lies somewhere in the midst of all this noise. Adaptation is the key to survival in an ever-changing environment, and we are certain that the behemoth that is the academic medical establishment, including neurosurgical training, will adapt to whatever comes. To paraphrase Mr. Churchill, “You can always count on [physicians] to do the right thing – after they’ve tried everything else.”

For neurosurgical trainees, we believe that the importance of patient care, operative experience, and education (all time-consuming activities) outweighs the perceived risk of neurosurgical resident fatigue. We believe that the ACGME should be challenged to demonstrate the value of DHR for neurological trainees and, in the absence of DHR, unique training parameters for neurosurgical training programs should be considered.

References

Disclosure
Dr. Lemole is a consultant for BrainLab.

Author Contributions
Conception and design: Bina, Dumont. Acquisition of data: Bina. Drafting the article: Bina, Dumont. Critically revising the article: all authors. Study supervision: Dumont.

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