Purpose of review
Resident duty hour limits were implemented in 2003 by the Accreditation Council for Graduate Medical Education to improve resident wellness, increase patient safety and improve the educational environment of American residents. Now that academic anesthesiology departments and medical centers have had more than 3 years of experience under the duty hour rules, it is critical to review the available evidence on the effectiveness of these rules.

Recent findings
The available data clearly support that American residents across specialties perceive an improvement in their educational environment and an increase in their quality of life. It is not clear if the duty hour rules have affected patient safety or the quality of resident education. Faculty have been impacted by these rules, with many feeling their work loads have increased, and hospitals have had to fund additional providers to cover work previously done by residents.

Summary
Accreditation Council for Graduate Medical Education duty hour rules are generally being followed by American anesthesiology residency programs. Residents perceive an improvement in their overall wellness, but it remains unclear if there has been an improvement in patient safety or quality of resident education.

Keywords
duty hour limits, faculty satisfaction, patient safety, resident education

Introduction
On 1 July 2003, the Accreditation Council for Graduate Medical Education (ACGME) required all physicians in ACGME training programs to comply with new duty hour rules. These rules restricting resident duty hours were intended to improve patient safety, resident wellness and education. It has been a challenge for residency programs to meet these new resident duty hour rules. We will review the duty hour rules, analyze available data on the current compliance rate among training programs and review the current literature to determine if the ACGME duty hour rules are having their intended affect.

What are the Accreditation Council for Graduate Medical Education duty hour rules?
The ACGME duty hour rules are commonly referred to as the ‘80-h work week rule’, but are actually made up of multiple duty hour restrictions that training programs must meet. These duty hour rules are included in the ACGME common program requirements as well as the specialty specific requirements. Individual Residency Review Committees (RRCs) can make their duty hour rules more restrictive than the common requirements, but all specialties must be compliant with the common requirements. The common requirements of all ACGME programs can be found on the ACGME website (www.acgme.org).

The 80-h work week
The 80-h work week is one of the most commonly misunderstood requirements. The ACGME does allow residents to exceed 80 h a week as long as they average 80 h or less per week over a 4-week period. The 4-week period is not a ‘rolling’ 4-week period, but is intended to be a specific rotation in a 4-week block or a calendar month rotation.

One day in 7 free of all educational and clinical responsibilities
The common program requirements define a day off as a continuous 24-h period. While a 24-h period post in-house call technically meets this definition, it is the intent of the ACGME for these periods to provide appropriate rest time for residents. Therefore, programs can be cited for violations if they only use post in-house call days as ‘days off’. Some specialty RRCs have specifically addressed that this should be a ‘calendar day’. The 1 day in 7 off is also averaged over 4 weeks.
Adequate time for rest after duty periods

The ACGME requires a rest period after all duty periods. The recommendation is 10 h; however this is a ‘should’, not a ‘must’, and this can be adjusted for educational reasons such as ‘critical didactic lectures’ or cases of great educational value to a resident such as rarely seen pathology. All exceptions to the 10-h rest period, however, require justification by individual program directors.

The 24 + 6 rule

Residents may not be on continuous in-hospital duty exceeding 24 h; however, they may work up to an additional 6 h to complete paperwork, attend teaching sessions, transfer care of patients or maintain continuity of care. They may not initiate care for new patients after working a 24-h in-hospital shift. Although it would be acceptable by the common requirements for a resident to complete an ongoing case (i.e. maintain continuity), the anesthesiology RRC would not approve a resident providing care past their 24-h shift. In addition, when a resident remains in the hospital (providing care or for an educational event) past 24 h it disqualifies that day as a ‘day off’ for rule 1 above.

Call frequency

Residents may take in-house call no more frequently than 1 in 3 days averaged over a 4-week block. Again, this rule is not a rolling 4-week period, but within a defined 4-week block or calendar month rotation.

At-home call or pager call

Residents who take call from home are excused from the 24 + 6 rule and the frequency of call rules. At-home call, however, must not be so burdensome that the residents are frequently in the hospital at night. There have been frequent citations for inappropriately designating in-house call responsibilities as ‘pager’ call to avoid duty hour rules. The hours residents spend in the hospital on pager call does count toward their weekly duty hour accumulation. Residents taking home call still need to be provided at least four 24-h periods free of all duties during the 4-week block.

