

Selected Articles on Resident and Physician Work Hours

Compiled by Ingrid Philibert, Updated December 2009

Articles are arrayed by topic, beginning with the most recent

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I. Effect/Predicted Effect of National Duty Hour Limits on Resident Education in Surgical Specialties

Olson EJ, Drage LA, Auger RR. Sleep deprivation, physician performance, and patient safety. Chest. 2009 Nov;136(5):1389-96.

Long work hours, overnight call duty, and rotating shifts are implicit features of hospital medical practice. Rigorous schedules have been deemed necessary to fulfill the professional obligation of patient beneficence, to optimize trainee learning, and to respond to economic realities. However, the resultant disruption and restriction of physicians' sleep produce demonstrable neurobehavioral impairments that may threaten other fundamental professional mandates, such as that of *primum non nocere* ("first, do no harm"). The article provides a basic overview of sleep/wake regulatory processes, examines the impact of physician schedules on sleep/wake homeostasis, summarizes the laboratory-demonstrated effects of sleep loss on humans, highlights recent literature on the personal and professional effects of sleep loss on physicians, and, finally, discusses the specific countermeasure of work-hour limits applicable to resident physicians but not attending physicians.

Sarff M, Ellis MC, Vetto JT. Case log review produces translational change in surgical oncology education. J Cancer Educ. 2009;24(3):176-9.

The recently mandated reduction in surgical resident work hours led to concerns that surgical cancer education would suffer, as measured by cancer case exposure. Final operative logs submitted to the American Board of Surgery by chief residents graduating from our program were compared for 2 time periods: prior to the mandate (2002-2003) and after (2006-2007). Case logs from graduating residents (n = 36) showed a nonsignificant decrease in cancer as the percentage of total major cases, due to an actual increase in total major cases. Conversely, endoscopy and minor cancer case experience both decreased.

Exposure to minor cancer cases and endoscopies has decreased; this has led to a requirement for a minimum number of endoscopies/graduating resident, and to strategies for increasing exposure to minor cancer cases.

Moalem J, Salzman P, Ruan DT, Cherr GS, Freiburg CB, Farkas RL, Brewster L, James TA. Should all duty hours be the same? Results of a national survey of surgical trainees. J Am Coll Surg. 2009 Jul;209(1):47-54, 54.e1-2.

Although duty hours regulations (DHR) were introduced as a measure to improve patient safety and graduate medical education, new evidence suggests that the opposite might be happening. This study was designed to assess surgery resident perceptions of the impact that DHR have had on their education, the number of hours they believed would be ideal for their training, and to evaluate the effect of seniority on these opinions. An Internet-based survey was electronically distributed to all Resident and Associate members of the American College of Surgeons.

Of 599 respondents, 247 (41%) believed that DHR were an important barrier to their education, and 266 (44%) believed that the ideal work week should have 80 to 100 hours. These two opinions were highly correlated, and were increasingly voiced with increased resident experience. Senior residents were more likely to view DHR as an important barrier to their education whether or not they were general surgery residents or were trained in small, medium, or large programs. **A large subset of surgery residents, particularly senior residents, considered DHR an important barrier to their education and expressed a desire to work longer hours than restrictions allow. These findings suggest that strict and uniform DHR do not allow for optimal training of residents at different levels who have**

disparate educational goals and needs. Introducing some flexibility into senior residents' limitations should be considered.

Grady MS, Batjer HH, Dacey RG. Resident duty hour regulation and patient safety: establishing a balance between concerns about resident fatigue and adequate training in neurosurgery. J Neurosurg. 2009 May;110(5):828-36.

Postgraduate training in medicine has been under scrutiny over the past 10 years with a major focus on physician personal health and patient safety. The culmination of a series of events led to the 80-hour work week instituted by the Accreditation Council on Graduate Medical Education in 2003. The effect this mandate has had on surgical education, and specifically training in neurological surgery, has been incompletely evaluated. Nevertheless, external pressure has prompted the Institute of Medicine to issue a new report on resident work hours and patient safety. In this report, the authors focus on the unique aspects of neurosurgical training in which physicians are trained to safely and effectively carry out complex high-risk tasks, the experience from abroad where work hours are reduced to well below 80 hours/week, and the risk that further reduction in work hours poses to the public. **The authors conclude that there must be an adequate balance between the risks associated with resident fatigue and those associated with an inexperienced neurosurgical work force for public health.**

Jagannathan J, Vates GE, Pouratian N, Sheehan JP, Patrie J, Grady MS, Jane JA. Impact of the Accreditation Council for Graduate Medical Education work-hour regulations on neurosurgical resident education and productivity. J Neurosurg. 2009 May;110(5):820-7.

Recently, the Institute of Medicine examined resident duty hours and their impact on patient safety. Experts have suggested that reducing resident work hours to 56 hours per week would further decrease medical errors. Although some reports have indicated that cutbacks in resident duty hours reduce errors and make resident life safer, few authors have specifically analyzed the effect of the Accreditation Council for Graduate Medical Education (ACGME) duty-hour limits on neurosurgical resident education and the perceived quality of training. The authors have evaluated multiple objective surrogate markers of resident performance and quality of training to determine the impact of the 80-hour workweek. The United States Medical Licensing Examination (USMLE) Step 1 data on neurosurgical applicants entering ACGME-accredited programs between 1998 and 2007 (before and after the implementation of the work-hour rules) were obtained from the Society of Neurological Surgeons. The American Board of Neurological Surgery (ABNS) written examination scores for this group of residents were also acquired. Resident registration for and presentations at the American Association of Neurological Surgeons (AANS) annual meetings between 2002 and 2007 were examined as a measure of resident academic productivity. As a case example, the authors analyzed the distribution of resident training hours in the University of Virginia (UVA) neurosurgical training program before and after the institution of the 80-hour work week. Finally, program directors and chief residents in ACGME-accredited programs were surveyed regarding the effects of the 80-hour workweek on patient care, resident training, surgical experience, patient safety, and patient access to quality care. Respondents were also queried about their perceptions of a 56-hour workweek.

Despite stable mean USMLE Step 1 scores for matched applicants to neurosurgery programs between 2000 and 2008, ABNS written examination scores for residents taking the exam for self-assessment decreased from 310 in 2002 to 259 in 2006 (16% decrease, $p < 0.05$). The mean scores for applicants completing the written examination for credit also did not change significantly during this period. Although there was an increase in the number of resident registrations to the AANS meetings, the number of abstracts presented by residents decreased from 345 in 2002 to 318 in 2007 (7% decrease, $p < 0.05$). An analysis of the UVA experience suggested that the 80-hour workweek leads to a notable increase in on-call duty hours with a profound decrease in the number of hours spent in

conference and the operating room. Survey responses were obtained from 110 program directors (78% response rate) and 122 chief residents (76% response rate). Most chief residents and program directors believed the 80-hour workweek compromised resident training (96%) and decreased resident surgical experience (98%). Respondents also believed that the 80-hour workweek threatened patient safety (96% of program directors and 78% of chief residents) and access to quality care (82% of program directors and 87% of chief residents). When asked about the effects of a 56-hour workweek, all program directors and 98% of the chief residents indicated that resident training and surgical education would be further compromised. Most respondents (95% of program directors and 84% of chief residents) also believed that additional work-hour restrictions would jeopardize patient care. Neurological surgery continues to attract top-quality resident applicants. Test scores and levels of participation in national conferences, however, indicate that the 80-hour workweek may adversely affect resident training. Subjectively, neurosurgical program directors and chief residents believe that the 80-hour workweek makes neurosurgical training and the care of patients more difficult. Based on experience with the 80-hour workweek, educators think that a 56-hour workweek would further compromise neurosurgical training and patient care in the US.

Payette M, Chatterjee A, Weeks WB. Cost and workforce implications of subjecting all physicians to aviation industry work-hour restrictions. Am J Surg. 2009 Jun;197(6):820-5; discussion 826-7.

Efforts to improve patient safety have attempted to incorporate aviation industry safety standards. We sought to evaluate the cost and workforce implications of applying aviation duty-hour restrictions to the entire practicing physician workforce. The work hours and personnel deficit for United States residents and practicing physicians that would be created by the adoption of aviation standards were calculated.

Application of aviation standards to the resident workforce creates an estimated annual cost of \$6.5 billion, requiring a 174% increase in the number of residents to meet the deficit. Its application to practicing physicians creates an additional annual cost of \$80.4 billion, requiring a 71% increase in the physician workforce. Adding in the aviation industry's mandatory retirement age (65 years) increases annual costs by \$10.5 billion. The cost per life-year saved would be \$1,035,227. Application of aviation duty-hour restrictions to the United States health care system would be prohibitively costly. Alternate approaches for improving patient safety are warranted.

Shonka DC Jr, Ghanem TA, Hubbard MA, Barker DA, Kesser BW. Four years of accreditation council of graduate medical education duty hour regulations: have they made a difference? 28. Laryngoscope. 2009 Apr;119(4):635-9.

Measure compliance with the Accreditation Council of Graduate Medical Education (ACGME) residents' work hour regulations and evaluate their impact on patient care and residents' performance on the Otolaryngology Training Examination (OTE). Retrospective review of an otolaryngology residency program's resident duty hour violations and OTE scores, and review of the associated hospital's benchmark patient data. Residents' duty hour violations were compiled and analyzed for individual violation, postgraduate year (PGY), and service in the program. Annual OTE scores and the department's hospital benchmark measures (inpatient mortality, inpatient length of stay, 30-day readmission rate) were compared before and after the institution of the ACGME duty hour mandate.

The 10-hour rule was most frequently violated; residents on the oncology service and PGY-2 year were most commonly in violation. There was no difference before and after institution of the ACGME duty hours mandate in 30-day hospital readmission rates (P = .42), hospital mortality index (P = .55), length of stay (P = .55), OTE scores (P = .11, Student's t test), and graduating resident's operative volume. Institution of the ACGME duty hour regulations did not improve patient care as measured by the 30-day readmission rate, inhospital mortality, and patient's length of stay. Residents' performance on the OTE did not change after implementation of the ACGME

rules. Further studies are warranted to assess the impact of the ACGME work hour regulations on patient care and resident-physicians' training.

Connors RC, Doty JR, Bull DA, May HT, Fullerton DA, Robbins RC. Effect of work-hour restriction on operative experience in cardiothoracic surgical residency training. J Thorac Cardiovasc Surg. 2009 Mar;137(3):710-3.

Resident work-hour regulations were instituted to improve patient care during resident training. Although initial data have not shown the intended benefit of limiting resident work hours, concern has developed as to whether resident operative experience has significantly decreased since instituting the work-hour restrictions. Resident operative logs were reviewed for 3 training institutions in the western United States for residents graduating in the years 1999-2007. Residents were divided into pre-work-hour restriction (1999-2002) and post-work-hour restriction (2003-2007) groups. Thoracic, cardiac, and all combined cases were reviewed separately for all residents at yearly intervals. Statistical analysis was subsequently conducted.

A total of 37 residents were identified from 3 different programs over the study period. Thoracic cases were lower during the first year of training but increased in the second and third years of training after work-hour restrictions (78 vs 42, 65 vs 72, and 102 vs 138; $P = .17$, $P = .59$, and $P = .11$, respectively). Cardiac cases were substantially lower during each year of training after work-hour restrictions (190 vs 153, 154 vs 108, and 116 vs 76; $P = 0.15$, $P < .0001$, and $P = .001$, respectively). **Overall total cases were also lower over all years of residency after work-hour restrictions (251 vs 195, 219 vs 187, and 234 vs 214; $P = .03$, $P = .049$, and $P = .59$, respectively). The overall volume of thoracic surgery cases was not significantly different after the implementation of the 80-hour work-week restriction.** The total number of cardiac cases logged was substantially less during the same time period, and therefore as a result, the total number of cases performed after the implementation of the work-hour restrictions was also reduced. Although recent data have not shown an improvement in patient outcomes after restriction of resident work hours, we speculate that in a time of increasingly complex cases, reduction in resident case volumes caused by work-hour restrictions and decreasing cardiac cases might lead to inadequate operative experience.

Caldicott CV, Holsapple JW. Training for fitness: reconsidering the 80-hour work week. Perspect Biol Med. 2008 Winter;51(1):134-43.