Moonlighting

In-house moonlighting in the resident’s training institutions does count toward the resident duty hours. This rule prevents programs from using ‘moonlighting’ residents to provide call coverage that violates the ACGME duty hour restrictions. (Moonlighting outside of the resident’s institutions does not count towards the 80-h limit; however it does require prospective written approval by the program director, who is also tasked with monitoring the resident’s fatigue and overall performance.)

Exceptions to the 80-h limit

While some RRCs will accept proposals for educationally justified exceptions to the 80-h limit, the anesthesiology RRC does not currently accept proposals for such exceptions.

Outside rotations

Program directors are responsible for duty hour violations for their residents even if on rotations with other departments or in other institutions. This is a frequent source of duty hour citations.

Are residency programs meeting the duty hour rules?

The ACGME has published data on the first 3 years of experience with duty hour rules (‘Summary of achievements for the third year under the common requirements’, http://www.acgme.org/acWebsite/dutyHours/dh_achieveSum05-06.pdf). This document provides an excellent summary of the duty hour rules. In addition, it provides tabular data on compliance by specialty with duty hour rules by ACGME site visits through 2006, as well as highlighting important areas of achievement and continued concerns. In the academic year 2005/06, 2363 programs were reviewed by site visitors from the ACGME. Of these programs, 187 programs (7.9%) received a citation related to noncompliance with at least one of the duty hour rules. This was an increase from the previous year in which 7.3% of programs reviewed had duty hour citations for non-compliance. The largest proportion of the citations were for violations of the ‘24 + 6’ rule (26.5% of all citations); with specialty specific citations representing the next highest proportion (22.5% of citations). Citations for violating the 80-h per week rule, the 1 day free in 7 and the 10-h break rule each accounted for less than 15% of duty hour citations. The most frequently cited specialty (percentage of reviewed programs in that specialty receiving citations) was neurological surgery at 26.3%, followed by pediatrics at 25.4% and family medicine at 23.4%. General surgery, however, accounted for the greatest number of total citations (21.7% of all duty hour citations received in academic year 2005/06).

What about anesthesiology programs? The ACGME data show that 35 core anesthesiology programs were reviewed in academic year 2005/06 which resulted in six duty hour citations (17.1% of reviewed programs). Three of these citations (50%) were for violation of the 80-h per week rule, while the other three citations were for lack of program oversight of resident duty hours. Overall, anesthesiology accounted for only 2.4% of duty hour citations in academic year 2005/06.

Although US residency programs still have room to improve in meeting resident duty hour rules, these data reveal overall substantial compliance with the ACGME duty hour rules by the majority of all training programs.
across all specialties. Thus, the key question remains – are the duty hour rules working?

Has restricting duty hours improved ‘resident wellness’, resident education or patient safety? Resident wellness is a subjective measure which makes studying outcomes difficult. There are very few validated tools to study resident quality of life. Similarly, measuring educational outcomes across multiple specialties and multiple training sites is very complex. As for quality of patient care and overall patient safety, there are no clear methods to survey and monitor resident duty hour restrictions on overall patient safety, there are no clear methods to

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Cull et al. [1*] surveyed 161 pediatric program directors as well as 500 pediatric residents who graduated before and after the imposition of the ACGME duty hour rules. Both the program directors and the residents reported marked perceived improvements in resident well being and program morale after the introduction of duty hour rules. Program directors perceived a worsening in the quality of resident education which was also detected to a lesser degree by the residents. Both program directors and residents detected a negative impact on continuity of patient care, while program directors perceived a slight worsening of quality of patient care at the same time that residents detected a slight improvement. There was an improvement in residents reporting falling asleep in lectures or while driving home and nearly all of the residents reported the duty hour rules were effective in ensuring appropriate work hours for residents. Surprisingly, even with the new duty hours rules in place, nearly 75% of these residents still report sleeping in lectures and more worrisome 20% report falling asleep while driving home (an improvement from the pre-duty hour period), suggesting that there are still opportunities for improvement in resident wellness. There was an improvement in residents’ perceptions of the quality of resident education after implementation of the duty hour rules.