The medical literature is replete with articles about the Accreditation Council for Graduate Medical Education's 2003 resident duty hour restrictions. Most of these papers describe creative and thoughtful responses to the new system. However, others express concern that the "80-hour work week" could hamper continuity of care and educational activities. Nevertheless, if fatigue impairs resident learning and medical care quality, then work hour restrictions seem worthwhile. Data support that fatigue occurs even with reasonable work schedules, and residents do not reliably use time off from work to rest. Regulated work schedules can interfere with adequate rehearsal of the physical and mental stamina required in certain specialties, yet patients have a right to expect their physicians to be trained in the particular demands of those specialties. Similarly, residents have a right to a realistic understanding of authentic clinical practice. Further, while self-sacrifice need not be routine, trainees should feel that occasional self-sacrifice is appropriate and acceptable for a physician. The authors reject uniform, arbitrary duty hour limits for all specialties and propose that a subspecialty-based system can foster the development of the endurance, skills, and reasoning that patients and colleagues expect.

Davenport DL, Henderson WG, Hogan S, Mentzer RM Jr, Zwischenberger JB; and the Participants in the Working Conditions of Surgery Residents and Quality of Care Study. Surgery resident working conditions and job satisfaction. Surgery. 2008 Aug;144(2):332-338.

Medical students demonstrate decreased interest in surgical residencies and resident attrition after entry into programs has been reported at 14% to 20%. This study surveyed surgery residents regarding working conditions and how those conditions influenced their job satisfaction. The authors developed a survey to measure residents' working conditions. Questions generated from literature review were expanded and validated through focus groups at 2 academic medical centers. The resulting survey was administered on general/vascular surgery services at 52 hospitals along with a job-satisfaction scale. Questions were grouped into composite measures using factor analysis. Correlations were calculated between working conditions and job satisfaction at the individual and the hospital level.

In 844 returned surveys, resident job satisfaction did not correlate with age, sex, or postgraduate year. **Perceived quality of patient care was the strongest ($R = .51$) of 68 items that did correlate ($P < .01$). Duty hours correlated less strongly ($R = -.17$). At the aggregate hospital level, effective ancillary staff/services ($R = .77$), empathetic nurses ($R = .69$), and attending teaching, appreciation and openness to suggestions ($R = .49$) correlated positively; scutwork ($R = -.63$) and erroneous paging ($R = -.37$) correlated negatively.** The authors' data confirm prior studies indicating that the teaching skills of the attending and the duty hours influence resident satisfaction. More important than these factors, however, were the effectiveness of systems and staff that facilitate the residents' job-care of the patient. Resident satisfaction and student recruitment efforts could be enhanced by the Program and Hospital Director's correction of deficiencies in these areas.

Morrison CA, Wyatt MM, Carrick MM. Impact of the 80-Hour Work Week on Mortality and Morbidity in Trauma Patients: An Analysis of the National Trauma Data Bank. J Surg Res. 2008 Jul 9.

The implementation of the 80-hour work week restrictions implemented by the Accreditation Council for Graduate Medical Education (ACGME) in July 2003 were intended, in part, to improve patient outcomes by reducing fatigue-related resident errors. Although concerns were raised regarding the possibility for increased error due to decreased continuity of patient care, recent studies have shown no significant change in mortality or complication rates since the onset of these new restrictions. This study is the first to examine the effects of the 80-h work week on mortality in trauma patients on a national level. Data were obtained from the National Trauma Data Bank (NTDB) version 6.2 from 1994 to 2005. Data were then divided into two groups: "pre-80-h work week" (2001-2002) and "post-80-h work week" (2004-2005). Because the ACGME's guidelines were implemented mid-year in 2003, and because the NTDB classifies admission date only by year, all patients admitted during 2003 were excluded from the analysis. Information regarding patient demographics and hospital type (teaching versus non-teaching) was collected. The primary outcome measure was mortality. Secondary outcomes included length of mechanical ventilation, length of ICU stay, and length of hospitalization.

The overall mortality rate decreased from 4.64% in the pre-80-h work week to 4.46% in the post-80-h work week ($P < 0.0001$). Of particular interest were the differences in outcomes observed in academic versus nonacademic institutions. In university hospitals, the mortality decreased from 5.16% to 5.03% ($P = 0.03$), whereas in non-teaching hospitals, mortality increased from 3.37% to 3.85% ($P < 0.001$). There were also small but statistically significant improvements seen in secondary outcomes during the post-80-h work week. Despite the great deal of controversy surrounding the 80-h work week, few papers exist that specifically examine patient mortality within the field of trauma surgery. This large retrospective analysis demonstrates slightly decreased mortality and morbidity among trauma patients in university hospitals nationwide after implementation of the 80-h work week, even when controlling for possible confounders. Although these differences are not likely to

be clinically important, the data are statistically very significant. Therefore, the authors conclude that the 80-h work week has not resulted in any significant deterioration in patient outcomes in this particular population.

Shin S, Britt R, Britt LD. Effect of the 80-hour work week on resident case coverage: corrected article. J Am Coll Surg. 2008 Jul;207(1):148-50.

On July 1, 2003, residency training programs were required to institute restricted duty hours as mandated by the Accreditation Council for Graduate Medical Education. A major concern, voiced by both surgical residents and faculty, was an expectation that this would result in a decrease in operative experience. The authors hypothesized that implementing restricted duty hours would decrease case coverage by resident trainees. They conducted a retrospective study of operative and endoscopic cases scheduled for a single general surgery practice for a year before and after July 1, 2003. Data collected included operation performed, number of attending surgeons present, whether a resident was present, and level of resident. **From July 2002 to June 2003, there were 1,278 cases scheduled; 890 records were available. From July 2004 to June 2005, there were 1,182 cases scheduled; 960 records were available. Before institution of the restricted duty hours, 24.6% of junior-level (PGY1 and 2) cases, 21.7% of intermediate-level (PGY3) cases, and 6.2% of senior-level (PGY4 and 5) cases were not covered by residents. After restricted duty hours were implemented, 27.3% of junior-level cases, 15.9% of intermediate-level cases, and 8.1% of senior-level cases were not covered by residents. Overall 20.8% (185 of 890) and 20.4% (196 of 960) of cases were not covered by residents before and after instituting restricted duty hours, respectively. No difference in case coverage was statistically significant in each category or overall.** The authors found that restricted duty hours have not affected resident case coverage.

Noroozi AR, Philbert RF. Residents' perception of the impact of the Bell Commission in oral surgery training: an initial study. J Oral Maxillofac Surg. 2008 Jul;66(7):1329-34.

In 1989, the New York State Legislature enacted New York State Code 405 (Bell Commission) in response to the death of Libby Zion at Lincoln Medical and Mental Health Center (Bronx, NY). The resultant limitations imposed on resident work hours have been the focus of much debate in medical literature, but their impact on the training of oral and maxillofacial surgery (OMFS) residents has remained relatively unexplored. The purpose of this study was to evaluate the opinion of OMFS residents toward the benefits of work hour restrictions. The authors asked residents how work hour restrictions affected their ability to provide care safely and efficiently and the quality of their surgical training. They also aimed to estimate the amount of their scheduled off-time that residents used for sleep. A 12-item questionnaire was forwarded to all available residents and interns in the 17 OMFS training programs in New York State. A total of 36 surveys were returned.

The majority of respondents felt that their program adhered fairly well to the guidelines of the Bell Commission and that it had a positive effect on the quality and efficiency in which they provided patient care. Most also felt that the Bell Commission guidelines had a positive effect on the quality of their residency. However, senior residents felt that the Bell Commission did not have as positive of an impact on their ability to provide care safely or efficiently as junior residents. Similarly, senior residents felt that the quality of their residency had not been as greatly improved by the Bell Commission as did junior residents, and used a lower percentage of their time off duty on actual sleep. **The study found that most OMFS residents perceive that the Bell Commission guidelines have a positive impact on their residency training and on patient care. The authors recommend further studies to evaluate the effects of the Bell Commission on OMFS training.** Additionally, the perception of OMFS faculty can be appraised in future studies. However, the limitations of this study include recall bias of the surveyed

residents and responder bias (including fear of reprisal in reporting details that might otherwise be considered by training programs to be confidential).

Vaughn DM, Stout CL, McCampbell BL, Groves JR, Richardson AI, Thompson WK, Dalton ML, Nakayama DK. Three-year results of mandated work hour restrictions: attending and resident perspectives and effects in a community hospital. Am Surg. 2008 Jun;74(6):542-6; discussion 546-7.

In response to the Accreditation Council of Graduate Medical Education mandated resident work hour restrictions, our residency program used a night float system in 2003. The authors undertook a survey of attending staff and residents to assess its effects on patient care and resident education. An anonymous survey was administered to attending staff and residents 1 year and 3 years after work hour restrictions took effect. **The areas of disagreement include: beneficial effect on education (residents vs. faculty: in 2004, 87% vs. 22%, respectively, $P = 0.02$; in 2006, 71% vs. 22%, $P = 0.03$); beneficial effect on patient care (in 2004, 53% vs. 10%, $P = 0.03$); and compromised continuity of care (in 2004, 27% vs. 70%, $P = 0.04$; in 2006, 7% vs. 89%, $P = 0.0002$). One area of agreement was that residents' quality of life had improved. Both disagreed that more errors were being made and that work hour restrictions should be mandated on practicing surgeons.** Attending staff and residents have deeply held opinions regarding the effects of work hour restrictions. This reflects a continuing dissatisfaction with providing patient care and educating residents under a set of requirements that solely addresses resident sleepiness and fatigue.

Baskies MA, Ruchelsman DE, Capeci CM, Zuckerman JD, Egol KA. Operative experience in an orthopaedic surgery residency program: the effect of work-hour restrictions. J Bone Joint Surg Am. 2008 Apr;90(4):924-7.

The implementation of Section 405 of the New York State Public Health Code and the adoption of similar policies by the Accreditation Council for Graduate Medical Education in 2002 restricted resident work hours to eighty hours per week. The effect of these policies on operative volume in an orthopaedic surgery residency training program is a topic of concern. The purpose of this study was to evaluate the effect of the work-hour restrictions on the operative experiences of residents in a large university-based orthopaedic surgery residency training program in an urban setting. **The authors analyzed the operative logs of 109 consecutive orthopaedic surgery residents (postgraduate years 2 through 5) from 2000 through 2006, representing a consecutive interval of years before and after the adoption of the work-hour restrictions. Following the implementation of the new work-hour policies, there was no significant difference in the operative volume for postgraduate year-2, 3, or 4 residents. However, the average operative volume for a postgraduate year-5 resident increased from 274.8 to 348.4 cases ($p = 0.001$). In addition, on analysis of all residents as two cohorts (before 2002 and after 2002), the operative volume for residents increased by an average of 46.6 cases per year ($p = 0.02$).** The authors noted that on the basis of the findings of this study, concerns over the potential adverse effects of the resident work-hour policies on operative volume for orthopaedic surgery residents appear to be unfounded.

Durkin ET, McDonald R, Munoz A, Mahvi D. The impact of work hour restrictions on surgical resident education. J Surg Educ. 2008 Jan-Feb;65(1):54-60.

Resident work-hour restrictions were instituted in July 2003 based on ACGME mandates. The American Board of Surgery In-Training Examination (ABSITE), American Board of Surgery Qualifying Examination (ABSQE), and operative volume traditionally have been measures of surgical resident education and competency. The objective of this study was to determine the effect of reduced work hours on resident standardized test scores and operative volume at our institution. The authors reviewed ABSITE scores, ABSQE scores, and operative logs from 1997 to 2005 of all general surgery residents.

Linear mixed-effects models were fitted for each component ABSITE score (total, basic science, and clinical management), and they were compared using a chi-squared likelihood ratio. **Operative logs of graduating residents were compared before and after the work restrictions and were evaluated for association with ABSITE score. p-values less than 0.05 were considered significant. This showed the program was compliant with ACGME mandates within 6 months of institution. ABSITE scores improved significantly after the restriction of work hours in both basic science (p = 0.003) and total score (p = 0.008). Clinical management scores were not affected. The number of major cases recorded by graduating residents did not change.** A positive correlation was found between number of cases performed during residency and clinical management ABSITE scores (p = 0.045). ABSQE scores were not impacted by operative volume during residency. ABSITE scores improved significantly after the restriction of resident work hours. Resident operative experience was not affected. An unexpected consequence of work-hour restrictions may be an improvement in surgical resident education.