Dola et al. [2*] surveyed residents and faculty across all specialties in a large university-based teaching hospital on their perceptions of the impact of the duty rules on residency training. This study included anesthesiology faculty and residents. They found that both faculty and residents perceived improvements in resident quality of life including more time spent with family, getting more rest and socializing. Residents and faculty had divergent views on impact on resident education. Residents reported the duty hour rules had a positive impact on resident reading time, clinical decision making and were generally beneficial to resident education. In contrast, only a minority of faculty members perceived that duty hour rules improved resident education. Residents and faculty also had divergent views on the duty hour rules impact on patient care; 45.3% of faculty compared with only 8.8% of residents felt there was a negative impact on quality of patient care. Faculty felt strongly that the rules negatively impacted continuity of care while only a minority of residents held that opinion. The majority of faculty and residents did not perceive a change in resident work ethic, and only a small minority felt the rules would increase medical errors.

Residents and faculty in otolaryngology [3] reported duty hour rules markedly improved residents’ mental health, but did not detect improvements in self-study, research or self-reported board exam performance. Nearly half of faculty members felt the rules had a negative effect on the residency training experience and patient care, while only a small percentage of residents reported detriments in this area. Neurosurgery residents and faculty [4] reported the duty hour rules had a negative impact on continuity of patient care as well as an overall negative impact on their training program. Residents in plastic surgery [5] reported the duty hour rules improved their ability to provide safe care to their patients, improvement in their ability to be successful with academic duties and an overall increase in their quality of life. There was more time for general reading, more time for case preparation and more time to prepare presentations for conferences. The residents perceived a significant improvement in the effectiveness of the didactic curriculum. These residents also noted a perceived improvement in their ability to deliver quality care. In a study of orthopedic residents [6*] the majority of respondents reported improvement in their satisfaction with their training experience and that they were getting more rest, without significantly affecting the quality of patient care. Junior residents were much more in favor of the duty hour rules than senior residents. A study of the impact of duty hour rules on surgical experience of orthopedic residents as measured by reported Current Procedural Terminology codes did not detect a significant difference in resident surgical volume after the implementation of the duty hour rules in a large university program [7*].

Jagsi et al. [8**] surveyed all training programs, including anesthesiology, at two large teaching hospitals. Again, these residents reported improvements in their well being, ability to learn, ability to safely care for patients and their overall satisfaction as a resident or fellow. In their educational programs, they did not detect a statistically significant change in any of 22 educational outcomes they assessed with the exception of three areas. The residents reported the duty hour rules had a slight decrease in quality of teaching from faculty, a slight decrease in overall satisfaction with the education received and an increase in the opportunity to perform research.

The current ACGME duty hour rules continue to allow extended work shifts of greater than 24 h which may
increase resident and patient injury. Barger et al. [9], in an important and frequently cited paper looking at resident safety outside of the hospital, reported extended shifts were associated with a significant increase in automobile crashes and near misses in a survey of 2737 interns. Extended work shifts were associated with an increase in resident reported serious medical errors and attentional failures in interns, as well as increased likelihood of sleeping during didactic sessions and on teaching rounds with attending physicians [10,11,12]. Extended shifts also increased the risk of percutaneous injuries with lapse in concentration and fatigue being reported as the most common contributing factors [13].

The ACGME duty hour rules have significantly affected the faculty of teaching programs. Coverdill et al. [14**] used questionnaires and follow-up interviews with surgical faculty in five academic and four nonacademic residency programs in general surgery. Faculty reported ACGME duty hour rules increased faculty workload, increased work-related stress and decreased overall satisfaction they derived from academic practice. Nearly two-thirds of respondents reported the duty hour rules added duties previously held by residents and decreased the time available to teach. The faculty also reported decreased time available to perform research. A study of clinical surgical faculty at a large tertiary care medical center using faculty surveys and relative value unit data pre and post duty hour implementation revealed no change in clinical productivity despite faculty reporting taking on work previously performed by residents [15*]. Many of these faculty reported academic productivity had fallen significantly after implementation of the duty hour rules. A study of both residents and faculty at a large Level I trauma center revealed faculty work hours significantly exceeded resident work hours and all trauma faculty were in violation of resident duty hour rules [16]. The residents reported their lifestyle was more favorable than their attendings and 71% cited faculty work hours as a reason to avoid trauma surgery as a career. Fifty percent of family medicine program directors reported increased patient care duties for attendings after implementation of the duty hour rules, with faculty members concerned about their increased patient care burden and loss of their educational time for residents [17*]. A large multiple specialty survey at an academic teaching center revealed 14% of faculty were out of compliance with resident duty hour rules, with nearly 5% reporting working greater than 100 h per week and nearly 60% of the faculty working 24 h in house shifts reporting non compliance [18**].