Everett CB, Helmer SD, Osland JS, Smith RS. General surgery resident attrition and the 80-hour workweek. Am J Surg. 2007 Dec;194(6):751-6; discussion 756-7.

This study examines the effect of implementation of the resident duty-hour regulations on the attrition rate of general surgery residents. The study design was a 7-part survey encompassing the 2001 to 2004 academic years that was sent to program directors of general surgery residency programs in the United States. **One hundred twenty-four of 252 programs (49%) responded, reporting a loss of 338 categorical residents. The total attrition rate increased from .6 residents lost/program/y to .8 residents/program/y (P = .0013). Lifestyle concerns were the most commonly reported reason for residents leaving during surgical training. The majority (56%) of those who left surgery entered other fields of medicine (i.e., Anesthesia and Family Medicine most commonly).** More residents are leaving general surgery training since the institution of the 80-hour workweek. Despite improvements in work hours and lifestyle during surgical training, residents migrate to specialties that are conducive to a more controllable lifestyle after experiencing surgery residency.

Immerman I, Kubiak EN, Zuckerman JD. Resident work-hour rules: a survey of residents' and program directors' opinions and attitudes. Am J Orthop. 2007 Dec;36(12):E172-9; discussion E179.

In July 2003, the Accreditation Council for Graduate Medical Education (ACGME) established nationwide guidelines for resident working environments and duty hours. Following these guidelines became a requirement for all accredited residency programs. Two years after implementation, the authors conducted a national survey to assess the opinions and attitudes of orthopedic residents and program directors toward the ACGME work-hour regulations and the effects of these regulations on resident education, resident quality of life, and patient care. Nine hundred seventy-six residents (30% response rate) and 85 program directors (56% response rate) completed the questionnaire. For resident education, junior residents were more likely than senior residents and program directors to perceive the work-hour regulations as having a positive effect on education. **There was overall agreement among the 3 groups that resident quality of life had improved as a result of work-hour regulations. For patient care, junior residents viewed the new regulations positively for surgical training and patient care, whereas senior residents and program directors disagreed.** This survey showed meaningful differences in the attitudes and opinions of junior residents, senior residents, and program directors toward the new ACGME work-hour regulations.

Izu BS, Johnson RM, Termuhlen PM, Little AG. Effect of the 30-hour work limit on resident experience and education. J Surg Educ. 2007 Nov-Dec;64(6):361-4.

The study evaluated the effect of the 30-hour restriction on resident operative participation and assess

whether the 30-hour restriction can be extended in certain cases to enhance educational experience and continuity of care without being detrimental to the 80-hour limit. In September 2006, the authors administered a 10-item Likert scale survey to 41 general surgery residents to assess their experience with the 30-hour work restriction. They also reviewed the operative reports from the busiest general surgery service in April 2003 and April 2005 to assess surgical participation before and after the 30-hour restriction. Twenty-three (56%) residents reported missed operations each month because of the 30-hour restriction. Thirty-four (83%) reported occasions where participating in an operation would require only an additional 1-4 hours. Thirty-six (88%) residents reported a better educational experience when operating on patients whom they had evaluated and a preference to operate on patients whom they had evaluated. The operative log review revealed that in April 2003, the resident assigned to the service participated in 47 out of 134 (35%) total operations and 11 out of 30 (37%) operations beginning after noon. In April 2005, the resident assigned to the service participated in 49 out of 109 (45%) total operations and 20 out of 45 (44%) of the operations beginning after noon.

The results showed that the difference in the amount of operations involving resident participation before and after the 30-hour restriction, including afternoon cases that would be most affected by the work restriction, was minimal. However, the authors identified occasions when the 30-hour work restriction could be extended to provide continuity of care and a better educational operative experience while maintaining weekly duty hours within the approved limit. Extensions beyond the 30 hours should be limited to providing unique and comprehensive experiences for residents where the additional time or episodes would not cause resident fatigue.

Philibert I, Heard J. Resident duty hours and professionalism--limits and opportunities. Pharos Alpha Omega Alpha Honor Med Soc. 2007 Autumn;70(4):47-8.

This commentary examines the hypothesized “cause-effect relationship” between duty hour limits and allegations of lower professionalism in residents. It noted that limits on resident hours are “blunt tools” and cannot by their absence or presence promote or obliterate professionalism in residents, and instead exploring intergenerational differences in expectations for a work/personal life balance as a contributing factor to both interesting limiting resident hours, and allegations of reduced professionalism by faculty.

The authors explore alternative ways of conceptualizing physician professionalism in the 21st century, in a system in which continuity of care does not rely on the most junior members of the health care team. **They offer team approaches to continuity as an alternative, but cautions against reductions that severely reduce continuity residents’ educational exposure to patients, which is important to learning by allowing them to see progression of illness, responses to treatment and appreciate complications that may arise. They also warn about systems failures that may result from hour limits being instituted without staffing or other changes, resulting in a compression of work for the residents or an inadequate number of professionals to perform the work, noting that the consequences often are indistinguishable from those of long hours worked by residents in isolation and without adequate supervision.** It is important to socialize resident physicians to the demands of continuity of care and the importance of putting their patients’ needs above their own, in an approach that does not itself create a potential source of harm for these patients.

Damadi A, Davis AT, Saxe A, Apelgren K. ACGME duty-hour restrictions decrease resident operative volume: a 5-year comparison at an ACGME-accredited university general surgery residency. J Surg Educ. 2007 Sep-Oct;64(5):256-9.

The authors compared the operative experience of chief residents at the Michigan State University Integrated Residency Program in General Surgery before and after duty-hour restrictions mandated by the Accreditation Council for Graduate Medical Education, noting that conflicting evidence exists regarding

the influence of duty-hour restrictions upon resident operative experience. The study used resident self-reported operative experience submitted to the Residency Review Committee (RRC) for Surgery. To control for a possible overall decrease in surgical procedures, for example, a decrease in referrals to the institution, the departmental database of surgical billings that is maintained independently from resident operative experience data also was reviewed. **An overall decrease of nearly 20% occurred in resident operative volume after promulgation of duty-hour restrictions. All residents met minimum RRC operative experience requirements.** Over the same period, no decrease was found in the number surgical procedures performed by the department. The data suggest that restriction of resident duty hours is associated with a significant decrease in operative experience.

Espey E, Ogburn T, Puscheck E. Impact of duty hour limitations on resident and student education in obstetrics and gynecology. J Reprod Med. 2007 May;52(5):345-8.

The authors sought to identify educators' attitudes about the impact of duty hour limitations on resident and student education in obstetrics and gynecology (OB-GYN). One hundred OB-GYN educators attending a session at the 2005 annual meeting of the Council on Residency Education/Association of Professors of Obstetrics and Gynecology were administered an anonymous survey that contained 16 items related to attitudes about the impact of resident duty hour limitations. All questions were answered by at least 77 respondents. **OB-GYN educators perceive that work hours have a negative impact on resident education: 63% reported that overall resident education is worse and that resident surgical volume has diminished. The majority of educators perceive that limited work hours created no change in resident interest in teaching, but 62% perceive that residents have less time available to teach. Thirty-nine percent perceive that medical students have a better attitude about the OB-GYN rotation.** Educators should accommodate duty hour limitations in the context of excellence in student and resident education.

Brau RH, Murray I, Quiruz E, Gelpi F, Cabrera F, Rivera C, Haddock L. Assessment of the educational experience in the Neurosurgery Residency Program of the University of Puerto Rico Medical Sciences Campus. P R Health Sci J. 2007 Mar;26(1):65-74.

In 2003, the American Council of Graduate Medical Education (ACGME) made significant changes in the medical postgraduate training policies, especially the 80 Duty Hours per Week regulation. The Neurological Surgery Department at Mayo Clinic performed a national survey regarding the perceptions of program directors and residents on how compliance with the ACGME requirements has changed neurosurgery training. Using a similar methodology, the authors analyzed the University of Puerto Rico's Medical Sciences Campus, Neurological Surgery Division's resident and faculty perceptions with regard the way its training is currently performed. Anonymous questionnaires were distributed among the neurosurgery division's resident and faculty at the University of Puerto Rico Medical Sciences Campus. Performance on the American Neurological Surgery Board (ANSB) written examinations was obtained from residents' records. The quantity and types of surgeries performed by residents was retrieved from neurosurgery section computer files. The relevant data was entered into a database and descriptive analysis and frequency distributions were performed.

The results showed some concerns from both residents and attending physicians on the topics of inpatient and outpatient facilities, research activities, duty hours and the number of residents currently in the program. An upward trend in the residents' ANSB written examination performance was observed over the years. The residents' yearly number and diversity of surgical procedures were adequate. Considering the results from the surveys, the performance of residents in the Board examination, and their surgical experience, it is concluded that the general perception of the educational experience in neurosurgery is satisfactory but improvements could be made.

Kusuma SK, Mehta S, Sirkin M, Yates AJ, Miclau T, Templeton KJ, Friedlaender GE. Measuring the attitudes and impact of the eighty-hour workweek rules on orthopaedic surgery residents. J Bone Joint Surg Am. 2007 Mar;89(3):679-85.

The literature on graduate medical education contains anecdotal reports of some effects of the new eighty-hour workweek on the attitudes and performance of residents. However, there are relatively few studies detailing the attitudes of large numbers of residents in a particular surgical specialty toward the new requirements. Between July and November 2004, a survey created by the Academic Advocacy Committee of the American Academy of Orthopaedic Surgeons was distributed by mail, fax, and e-mail to a total of 4207 orthopaedic residents at the postgraduate year-1 through year-6 levels of training. The survey responses were tabulated electronically, and the results were recorded. The survey response rate was 13.2% (554 residents). Sixty-eight percent (337) of the 495 respondents whose postgraduate-year level was known were at the postgraduate year-4 level or higher.

Attitudes concerning the duty rules were mixed. Twenty-three percent of the 554 respondents thought that eighty hours constituted an appropriate number of duty hours per week; 41% believed that eighty hours were too many, and 34% thought that eighty hours were not sufficient. Thirty-three percent of the respondents had worked greater than eighty hours during at least a single one-week period since the new rules were implemented; this occurred more commonly among the postgraduate year-3 and more junior residents. Orthopaedic trauma residents had the most difficulty adhering to the new duty-hour restrictions. Eighty-two percent of the respondents indicated that their residency programs have been forced to make changes to their call schedules or to hire ancillary staff to address the rules. The use of physician assistants, night-float systems, and so-called home-call assignments were the most common strategies used to achieve compliance. Resident attitudes toward the work rules are mixed. The rules have forced residency programs to restructure. Junior residents have more favorable attitudes toward the new standards than do senior residents. Self-reporting of duty hours is the most common method of monitoring in orthopaedic training programs. Such systems allow ample opportunity for inaccuracies in the measurement of hours worked. Although residents report an improved quality of life as a result of these new rules, the attitude that the quality of training is diminished persists.

Weatherby BA, Rudd JN, Ervin TB, Stafford PR, Norris BL. The effect of resident work hour regulations on orthopaedic surgical education. J Surg Orthop Adv. 2007 Spring;16(1):19-22.

Accreditation Council for Graduate Medical Education (ACGME) resident work hour regulations have been effective since July 2003. Several areas affected by these changes have been identified, including surgical education. In the current study, the authors evaluated the impact of these changes on surgical education at a two-person-per-year orthopaedic training program. Operative case experiences of PGY 2 and 3 residents during the academic years 2002-2003 and 2003-2004 were compared utilizing ACGME case logs. A data entry log was also distributed to examine subjectively the effects on operative case load.

ACGME data showed that PGY 2 and 3 residents performed 21.5% fewer cases between years. The average number of cases per rotation decreased by 20.44% (p =.009, paired t-test). Subjective results also showed a decrease, with an average of 10.8% of cases missed per resident. This study shows that residents who have begun training post-80-hour work week will do fewer procedures. This may result in a decreased level of skill, or it may shift operative experience to the senior resident years, prolonging the learning curve. Regardless, future analysis must be done to determine the full impact on training of the orthopaedic resident.

Jagsi R, Shapiro J, Weissman JS, Dorer DJ, Weinstein DF. The educational impact of ACGME limits on resident and fellow duty hours: a pre-post survey study. Acad Med. 2006 Dec;81(12):1059-68.

To assess the educational impact of Accreditation Council for Graduate Medical Education resident work-hour limits implemented in July 2003, all trainees in all 76 accredited programs at two large teaching hospitals were surveyed between May and June 2003 (before work-hour reductions) and then between May and June 2004 (after work-hour reductions) about hours, education, and fatigue. Based on changes in weekly duty hours, 13 programs experiencing substantial reduction in hours were classified into a reduced-hours group. Differences in assessments of educational endpoints before and after policy implementation by trainees in the reduced-hours group were compared with those in other programs to control for potential temporal trends, using two-way ANOVA with interaction. The number of respondents was 1,770 (60% response rate).

The reduced-hours group reported a significant decrease in time spent directly caring for patients (from 48.5 to 42.3 mean h/wk, $P = 0.03$), but the volume of important clinical experiences, including procedures, was preserved, as was the sense of clinical preparedness. On 22 questions related to educational quality and adequacy, only three of the “differences in differences” were significant, with the reduced-hours group reporting a relative increase in opportunities for research, decrease in quality of faculty teaching, and decrease in educational satisfaction. The percentage of trainees reporting frequent negative effects of fatigue dropped more in the reduced-hours programs than in the other programs ($P < 0.05$). This study shows that it may be possible to reduce residents' hours--and the perceived adverse impact of fatigue--while generally preserving the self-assessed quality, quantity, and outcomes of graduate medical education.

Myers JS, Bellini LM, Morris JB, Graham D, Katz J, Potts JR, Weiner C, Volpp KG. Internal medicine and general surgery residents' attitudes about the ACGME duty hour regulations: a multi-center study. Acad Med. 2006 Dec;81(12):1017-20.

To assess internal medicine and general surgery residents' attitudes about the effects of the Accreditation Council for Graduate Medical Education duty hour regulations on medical errors, quality of patient care, and residency experiences. In 2005, the authors surveyed 200 residents who trained both before and after duty hour reform at six residency programs (three internal medicine, three general surgery) at five academic medical centers in the United States. Residents' attitudes about the effects of the duty hour regulations on the quality of patient care, residency education, and quality of life were measured using a survey instrument containing 19 Likert scale questions on a scale of 1 to 5. Survey responses were compared using the Student's t-test. The response rate was 80% (159 residents).

Residents reported that whereas fatigue-related errors decreased slightly, errors related to reduced continuity of care significantly increased. Additionally, duty hours regulations somewhat decreased opportunities for formal education, bedside learning, and procedures, but there was no consensus that graduates would be less well trained after duty hours reform. **Residents, particularly surgical trainees, reported improvements in quality of life and reduced burnout. Residents in medicine and surgery had similar opinions about the effects of duty hour reform, including improved quality of life. However, resident opinions suggest that reduced fatigue-related errors have been offset by errors related to decreased continuity of care and that the quality of the educational experience may have declined.** Quantifying the degree to which regulating duty hours affected errors related to discontinuity of care should be a focus of future research.

Carpenter RO, Spooner J, Arbogast PG, Tarpley JL, Griffin MR, Lomis KD. Work hours restrictions as an ethical dilemma for residents: a descriptive survey of violation types and frequency. Curr Surg. 2006 Nov-Dec;63(6):448-55.

The Accreditation Council for Graduate Medical Education (ACGME) implemented requirements regarding allowable duty hours for resident training in the United States in July 2003. In a previous pilot study at Vanderbilt University Medical Center, a significant number of residents reported violation of requirements. In addition, almost half of those individuals admitted under-reporting their hours worked. The authors' goal was to further delineate the type and frequency of violations and under-reporting. A survey tool was designed to assess specific types of violations as well as factors that influence the number of hours residents worked and reported. Approval was obtained from the Vanderbilt Institutional Review Board and Office of Graduate Medical Education before enrollment of subjects. The program directors of Pediatrics, Internal Medicine, Medicine-Pediatrics, and General Surgery supported the participation of their residents. A voluntary anonymous survey of these residents was conducted 1 year after the pilot study. Of 263 eligible residents, 175 were surveyed. Of 175 residents, 125 (71%) residents responded.

Eighty-five percent of residents reported violation of duty-hour requirements within the preceding 3 months. Residents reported violation of specific requirements as follows: 1 day off in 7, 28%; 80-hour weekly average, 65%; and "24+6" consecutive hours, 85%. Residents were asked to estimate the number of hours by which they exceeded requirements. Hours over the 80-hour weekly requirement were reported as follows: 1 hour, 12%; 2 hours, 15%; 3 hours, 21%; 4 hours, 5%; 5 hours, 14%; and 6 or more hours, 33%. Hours over the "24+6" requirement were reported as follows: 1 hour, 30%; 2 hours, 42%; 3 hours, 18%; 4 hours, 7%; 5 hours, 1%; and 6 or more hours, 2%. Forty-eight percent of respondents admitted under-reporting violations to their program director. Eighty-five percent of residents reported at least 1 violation, and 48% admitted under-reporting violations. These results support the previous findings of 80% and 49%, respectively. Of the various requirements, the "24+6" rule was most frequently violated. Of those in violation of the "24+6" requirement, the majority (90%) exceeded limits by no more than 3 hours. Of those in violation of the 80-hour weekly average requirement, the majority (57%) exceeded limits by no more than 5 hours. Per the ACGME website, "an RRC may grant exceptions for up to 10% of the 80-hour limit, to individual programs based on a sound educational rationale." Although the overall percent of residents reporting violation remains high, the number of excess hours worked is small relative to established standards (within 10%). The authors propose that systems adaptations could be developed to improve compliance. Special attention is warranted to investigate the activities of residents in the post-call period.

de Virgilio C, Yaghoubian A, Lewis RJ, Stabile BE, Putnam BA. The 80-hour resident workweek does not adversely affect patient outcomes or resident education. Curr Surg. 2006 Nov-Dec;63(6):435-9; discussion 440.

The purpose of this study was to determine whether the 80-hour resident workweek adversely affects patient outcomes or resident education. To assess patient outcomes, the authors reviewed trauma patient morbidity and mortality at the second busiest level I trauma center in Los Angeles County before (July 1998-June 2003, Period 1) and after (July 2003-June 2005, Period 2) implementation of the duty hour limitation via a retrospective review of a prospective database. All patients were operated and managed by residents under faculty supervision. Patient characteristics included the injury severity score (ISS), mechanism of injury, complications, and death. To assess resident education, the authors compared ABSITE percentile scores, first-time pass rates on the American Board of Surgery Qualifying and Certifying Examinations, and total and chief resident operative case volumes. In addition, they estimated institutional costs incurred to comply with the new duty hour rules.

Patient outcomes: over the entire 7-year study period, 11,518 trauma patients were transported to Harbor-UCLA Medical Center. Compared with Period 1, Period 2 experienced an increase in average yearly patient volume from 1510 to 1981 (p 0.01). The average ISS also increased, from 7.9 to 9.6 (p < 0.0001), as did the proportion of penetrating trauma from 14.8% to 17.6% (p < 0.0001). Morbidity and mortality rates remained unchanged. Resident education. Mean ABSITE scores and first-time Qualifying and Certifying Exam pass rates were unchanged. Mean resident total major case volumes increased significantly in Period 2 from 831 to 1156 (p < 0.0001), whereas chief resident year case volumes were unchanged. The estimated cost incurred by this institution to conform to the new work hour standards was approximately 359,000 dollars per year.

Despite concerns that the 80-hour workweek might threaten patient care and resident education, the morbidity and mortality rates at a busy level I trauma center remained unchanged. The quality of surgical resident education, as measured by operative volumes, ABSITE scores, and written and oral board examination pass rates were likewise unchanged. The reorganization of the authors' general surgery residency program to comply with the duty hour restrictions was achieved within reasonable cost.

Biller CK, Antonacci AC, Pelletier S, Homel P, Spann C, Cunningham MJ, Eavey RD. The 80-hour work guidelines and resident survey perceptions of quality. J Surg Res. 2006 Oct;135(2):275-81.

We hypothesized that resident fatigue error should improve, related to well-rested trainees as a direct cause/effect benefit. However, patient hospital care quality is multi-factorial, so impact on patient care quality by changing only one variable for a single caregiver group was unknown. Convenience samples of 156 residents from three surgical specialties were administered a questionnaire in early 2004 addressing perceptions of patient care quality before and after the 80-hour workweek. Additionally, residents recently under work-hour restrictions (Newly Restricted, NR) were compared to New York state trainees already regulated by work-hour restrictions (Previously Restricted, PR). This took place in surgical residency training venues. The main outcome measure was survey results; the level of significance for all tests was 0.05. The participation response rate was 94.5%.

Eighty-eight percent of respondents indicated by survey subjective impression that patient care quality was either unchanged (63%) or worse (26%) due to work-hour restrictions (P = 0.003). PR residents were more likely than NR residents to report unchanged or worse quality of care (P = 0.015). Residents overall did perceive improvement in some types of error with fewer fatigue-related errors (P < 0.001), e.g., medication (P < 0.001), judgment (P = 0.001), and dexterity (P = 0.013), subsequent to work-hour restrictions. However, more errors were perceived related to continuity of care (P < 0.001), miscommunication (P = 0.001), and cross-coverage availability (P = 0.001). Despite an expected perception of improvement in fatigue-related errors, most participants (particularly PR residents) reported impressions that patient care quality had remained unchanged or had declined under the work-hour restrictions. Unresolved challenges with continuity of care, miscommunication, and cross-coverage availability are possible explanations. Mere work-hour reduction does not appear to improve patient care quality automatically nor to decrease the possibility for some types of error. Process interventions that specifically target trainee sign-out coverage constraints as part of a global reassessment will be important for future attempts to enhance quality hospital patient care.

Choi D, Dickey J, Wessel K, Girard DE. The impact of the implementation of work hour requirements on residents' career satisfaction, attitudes and emotions. BMC Med Educ. 2006 Oct 17;6:53.

The purpose is to assess the impact of work hours' limitations required by the Accreditation Council for Graduate Medical Education (ACGME) on residents' career satisfaction, emotions and attitudes. A validated survey instrument was used to assess residents' levels of career satisfaction, emotions and attitudes before and after the ACGME duty hour requirements were implemented. The "pre"

implementation survey was distributed in December 2002 and the "post" implementation one in December 2004. Only the latter included work-hour related questions. The response rates were 56% for the 2002 and 72% for the 2004 surveys respectively.

Although career satisfaction remained unchanged, numerous changes occurred in both emotions and attitudes. Compared to those residents who did not violate work-hour requirements, those who did were significantly more negative in attitudes and emotions. With the implementation of the ACGME work hour limitations, the training experience became more negative for those residents who violated the work hour limits and had a small positive impact on those who did not violate them. Graduate medical education leaders must innovate to make the experiences for selected residents improved and still maintain compliance with the work hour requirements.

Dola C, Nelson L, Lauterbach J, Degefu S, Pridjian G. Eighty hour work reform: Faculty and resident perceptions. Am J Obstet Gynecol. 2006 Nov;195(5):1450-6.

The purpose of the study was to describe resident and faculty perceptions on the impact of the 80 hour work reform on residency training. Surveys were distributed to resident and faculty at a major university-based teaching institution. All responses were anonymous. Information abstracted from the survey included: demographic characteristics and resident and faculty perceptions on resident education, patient care, resident work environment, and quality of life after the institution of new regulations on resident duty hours. Descriptive and comparison analyses were performed. Ninety-four residents and 56 faculty members responded. **Significant differences were detected in resident and faculty perceptions that work reform improved resident education (52.3% vs. 20.8%, respectively, $P < .01$), and worsened quality of patient care (8.8% vs. 45.3%, respectively, $P < .01$). Both residents (84.4%) and faculty (90.7%) agreed that work reform improved resident quality of life.** Faculty and resident perceptions differed on the impact of the work reform on patient care and resident education but agreed that it improved resident quality of life.

Tran J, Lewis R, de Virgilio C. The effect of the 80-hour work week on general surgery resident operative case volume. Am Surg. 2006 Oct;72(10):924-8.