What is the role of midlevel practitioners to help hospitals and academic departments meet duty hour rules while maintaining excellent educational programs and clinical productivity? Two recent studies looked at midlevel practitioners in busy academic general surgical departments [19**,20]. These studies used modeling and workforce analyses to determine the feasibility of replacing decreased availability of surgical residents with midlevel practitioners such as Physician Assistants and Nurse Practitioners. These practitioners can greatly help a department meet their educational and clinical responsibilities but can be very costly, easily exceeding US$1 million for a busy surgical service with 24 general surgery residents and fellows. This is a cost few departments can afford without significant investment by the hospitals hosting residency programs. There is currently little evidence showing that employing midlevel practitioners will improve the educational experiences of residents. In anesthesiology, most departments do not have difficulty meeting the new duty hour rules but the employment of certified registered nurse anesthetists and anesthesiology assistants may help both faculty and residents meet academic goals and improve overall academic satisfaction.

**Conclusion**

The ACGME duty hour rules are being substantially followed by the majority of residency training programs in the US. Anesthesiology programs have an above average compliance compared with other specialties. The evidence published since the inception of the resident duty hour rules in July 2003 strongly supports an improvement in resident well being, resident morale, improvements in resident fatigue and overall satisfaction with the duty hour restrictions. The impact of duty hour restrictions on resident education and patient care is less clear. The majority of the evidence is based upon potentially biased self reporting of resident and faculty perceptions rather than true outcome data. It may be difficult or impossible to ever obtain definitive data in these areas. There have not been reports of noticeable increases in critical/sentinel events in hospitals or reports from program directors of systematic degradation of resident competence since the implementation of the ACGME duty hour rules. Faculty have taken on duties previously performed by residents. There is concern that this may decrease time for academic activities and decrease faculty satisfaction with an academic career. There is also great concern about a ‘shift worker’ mentality among graduates of programs since these rules were adopted. Many of the challenges faced by programs are specialty specific and there is little evidence published from American anesthesiology programs concerning duty hour rules and impact on anesthesiology residency education.

Our American anesthesiology training programs are doing well under the ACGME duty hour rules. American medical students are applying to our programs in record numbers. It is the challenge of our training programs to continue to transition to becoming true educational programs rather than clinical apprenticeships to develop the
perioperative physicians of the future. American academic anesthesiology departments must carefully balance clinical service with the educational and research needs of our residents, faculty and specialty. Hospitals and health systems must provide financial support to make up for ‘lost productivity’ of resident duty hour restrictions in order to recruit faculty and maintain outstanding anesthesiology departments. We must develop innovative resident educational programs that allow residents to learn clinical medicine, but also foster interests in research, teaching and subspecialty training. The ACGME duty hour rules have provided us an opportunity to train residents who are less fatigued and more satisfied with their educational experience. It is our duty to develop the programs to take advantage of this opportunity.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

• of special interest
•• of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 609–610).


8 Jaggi R, Shapiro J, Weissman JS, et al. The educational impact of ACGME limits on resident and fellow duty hours: a prepost survey study. Acad Med 2006; 81 (12):1059–1068. Excellent study in a large teaching hospital surveying residents in all specialties. They had a 60% response rate with residents reporting less fatigue and more time for research after duty hour implementation, but also a decrease in the quality of faculty teaching and an overall decrease in educational satisfaction.


13 Ayas NT, Barger LK, Cade BE, et al. Extended work duration and the risk of self-reported percutaneous injuries in interns. JAMA 2006; 296 (9):1055–1062. This paper looks at duty hour issues that may increase job related injury of residents.


18 Girard DE, Choi D, Dickey J, et al. A mid year comparison study of career satisfaction and emotional states between residents and faculty at one academic medical center. BMC Med Educ 2006; 6 (6):36–42. These authors surveyed all specialties in a large university teaching hospital. They discovered that faculty were more frequently out of compliance with ACGME duty hour standards than residents.