To meet the new duty hour restrictions on July 1, 2003, a general surgery residency program underwent many changes. The purpose of this study was to examine whether the implementation of these changes, made in part to comply with new duty hour restrictions, would adversely impact general surgery residents' operative volume. The operative cases of categorical surgical residents were recorded from July 1, 2000 to December 31, 2004. The main outcome measure was the median number of operative cases performed by each resident per quarter (a 3-month period). The number of in-house calls each resident took per quarter was also recorded. From 2000 to 2004, the median number of in-house calls per quarter significantly decreased (27, 25, 15, 10, and 14, respectively; $P < 0.001$). The median number of operative procedures performed did not vary from quarter to quarter ($P = 0.49$). There was a trend toward an increase in number of cases performed at the postgraduate year (PGY) 1 ($P = 0.07$) and 2 ($P = 0.04$) levels, a decrease at the PGY3 level ($P = 0.058$), and no change at the PGY4 and 5 years. The 80-hour work week did not adversely affect the operative experience of categorical surgical residents despite significant reductions of in-house call.

Barrack RL, Miller LS, Sotile WM, Sotile MO, Rubash HE. Effect of duty hour standards on burnout among orthopaedic surgery residents. Clin Orthop Relat Res. 2006 Aug;449:134-7.

The authors surveyed orthopaedic surgery residents and faculty from two university training programs to quantify quality of life measures including burnout, general health, and relationship issues. Residents

exhibited high levels of burnout and emotional exhaustion but only average levels of personal achievement, while faculty showed lower levels of burnout and emotional exhaustion with above average scores for personal achievement. Resident burnout was positively correlated with number of hours worked while faculty hours worked was inversely related to burnout. The survey was re-administered two years after implementing the Accreditation Council on Graduate Medical Education guidelines on residency duty hours. **At this time resident scores for personal accomplishment had improved, while scores for emotional exhaustion showed a strong trend towards decreasing, and depersonalization scores also showed a possible trend towards decreasing. Resident duty hour limitation was associated with improvement in objective measures of burnout.**

Friedlaender GE. The 80-hour duty week: rationale, early attitudes, and future questions. Clin Orthop Relat Res. 2006 Aug;449:138-42.

There is considerable concern and much evidence resident fatigue results in medical errors, some of which have serious consequences. Similarly, fatigue causes poor health in house-staff and places these individuals at greater risk for personal injuries, including motor vehicle accidents. These circumstances led the Accreditation Council on Graduate Medical Education to develop and, on July 1, 2003, to implement guidelines for all residency training programs limiting the time of in-house duty to 80 hours per week. **Surveys of orthopaedic residents by the American Academy of Orthopaedic Surgeons, before and right after implementation of these new duty rules, confirm residents were working longer than 80 hours before July 2003 and are largely in compliance since that date.** Residents generally approve of these changes and are personally happier, but also express concern for a loss of continuity of care and reduced exposure to operative cases. It remains to be demonstrated whether these new rules will improve patient care, enhance resident well-being, or influence education.

Peabody T. The effect of work hour restrictions on the education of orthopaedic surgery residents. Clin Orthop Relat Res. 2006 Aug;449:128-33.

In 2005 the Academic Leadership Group of the American Orthopaedic Association surveyed orthopaedic program directors, chairs, and members of the Resident Leadership Forum to gather information about the effect of the Accreditation Council for Graduate Medical Education work-hour restrictions on resident education. The authors compared these results with a similar survey performed 2 years ago. Ninety-four program directors and chairs and 59 senior residents responded to this survey. Overall, the respondents thought the duty hour restrictions had a negative impact on orthopaedic residency education but less so than in the previous survey. This conclusion was based on perceived negative effects on professionalism, resident operative experience, continuity of care, and increased workload for the faculty. Senior residents who worked before and after the work-hour limitations were instituted were more concerned about the negative effects than junior residents. Residents did seem more rested and content but not better prepared or necessarily more attentive. Respondents were not of the opinion resident performance had improved as measured by perceptions of performance on standardized tests. Orthopaedic departments had adapted to the work-hour limitations by scheduling night float rotations, converting in-house call to home call, and by hiring additional personnel in the form of physician extenders.

Schenarts PJ, Anderson Schenarts KD, Rotondo MF. Myths and realities of the 80-hour work week. Curr Surg. 2006 Jul-Aug;63(4):269-74.

Myths are so ingrained into cultural traditions that emotion frequently overshadows a rational evaluation of the facts. The reduction in resident work hours has resulted in the formation of several myths. The purpose of this review is to examine the published data on resident work hours to separate out myth from reality. An electronic database was searched for publications related to resident training, work-hours,

continuity of care, sleep deprivation, quality of life, patient safety, clinical/operative experience, faculty work hours, and surgical education. Sleep deprivation has been shown to be harmful, and residents played a role in advocating for work-hour limits. Surgical residents have seen a less dramatic improvement in quality of life compared with other disciplines. Work-hour reductions have decreased participation in clinic but have not resulted in a significant decline in clinical or operative exposure. Limiting resident work hours will unlikely result in a decrease health-care cost. Reduction in resident work hours has not resulted in an improvement or deterioration in patient outcome. Reduction of work hours has not increased faculty work hours nor made surgery a more attractive career choice. Despite strongly held opinions, resident work-hour reduction has resulted in little significant change in lifestyle, clinical exposure, patient well-being, faculty work hours, or medical student recruitment.

Brunworth JD, Sindwani R. Impact of duty hour restrictions on otolaryngology training: divergent resident and faculty perspectives. *Laryngoscope*. 2006 Jul;116(7):1127-30.

In 2003, the Accreditation Council for Graduate Medical Education (ACGME) passed a mandate limiting resident work hours. The authors examined the impact of these restrictions on otolaryngology programs and to explore faculty and resident perspectives. Faculty and residents of all 102 ACGME-accredited otolaryngology residency programs were invited to participate in an anonymous online survey. The study population consisted of 460 respondents: 275 residents and 185 faculty (including 41 program directors) representing 57 otolaryngology programs. Sixty-five percent of programs implemented at least one change specifically to comply with duty-hour restrictions. Strategies included tracking work hours electronically (35.7%), utilization of "home call" (33.1%), and hiring additional healthcare professionals (23.1%). **When asked if the restrictions have had a negative effect on patient care, 61% of respondents said no, but a surprising 33% said yes. Sixty-nine percent of faculty felt that the restrictions have actually had a negative effect on resident training compared with only 31% of residents (P<.001). Thirty-nine percent of participants felt resident workload was excessive before the restrictions. Opinions on whether duty-hour limits had fostered improvements in resident education, research, or examination scores varied, but most agreed that resident mental health had improved (67%). Otolaryngology programs have successfully restricted resident duty hours through significant infrastructural changes. Of concern, the majority of residents surveyed appeared to be in favor of the ACGME restrictions, whereas most program directors and faculty were opposed.** Further studies are needed to establish whether limited work hours will enhance or hinder the residency training experience.

Girard DE, Choi D, Dickey J, Wessel K, Austin D. A mid year comparison study of career satisfaction and emotional states between residents and faculty at one academic medical center. *BMC Med Educ*. 2006 Jul 76:36.

The Accreditation Council for Graduate Medical Education's (ACGME) new requirements raise multiple challenges for academic medical centers. The authors sought to evaluate career satisfaction, emotional states, positive and negative experiences, work hours and sleep among residents and faculty simultaneously in one academic medical center after implementation of the ACGME duty hour requirements. Residents and faculty (1330) in the academic health center were asked to participate in a confidential survey; 72% of the residents and 66% of the faculty completed the survey. Compared to residents, faculty had higher levels of satisfaction with career choice, competence, importance and usefulness; lower levels of anxiousness and depression. The most positive experiences for both groups corresponded to strong interpersonal relationships and educational value; most negative experiences to poor interpersonal relationships and issues perceived outside of the physician's control. Approximately 13% of the residents and 14% of the faculty were out of compliance with duty hour requirements. Nearly 5% of faculty reported working more than 100 hours per week. For faculty who worked 24 hour shifts,

nearly 60% were out of compliance with the duty-hour requirements. Reasons for increased satisfaction with career choice, positive emotional states and experiences for faculty compared to residents are unexplained. Earlier studies from this institution identified similar positive findings among advanced residents compared to more junior residents. Faculty is more frequently at risk for duty-hour violations. If patient safety is of prime importance, faculty, in particular, should be compliant with the duty hour requirements. Perhaps the ACGME should contain faculty work hours as part of its regulatory function.

Gordon CR, Axelrad A, Alexander JB, Dellinger RP, Ross SE. Care of critically ill surgical patients using the 80-hour Accreditation Council of Graduate Medical Education work-week guidelines: a survey of current strategies. Am Surg. 2006 Jun;72(6):497-9.

As a result of the recently mandated work-hour restrictions, it has become more difficult to provide 24-hour intensive care unit (ICU) in-house coverage by the general surgical residents. To assess the current state of providing appropriate continuous care to surgical critical care patients during the era of resident work hour constraints, a national survey was conducted by the Association of Program Directors of Surgery. The results revealed that 37 per cent of programs surveyed have residents other than general surgery housestaff providing cross-coverage and writing orders for surgical ICU patients. Residents in emergency medicine, anesthesia, family medicine, otolaryngology, obstetrics/gynecology, internal medicine, urology, and orthopedic surgery have provided this cross-coverage. Some found it necessary to use physician extenders (i.e., nurse practitioners or physician assistants), thereby decreasing the burden of surgical housestaff coverage. The results indicated that 30 per cent use physician extenders to help cover the ICU during daytime hours and 11 per cent used them during nighttime hours. In addition, 24 per cent used a "night-float" system in an attempt to maintain continuous care, yet still adhere to the mandated guidelines. In conclusion, the survey found multiple strategies, including the use of physician extenders, a "night-float" system, and the use of non-general surgical residents in an attempt to provide continuous coverage for surgical ICU patients. The overall outcome of these new strategies still needs to be assessed before any beneficial results can be demonstrated.

Hutter MM, Kellogg KC, Ferguson CM, Abbott WM, Warshaw AL. The impact of the 80-hour resident workweek on surgical residents and attending surgeons. Ann Surg. 2006 Jun;243(6):864-71; discussion 871-5.

The authors assessed the impact of the 80-hour resident workweek restrictions on surgical residents and attending surgeons. The ACGME mandated resident duty hour restrictions have required a major workforce restructuring. The impact of these changes needs to be critically evaluated for both the resident and attending surgeons, specifically with regards to the impact on motivation, job satisfaction, the quality of surgeon training, the quality of the surgeon's life, and the quality of patient care. Four prospective studies were performed at a single academic surgical program with data collected both before the necessary workforce restructuring and 1 year after, including: 1) time cards to assess changes in components of daily activity; 2) Web-based surveys using validated instruments to assess burnout and motivation to work; 3) structured, taped, one-on-one interviews with an external PhD investigator; and 4) statistical analyses of objective, quantitative data. After the work-hour changes, surgical residents have decreased "burnout" scores, with significantly less "emotional exhaustion" (Maslach Burnout Inventory: 29.1 "high" vs. 23.1 "medium," $P = 0.02$). Residents have better quality of life both in and out of the hospital. They felt they got more sleep, have a lighter workload, and have increased motivation to work (Herzberg Motivation Dimensions). **The authors found no measurable, statistically significant difference in the quality of patient care (NSQIP data). Resident training and education objectively were not statistically diminished (ACGME case logs, ABSITE scores). Attending surgeons perceived that their quality of their life inside and outside of the hospital was "somewhat worse" because of the work-hour changes, as they had anticipated. Many concerns were identified with**

regards to the professional development of future surgeons, including a change toward a shift-worker mentality that is not patient-focused, less continuity of care with a loss of critical information with each handoff, and a decrease in the patient/doctor relationship.: Although the mandated restriction of resident duty hours has had no measurable impact on the quality of patient care and has led to improvements for the current quality of life of residents, there are many concerns with regards to the training of professional, responsible surgeons for the future.

Nguyen L, Brunicardi FC, Dibardino DJ, Scott BG, Awad SS, Bush RL, Brandt ML. Education of the Modern Surgical Resident: Novel Approaches to Learning in the Era of the 80-Hour Workweek. World J Surg. 2006 Jun;30(6):1120-7

Implementation of the 80-hour work week has resulted in limitations on the hours available for resident education, creating a need for innovative approaches to teach surgical residents successfully. The authors report the methods and results of an innovative didactic learning program at a large academic surgical residency program. Between 2004 and 2005, based on known principles of adult education and innovative learning techniques, a didactic learning program was instituted in a major academic surgery program. The course work consisted of a structured reading program using Schwartz's Textbook of Surgery, with weekly testing and problem-based learning (PBL) groups led by surgical faculty. The residents' progress was assessed by American Board of Surgery In-Training Examination (ABSITE) training scores before and after program implementation. A resident survey was also conducted to assess residents' attitudes toward the new program. Results were reported as a mean, and categorical variables were compared using a paired Student's t-test. During the academic year of the structured reading program, the mean ABSITE score improved by 10% ($P = 0.02$) from the previous year. The postgraduate year 4 class had the largest change, with a score increase of 17% over the previous year's performance ($P = 0.02$). Survey results demonstrated that 64% of the responders agreed that the small-group PBL was preferable for achieving educational goals. Furthermore, 89% of residents responded that the PBL groups improved interaction between residents and faculty members. An innovative formal learning program based on a major surgical textbook with weekly testing and small group sessions can significantly improve surgical training in the modern era of work-hour restrictions. Furthermore, surgical trainees find this format to be innovative and useful for improving didactic teaching.

Kellogg KC, Breen E, Ferzoco SJ, Zinner MJ, Ashley SW. Resistance to change in surgical residency: an ethnographic study of work hours reform. 1: J Am Coll Surg. 2006 Apr;202(4).

Although the practical challenges to work hour restrictions have been the focus of much discussion, cultural resistance to such change has received less attention. Surgical residency has its own unique social structure. The authors hypothesized that challenges to this would provide impediments to successful implementation of duty hour reform. The authors used ethnographic research methods to study the efforts at work hour restriction over a 15-month period before the introduction of the Accreditation Council for Graduate Medical Education regulations. These methods, validated for studying institutional change, build on intense periods of observation. Records of observations are then analyzed and coded to uncover cultural and political challenges. **The frequency of successful hand-offs in sign-out situations between day and night float residents was measured as an objective index of success. Practical issues were addressed initially by scheduling adjustments including creating a night float system. The hand-offs that this system required, however, were successful only 14% of the time. Subsequent steps to address the challenge to resident identity by top-down support of a new definition of professionalism increased the number of successful hand-offs to 39%. Finally, a reduction in a noted hierarchy violation led to successful hand-offs 79% of the time.** These results demonstrate that practical solutions alone may not be a sufficient basis for change in surgical residency. While there are

other challenges to the traditional surgical culture, attention to social and political issues may enhance the success of efforts.

Ladd AP. Pediatric surgery fellowship compliance to the 80-hour work week. J Pediatr Surg. 2006 Apr;41(4):687-92.

The goal of this study was to determine the compliance of pediatric surgery fellowships with Accreditation Council for Graduate Medical Education (ACGME) duty hour restrictions while confronting a reduced resident workforce. An evaluation of training programs was performed by surveying pediatric surgery fellows on aspects of work hours, ACGME guideline compliance, operative case volume, employment of physician extenders, and didactic education. A 74% survey response rate was achieved. **Of the respondents, 95% felt fully aware of ACGME guidelines. Although 95% of programs had mechanisms for compliance in place, only 45% of fellows felt compliant. Median work hours were 80 to 90 hours per week. Although subordinate residents were felt to obtain better compliance (>86%), only 69% of fellows perceived greater service commitment as a result. No impact on volume of operative cases was perceived. Of the programs, 89% employed physician extenders and 55% used additional fellows, but no overall effect on fellow work hours was evident. Fellows did not identify an improvement in the quality of clinical fellowships with guideline implementation. A minority of fellows comply with ACGME guidelines.** Vigilance of duty hour tracking correlates to better compliance. A shift of patient care to fellows is perceived. Use of support personnel did not significantly aid compliance.

Byrnes MC, Narciso VC, Brantley L, Helmer SD, Smith RS. Impact of resident work-hour restrictions on trauma care. Am J Surg. 2006 Mar;191(3):338-43.

July 2003, the American Council for Graduate Medical Education (ACGME) required residency programs to significantly restrict resident work hours. The effect of these regulations on trauma services has not yet been investigated. The purpose of this study was to evaluate the effect of the ACGME regulations on the care of injured patients and resident education. A 24-question instrument was mailed to a sample of senior trauma surgeons. Shift work has become significantly more common among trauma residents since July 2003 (14% vs. 53.4%, ($P < .001$)). Fifty-four percent of respondents believed that trauma education has worsened and 45% believed that patient care has worsened as a result of the work-hour restrictions. The ACGME-mandated work-hour restrictions have had a dramatic effect on resident and staff surgeons involved in the care of injured patients. Appropriate methods of responding to these challenges must be developed to improve trauma care and enhance resident education.

Leibrandt TJ, Pezzi CM, Fassler SA, Reilly EF, Morris JB. Has the 80-hour work week had an impact on voluntary attrition in general surgery residency programs? J Am Coll Surg. 2006 Feb;202(2):340-4.

This article attempts to assess the effect of the duty-hour limitations implemented in 2003 on voluntary withdrawal of general surgery residents. A questionnaire asked the program directors how many categorical general surgery residents left voluntarily in 2003 to 2004, their training levels, why they left, and where they went. Results were compared with an identical study of 2000 to 2001 and analyzed statistically using chi-square analysis. **A total of 215 programs (85%) responded, compared with 206 programs (81%) in the previous study. One hundred two programs (48%) reported voluntary attrition of 148 residents, compared with 110 programs (53%) and 167 residents previously. An average of 1.5 residents per program left in programs that reported attrition and 0.7 residents per program in all responders, compared with 1.5 and 0.8 residents in the previous study. In both studies, most programs with attrition lost one (66% [2000 to 2001] and 65% [2003 to 2004]) or two**

residents (21% [2000 to 2001] and 27% [2003 to 2004]). Most attrition occurred at PGY1 (47%) and PGY2 (28%) levels; a total of 75% of all attrition occurred at these levels, compared with a total of 76% in the previous study. One hundred eleven residents (75%) entered other medical specialties, and 23 (16%) transferred to other general surgery programs, compared with 105 residents (63%) and 40 residents (24%) in the previous study. In both studies, personal issues and work hours/lifestyle were cited as the most common reasons for leaving. In each study, the net loss to general surgery (the number of residents who left voluntarily divided by the total resident population at risk) was 3% for that academic year. Analysis showed no statistically significant difference. Rates and patterns of attrition seem to have been unaffected by Accreditation Council for Graduate Medical Education work-hours limitations.

Abraham T, Freitas M, Frangos S, Frankel HL, Rabinovici R. Are resident work-hour limitations beneficial to the trauma profession? Am Surg. 2006 Jan;72(1):35-41.

In July 2003, work-hour restrictions were implemented by the Accreditation Council for Graduate Medical Education (ACGME) to limit resident duty hours. Attending surgeon work-hours have not been similarly reduced, and many trauma services have added emergency general surgery responsibilities. The authors hypothesized that trauma attending/resident work-hour disparity may disincentivize residents from selecting trauma careers and that trauma directors would view ACGME regulations negatively. The authors conducted a 6-month study of resident and in-house trauma attending self-reported hours at a level I trauma center and sent a questionnaire to 172 national level I trauma directors (TDs) regarding work-hours restrictions. TD survey response rate was 48 per cent; 100 per cent of 15 residents and 6 trauma faculty completed work-hour logs. **Attending mean hours (87.1/ wk), monthly calls (5), and shifts > 30 hours exceeded that of all resident groups. Case volume was similar. Residents viewed their lifestyle more favorably than the lifestyle of the trauma attending (Likert score 3.6 +/- 0.5 vs. Likert score 2.5 +/- 0.8, P = 0.0003). Seventy-one per cent cited attending work hours and lifestyle as a reason not to pursue a trauma career. Nationally, 80 per cent of trauma surgeons cover emergency general surgery; 40 per cent work greater than 80 hours weekly, compared with < 1 per cent of surgical trainees (P < 0.0001). Most TDs feel that residents do not spend more time reading (89%) or operating (96%); 68 per cent feel patient care has suffered as a result of duty-hours restrictions. Seventy-one per cent feel residents will not select trauma surgery as a career as a result of changes in duty hours.** Perceived trauma attending/ resident work-hour disparity may disincentive trainees from trauma career selection. TDs view resident duty-hour restrictions negatively.

Coverdill JE, Adrales GL, Finlay W, Mellinger JD, Anderson KD, Bonnell BW, Cofer JB, Dorner DB, Haisch C, Harold KL, Termuhlen PM, Webb AL. How surgical faculty and residents assess the first year of the Accreditation Council for Graduate Medical Education duty-hour restrictions: results of a multi-institutional study. Am J Surg. 2006 Jan;191(1):11-6.

This study examined how surgical residents and faculty assessed the first year of the Accreditation Council for Graduate Medical Education duty-hour restrictions. Questionnaires were administered in 9 general-surgery programs during the summer of 2004; response rates were 63% for faculty and 58% for residents (N = 259). Questions probed patient care, the residency program, quality of life, and overall assessments of the duty-hour restrictions. Results include the means, mean deviations, percentage who agree or strongly agree with the hour restrictions, and significance tests. Although most support the restrictions, few maintain that they improved surgical training or patient care. Faculty and residents differed (P < or = .05) on 16 of 21 items. Every difference shows that residents view the restrictions more favorably than faculty. The sex of the resident shaped the magnitude of the gap for 11 of 21 items. Few believe that duty-hour restrictions improve patient care or resident training. Residents, especially female residents, view the restrictions more favorably than faculty.

Karamanoukian RL, Ku JK, DeLaRosa J, Karamanoukian HL, Evans GR. The effects of restricted work hours on clinical training. Am Surg. 2006 Jan;72(1):19-21.

Resident education has changed dramatically over the past 10 years. With the implementation of restricted work hours on clinical training, questions have arisen whether these restricted hours will affect clinical competency. This manuscript attempts to answer this question through a survey performed to assess the perception of residents about duty-hour restrictions and the potential effect on residents' clinical exposure. In this study, a majority of the respondents did believe that work-week restrictions significantly affected patient care and clinical exposure. However, few respondents were willing to accept an additional year of training to compensate for the loss of this clinical exposure. Regardless, work-hour restrictions are here to stay and will probably be further limited in the future. Training programs will have to adjust to provide the necessary clinical exposure while complying with these new ACGME guidelines.

Lin GA, Beck DC, Garbutt JM. Residents' perceptions of the effects of work hour limitations at a large teaching hospital. Acad Med. 2006 Jan;81(1):63-7.

The authors sought to assess residents' perceptions of the impact of resident work hour restrictions on patient care, education, and job satisfaction. Four focus groups of internal medicine residents at Barnes-Jewish Hospital at the Washington University School of Medicine were conducted during February and March 2004. Twenty-six residents from the first three years of residency participated; all were volunteers. Transcripts were analyzed for major themes. Both residents and interns supported work hour limitations and enjoyed the benefits of working fewer hours. However, they had difficulty complying with the restrictions, particularly if they felt patient care, teaching, or their own education would be compromised. Participants perceived that restricted work hours diminished the continuity of patient care and increased the likelihood of medical errors such as those resulting from delayed follow-up of diagnostic tests. Both interns and residents found it difficult to attend conferences, and residents found fewer opportunities to teach. Effects on job satisfaction were mixed as a result of work hour restrictions. Residents in the sample favored work hour restrictions but had serious concerns about the effects of the restrictions on patient care and medical education. The findings suggest that imposing rigid work hour restrictions has significant consequences for patient care and medical education and that the most effective ways to balance work hour limitations with the demands of patient care and necessary educational components to train competent physicians have yet to be identified.

Nuthalapaty FS, Carver AR, Nuthalapaty ES, Ramsey PS. The scope of duty hour-associated residency structure modifications. Am J Obstet Gynecol. 2006 Jan;194(1):282-8.

The purpose of this study was to characterize the duty hours-associated modifications made to the educational and patient care structure of obstetrics and gynecology residency programs, and the relationship of these modifications to residency program setting and size. A survey of accredited obstetrics and gynecology residency programs in the United States (excluding New York State) was performed between June 21st and July 16th, 2004. Program representatives were queried on the difficulty encountered in complying with each of the 6 components of the ACGME common duty hour requirements and the prevalence of residency modifications affecting the educational and patient care structure. Fifty-eight percent (123/211) of the study population completed the questionnaire. **Ensuring a minimum 10-hour rest period between shifts was rated the most difficult requirement. Ninety-eight percent of respondents reported various types of modifications to program structure, including modification of on-call structure (94%), redistribution of responsibilities among resident levels (85%), modification of resident participation in patient care processes (80%), and modification of resident assignments to clinical services (75%). A minimum of 38% of programs reported**

reductions in resident participation in patient care, regardless of clinical service type or care setting. The prevalence of hiring attending physicians was significantly higher among non-university-based programs (18%), compared to university-based programs (3%, $P = .007$). Duty hour-related changes have resulted in near universal program modifications. One third of programs have made modifications that have resulted in a decrease in the available clinical experiences for residents.

Feanny MA, Scott BG, Mattox KL, Hirshberg A. Impact of the 80-hour work week on resident emergency operative experience. Am J Surg. 2005 Dec;190(6):947-9.

The goal of this study was to analyze the impact of the 80-hour work week on the emergency operative experience of surgical residents. A 2-year retrospective comparison of the operative experience in emergency abdominal procedures of postgraduate year 4 and 5 residents in a city hospital before (group 1) and after (group 2) duty hour restriction. **There was no difference between groups in the mean number of procedures performed as the primary surgeon, but group 2 showed a 40% decrease in technically advanced procedures with a 44% increase in basic procedures. The study also demonstrated a 54% decrease in the operative volume as first assistant. Operative continuity of care by residents decreased from 60% to 26% of cases. The ACGME regulatory environment is adversely affecting the emergency operative experience of surgical residents.** The authors' findings underscore the need to develop alternative methods to augment the residents' operative experience.

Lund KJ, Teal SB, Alvero R. Resident job satisfaction: one year of duty hours. Am J Obstet Gynecol. 2005 Nov;193(5):1823-6.

This study was undertaken to assess job satisfaction and quality of life aspects among residents in obstetrics/gynecology before and after the implementation of duty-hour requirements. The authors administered a survey to residents before and after duty-hour restrictions, addressing satisfaction with residency training, quality of life, and predictions/impressions of the effect of reduced work hours. Satisfaction with overall residency training as a discrete survey item did not change; however, the composite score from all responses to specific items increased. **Several specific clinical and academic items garnered higher satisfaction scores in 2004. Residents reported less-than-anticipated increases in healthiness of their lifestyle and a decrease in interest in teaching. This is a prospective assessment of the effect of duty-hour requirements, improvements in residents' perception of their time and ability to study and pursue research and in clinical areas are encouraging. The perception that there is less interest in teaching is of concern.**

Naylor RA, Rege RV, Valentine RJ. Do resident duty hour restrictions reduce technical complications of emergency laparoscopic cholecystectomy? J Am Coll Surg. 2005 Nov;201(5):724-31.

The impact of resident duty hour restrictions on patient care has not been assessed. The authors studied 275 patients undergoing emergency cholecystectomy before and after duty hour regulations instituted by the Accreditation Council for Graduate Medical Education. Operations were stratified into 6-hour intervals from the time in-hospital call began. Procedure-related complications (bile duct injury, cystic duct leak, abdominal hemorrhage, trocar injury, intraabdominal/wound infection, unrecognized retained stone) were the primary outcomes variables. **Complications occurred after 7 of 107 (6.5%) operations performed before duty hour restrictions, which was not different from 15 of 168 (8.9%) after duty hour restrictions. In both periods, all complications followed operations that began within the first 18 hours of duty. Patients with complications had longer operative times ($p = 0.038$) and a higher proportion of operations lasting 120 minutes or longer ($p = 0.006$). Comparing patients with and**

without complications, there were no significant differences in patient demographics, operative complexity, or PGY level of the surgeon. Only operative time of 120 minutes or longer retained significance in the multivariable model ($p = 0.0023$; odds ratio, 4.05; 95% CI, 1.65-9.97). There was no correlation between imposition of duty hour restrictions and technical complication rates in this study. Duration of operative time of 120 minutes or longer was the only independent marker, suggesting that technical complications are a function of operative complexity, not duration of duty. These data suggest that duty hour restrictions might not have a measurable influence on the surgical complication rate after emergency cholecystectomy.

Ferguson CM, Kellogg KC, Hutter MM, Warshaw AL. Effect of Work-hour Reforms on Operative Case Volume of Surgical Residents. *Curr Surg.* 2005 Sep-Oct;62(5):535-8.

The article sought to address concerns regarding the impact of work-hour reforms on the operative case volume of surgical residents. Operative case volume by PGY year and clinical rotation were examined to determine if changes in work hours affected residents' operative case volume. A careful but aggressive plan of work-hour reduction was devised for the residency of the authors' institution with the goal to decrease work hours while maintaining optimal patient care and resident education, including operative case volume. **Changes made included hiring physician extenders (PEs), decreasing call schedules to every fourth night (with the next day free from clinical activities-Q4) or call from home (HC), and night float rotation coverage for services (NF).** Case volume before (academic year 2002) and after (academic year 2003) changes were compared by PGY year, for all residents and for specific rotations-private general surgery, which had changes of PE, HC, and NF for PGY5; PE, Q4 and NF for PGY1 and 10% exemption for work hours; Churchill service (a resident-run ward teaching service), which had changes of PE and Q4 for PGY5 and PGY1 and 10% exemption for work hours; and vascular surgery, which had HC and NF for PGY5. Total case volume on these services was likewise compared. Statistical analysis was by student t test. Operative case volume was measured with data from the resident-entered information on the ACGME Surgical Operative Log (SOL). Case volume for PGY4 residents could not be compared over this time period because of lack of access to archived data by PGY year for graduated residents through the ACGME SOL. Work hours before and after rotation changes were measured with an intranet-based monitoring system. This article is a retrospective review of the affects of these work-hour changes on operative case volume.

As a result, total case volume for the general surgical services (both private and Churchill) was unchanged over this period (5905 in 2002, 5930 in 2003), and likewise for the vascular service (1101 vs. 1196). **Overall, there was no change in mean operative volume per year for surgical residents in this program (231 cases in 2002, 246 cases in 2003; $p = 0.61$).** For PGY5 residents, the case volume increased; 339 cases 02, 390 in 03, and $p = 0.05$. Mean case volume for PGY5 residents increased on the private general surgery service (136 in 02, 160 in 03, $p = 0.03$), but it remained stable on the Churchill service (137 in 02, 158 in 03, $p = 0.39$) and vascular service (65 in 02, 73 in 03, $p = 0.42$). For PGY3 residents, case volume remained stable (171 in 02, 187 in 03, $p = 0.62$), as it did for PGY2 and PGY1 residents (PGY2: 148 in 02, 121 in 03, $p = 0.12$; PGY1: 265 in 02, 246 in 03, $p = 0.23$). However, operative case volume for PGY1 residents did decrease on the private general surgery service (mean 52 cases per month 02, 43 cases per month 03, $p = 0.07$), while remaining stable on the Churchill service (mean 23 cases per month 02, 25 cases per month 03, $p = 0.66$). Average hours worked per week decreased significantly over the time period. Before work-hour reforms, residents' average work hours were as follows: PGY1 105, PGY2 97, PGY3 78.7, PGY4 111, and PGY5 92. After the changes, average work hours were PGY1 81.5, PGY2 77.7, PGY3 78.7, PGY4 75.5, and PGY5 75.9.

Work-hour limitation can be devised to maximize resident education, optimize patient care, and maintain resident operative volume. Although some changes (HC, PE, NF) seemed to increase the operative case volume for PGY5 residents, others had no effect (Q4, HC). There does not seem to be

a clear relationship between types of changes and case volume. At the PGY1 level, Q4 and PE changes decreased operative experience on 1 rotation but not on another, although the difference in this decrease seems clinically insignificant. Individualization of changes to meet the needs of specific rotations seems more important than specific changes in coverage pattern. Perhaps the most important finding is that changes can be made to bring work hours into compliance without materially effecting operative case volume.

Bland KI, Stoll DA, Richardson JD, Britt LD; Members of the Residency Review Committee-Surgery. Brief communication of the Residency Review Committee-Surgery (RRC-S) on residents' surgical volume in general surgery. J Surg. 2005 Sep;190(3):345-50.

The Residency Review Committee-Surgery (RRC-S), 1 of 10 surgical specialties of the Accreditation Council for Graduate Medical Education (ACGME) has monitored the surgical volume of all general surgical residents closely. As a consequence of the reduction of duty hours with the limitation of an 80-hour work-week (averaged over 4 weeks), the authors were interested in the impact of these restrictions on surgical (volume) experience since its first year of implementation (2003--2004). They evaluated the surgical volume of general surgical services since the implementation of the ACGME duty-hour restrictions and compared this volume with that of previous years without these duty limits.

The Biostatistical Management Section of the ACGME implemented prospective analysis of categorized data for total surgical procedures and Chief Resident cases. The study interval included all resident surgical procedures completed from 1997 to 2004. The authors were interested particularly in evaluating trends and outcomes after the first year of successful full compliance of the 80-hour work week. Specific evaluations included the impact on surgical programs for total major procedures and Chief Resident cases requisite for application to the American Board of Surgery. The average number of total major procedures for both resident and program averages were noted to increase steadily through the academic years of evaluation (1997--2001). A sharp decrease was evident in the total major procedures for the academic year 2001--2002 that relates to a correction of the biostatistical database implemented by the ACGME to correct a system conversion that began in the academic year 2001--2002. Despite significant changes to the system data mappings, beginning in the academic year 2001, this reduction is explained by the total counted surgeries as major that were eliminated in a revised counting methodology. It was evident on evaluation of the average (of averages) for major surgical procedures per resident (per program) in academic years 1997 to 2004 that the number of procedures was not statistically different in the academic years evaluated when compared with the year for implementation of duty-hour standards (2003--2004). **Data analysis further indicates that the average procedures (per resident) performed as Chief Resident in general surgery remained stable from 1997 to 2004; the use of tiered t tests comparing Chief Resident averages (per program) for the academic years 2002--2003 versus 2003--2004 indicated that data remained consistent and confirmed no statistical variance in volumes during this interval (P=0.43).** Because some general surgery programs have exceptions for duty-hour requirements (n=15) to allow an 88-hour week averaged over 4 weeks, these differences were of interest to evaluate programs with and without these duty-hour exceptions. **Preliminary data with these limited parameters of evaluation suggest no detrimental outcomes related to the duty-hour restrictions for total major procedures per resident or for surgical procedures as Chief Residents for programs with and without these approved exceptions.**

RRCs that evaluate general surgery and surgical specialties have responded aggressively and professionally to implement the duty-hour standards per the ACGME. This brief report should be considered an interim communication to evaluate the surgical experience impact for programs currently under the restriction of duty-hour limits. The data provided in the first year of evaluation since the implementation of the 80-hour work-week restriction policy suggest that there has been no significant change in the overall surgical experience for major procedures (per resident), nor has there been a negative impact on Chief Resident surgical experience. A continuum of the prospective evaluation

process is required by the RRC-S and other surgical specialties to ensure that requisite surgical volume is maintained throughout the entire 5 years of clinical surgery.

Chung RS. How much time do surgical residents need to learn operative surgery? Am J Surg. 2005 Sep;190(3):351-3.

The authors calculated the time a resident spent to acquire the average operative experience before mandated duty hours, to generate a standard for curriculum redesign. Using data from 2002 to 2003 furnished by the Residency Review Committee for Surgery, and the operation times of attending surgeons in a hospital consortium, the time devoted to operative surgery over 5 years of training were calculated. **An average of 2753 hours or 14.3% of 19,200 hours (5 years of 80-hour work weeks) were spent as a chief surgeon, 272 hours as an assistant, and another 938 hours for immediate preoperative and postoperative attendance. The average total time for operative training was 3963 hours or 20.6% of 5 years of 80-hour weeks (16.5 h/wk).** The database is useful for redesigning the surgical curriculum for the mandated duty hours. It also may be used to determine rapidly if a program currently is providing sufficient time for operative surgery.

Fletcher KE, Underwood W 3rd, Davis SQ, Mangrulkar RS, McMahon LF Jr, Saint S. Effects of work hour reduction on residents' lives: a systematic review. JAMA. 2005 Sep 7;294(9):1088-100.

This review of the literature sought to assess the effect of the duty hour limits on aspects of the lives of residents. The authors summarized the literature regarding the effect of interventions to reduce resident work hours on residents' education and quality of life. They searched the English-language literature about resident work hours from 1966 through April 2005 using MEDLINE, EMBASE, and Current Contents, supplemented with hand-search of additional journals, reference list review, and review of abstracts from national meetings.

Studies were included that assessed a system change designed to counteract the effects of resident work hours, fatigue, or sleep deprivation; included an outcome directly related to residents; and were conducted in the United States. For each included study, 2 investigators independently abstracted data related to study quality, subjects, interventions, and findings using a standard data abstraction form.

Fifty-four articles met inclusion criteria. The interventions used to decrease resident work hours varied but included night and day float teams, extra cross-coverage, and physician extenders. **Outcomes included measures of resident education (operative experience, test scores, satisfaction) and quality of residents' lives (amount of sleep, well-being). Interventions to reduce resident work hours resulted in mixed effects on both operative experience and on perceived educational quality but generally improved residents' quality of life. Many studies had major limitations in their design or conduct. Past interventions suggest that residents' quality of life may improve with work hour limitations, but interpretation of the outcomes of these studies is hampered by suboptimal study design and the use of non-validated instruments. The long-term impact of reducing resident work hours on education remains unknown. Current and future interventions should be evaluated with more rigorous methods and should investigate links between residents' quality of life and quality of patient care.**

Irani JL, Mello MM, Ashley SW, Whang EE, Zinner MJ, Breen E. Surgical residents' perceptions of the effects of the ACGME duty hour requirements 1 year after implementation. Surgery. 2005 Aug;138(2):246-53.

The objectives of this study were (1) to determine the extent and means of compliance with the ACGME requirements within general surgery residency programs and (2) to examine general surgery residents'

perceptions of the effects of the ACGME requirements on patient care and residents' training experience. A survey was mailed to residents in 19 New England general surgery programs in spring 2004 (n=238).: The overall response rate was 36%. More than 89% of respondents reported that the requirements generally were being enforced, and respondents' mean work hours (80.8 +/- 11.7 per week) supported this claim. **Forty-three percent felt that quality of care had deteriorated. Although 70% perceived decrements in continuity of care, only 32% believed that the risk of patient management errors had increased. Sixty percent reported doing fewer operations, and half felt that residents missed out on too many learning opportunities. Yet, only 39% reported that the requirements had worsened the quality of training. Residents consistently reported an improved quality of life. Seventy-five percent felt that, overall, the requirements were a good thing.**

Most surgical residents do not believe that the ACGME duty hour requirements have had their intended effect of improving quality of care and are ambivalent about effects on the quality of their training. However, they report an improved quality of life, and most residents do support the requirements overall.

Ellman PI, Kron IL, Alvis JS, Tache-Leon C, Maxey TS, Reece TB, Peeler BB, Kern JA, Tribble CG. Acute sleep deprivation in the thoracic surgical resident does not affect operative outcomes. Ann Thorac Surg. 2005 Jul;80(1):60-4; discussion 64-5.

There is an increasing trend toward work hour restrictions for doctors world wide. These reforms have been inspired, in part, by the assertion by some that the fatigued physician is more prone to making errors. Interestingly, there is very little in the way of objective data with regard to the effects of sleep deprivation on patient outcomes. The authors previously studied this in attending surgeons. The present study focused on thoracic surgical residents. The study hypothesis was that acute sleep deprivation would not lead to an increase in operative times or complications.

A retrospective review of all cases performed by thoracic surgical residents at the University of Virginia from January 1994 to March of 2004 was done. **Complication rates of cases performed by "sleep deprived" (SD) residents were compared with cases done when the residents were "not sleep deprived" (NSD). A resident was deemed sleep deprived if he or she performed a case the previous evening that started between 10 pm and 5 am or ended between the hours of 11 pm and 7:30 am. A total of 7,323 cases were recorded in the STS database over the 10-year period examined. Two hundred and twenty-nine of these cases (3%) were performed by SD residents. Mortality rates for coronary artery bypass operations showed no significant differences (2.1% [SD = 3 of 141 patients] vs. 3.1% (NSD = 143 of 4452 patients), p = 0.63). A comparison of operative, neurologic, renal, infectious, and pulmonary complications as well as cardiopulmonary bypass times, cross-clamp times, the use of blood products, and length of stay also demonstrated no significant differences between groups.** The authors concluded that acute sleep deprivation in thoracic surgical residents does not affect operative efficiency, morbidity, or mortality in cardiac surgical operations.

McElearney ST, Saalwachter AR, Hedrick TL, Pruett TL, Sanfey HA, Sawyer RG. Effect of the 80-hour work week on cases performed by general surgery residents. Am Surg. 2005 Jul;71(7):552-5; discussion 555-6.

Due to the traditionally long hours in general surgery, the effect of restrictions on surgical training and case numbers was a matter of concern. Data was compiled retrospectively from ACGME logs and operating room (OR) records at a university hospital for 2002 and 2003. Work week restrictions began in January 2003. This data was reviewed to determine resident case numbers, both in whole and by postgraduate year (PGY). Mean case numbers per resident-month in 2002 were 8.8 +/- 8.2 for PGY1s, 16.2 +/- 15.7 for PGY2s, 31.4 +/- 12.9 for PGY3s, 31.5 +/- 17.6 for PGY4s, and 31.5 +/- 17.6 for PGY5s. **In 2003, they were 8.8 +/- 5.2 for PGY1s, 16.6 +/- 13.9 for PGY2s, 27.8 +/- 12.5 for PGY3s, 38.2 +/-**

18.8 for PGY4s, and 26.1 +/- 9.6 for PGY5s. PGY1s, PGY2s, PGY3s, PGY4s, or all classes were not statistically different. PGY5s did have statistically fewer cases in 2003 (P = 0.03). PGY5s did have statistically fewer cases after the work-hours restriction, which likely represented shifting of postcall afternoon cases to other residents. Comparing other classes and all PGYs, case numbers were not statistically different. Operative training experience does not appear to be hindered by the 80-hour work week.

Kaafarani HM, Itani KM, Petersen LA, Thornby J, Berger DH. Does resident hours reduction have an impact on surgical outcomes? J Surg Res. 2005 Jun 15;126(2):167-71.

The article assessed the impact of restricting surgical resident work hours as required by the Accreditation Council for Graduate Medical Education (ACGME), on postoperative outcomes. The divisions of General and Vascular Surgery at the Michael E. DeBakey Houston Veteran Affairs Medical Center implemented a limited work hours schedule effective October 1, 2002. The authors compared the rate of postoperative morbidity and mortality before and after the new schedule. Clinical data were collected by the VA National Surgical Quality Improvement Program (NSQIP) for the periods of October 1, 2001 to September 30, 2002 (preintervention), and October 1, 2002 to September 30, 2003 (postintervention). The study assessed risk-adjusted observed to expected (O/E) ratios of mortality and prespecified postoperative morbidity for each study period.

In the preintervention period, there were 405 general surgery and 202 vascular surgery cases as compared to 382 and 208 cases, respectively in the postintervention period. There were no significant differences in mortality O/E ratios between the pre- and postintervention periods (0.63 versus 0.60 in general surgery; 0.78 versus 0.81 in vascular surgery; P = 0.90 and 0.94, respectively) or in morbidity O/E ratios (1.06 versus 1.27 in general surgery; 1.47 versus 1.50 in vascular surgery; P = 0.20 and 0.90, respectively). The restricted resident work hour schedule in general and vascular surgery in the authors' facility did not significantly affect postoperative outcomes.

Kupferman TA, Lian TS. Implementation of duty hour standards in otolaryngology-head and neck surgery residency training. Otolaryngol Head Neck Surg. 2005 Jun;132(6):819-22.

To determine what impact of the recently implemented duty hour standards have had on otolaryngology-head and neck surgery residency programs from the perspective of program directors. The authors hypothesized that the implementation of resident duty hour limitations caused changes in otolaryngology training programs in the United States. Information was collected via survey in a prospective, blinded fashion from program directors of otolaryngology-head and neck residency training programs in the United States.

Overall, limitation of resident duty hours is not an improvement in otolaryngology-head and neck residency training according to 77% of the respondents. The limitations on duty hours have caused changes in the resident work schedules in 71% of the programs responding. Approximately half of the residents have a favorable impression of the work hour changes. Thirty-two percent of the respondents indicate that changes to otolaryngology support staff were required, and of those many hired physician assistants. Eighty-four percent of the respondents did not believe that the limitations on resident duty hours improved patient care, and 81% believed that it has negatively impacted resident training experience. Forty-five percent of the program directors felt that otolaryngology-head and neck faculty were forced to increase their work loads to accommodate the decrease in the time that residents were allowed to be involved in clinical activities. Fifty-four percent of the programs changed from in-hospital to home call to accommodate the duty hour restrictions.

According to the majority of otolaryngology-head and neck surgery program directors who responded to the survey, the limitations on resident duty hours imposed by the ACGME are not an

improvement in residency training, do not improve patient care, and have decreased the training experience of residents. This study demonstrates that multiple changes have been made to otolaryngology-head and neck surgery training programs because of work hour limitations set forth by the ACGME.

Gallagher SF, Ross SB, Haines K, Shalhub S, Fabri PJ, Karl RC, Murr MM. Realistic expectations and leadership in the era of work hour reform. J Surg Res. 2005 Jun 15;126(2):137-44.

Work hour guidelines and core competencies were introduced to improve surgical education and are changing the landscape of surgical training. The authors sought to examine perceptions and attitudes regarding the impetus and impact associated with these changes. Anonymous surveys were distributed to faculty and surgeons-in-training in an Accreditation Council for Graduate Medical Education, university-based, training program. Faculty (F, n = 30) and trainees (T, n = 30) agree that lifestyle expectations and long work hours are the principal issues facing surgical education (F = 80%, T = 56%; P = 0.03). Implementation of ACGME guidelines is perceived as NOT improving patient care or clinical experience (F = 100%, T = 90%; P = 0.03) while reducing operative experience (F = 50%, T = 70%). More faculty (>80%) than trainees (33%) are concerned that ACGME guidelines will diminish patient care experiences. Although most (F = 77%, T = 83%; P = NS) agree that hiring additional providers will improve guideline compliance, many oppose ACGME guideline implementation fearing a loss of professionalism. Although both (F = 50%, T = 47%) admonish deficient interpersonal and communication skills as the major impediment to implementing ACGME guidelines, opinions regarding implementation differ. Most faculty physicians (67%) believe ACGME-imposed deadlines are the most influential reason; however, trainees (57%) believe guidelines should be promptly implemented to address long-awaited changes in work environment and surgical graduate medical education. Although faculty and trainees' perception of the issues surrounding ACGME guidelines converge, perception of changes following implementation is quite divergent. For successful implementation, leadership must address prevailing attitudes and set realistic expectations. These trends have important implications for planning the future of surgical education, unifying multi-generational colleagues, and improving systems-based practice.

Reiter ER, Wong DR. Impact of duty hour limits on resident training in otolaryngology. Laryngoscope. 2005 May;115(5):773-9.

The article sought to test the hypothesis that the implementation of Accreditation Council for Graduate Medical Education (ACGME) duty hour standards has had limited effects on resident training in otolaryngology. It used a retrospective survey of residents and residency program directors (PDs). Surveys were mailed to residents and PDs in otolaryngology asking about compliance with ACGME duty hour standards and perceptions of changes brought on by the new regulations.

Surveys were returned by 53.5% of PDs and 29.9% of residents. A majority of PDs described changes made to achieve compliance as "minor;" this consisted most commonly of altering call structure, although some programs hired new support staff or faculty. **Mean estimated costs for changes were \$14,211. Residents reported working a mean of 67.5 hours per week. Among PDs and residents, only 60% to 70% reported always being in compliance with the main components of the duty hour standards.** Residents were largely divided in their opinions as to whether the duty hour limits had led to improvements in patient care, resident education, fatigue, or errors, although most felt that improvement in resident morale had occurred. PDs were more negative because almost half disagreed that improvement had occurred in any of these areas.

Compliance with ACGME duty hour standards remains challenging in otolaryngology. Neither residents nor PDs agree that implementation of the duty hour standards has led to the intended improvements in patient care or resident education, although most agree that resident morale has

improved. Further study of objective patient care and educational outcome measures is indicated to validate the need for this change in residency training.

Spencer AU, Teitelbaum DH. Impact of work-hour restrictions on residents' operative volume on a subspecialty surgical service. J Am Coll Surg. 2005 May;200(5):670-6.

Whether the 80 hours per week limit on surgical residents' work hours has reduced the number or variety of cases performed by residents is unknown. The authors quantified residents' operative experience, by case category, on a pediatric surgical service. The number of senior and junior residents' cases were compared between residents from the year before (n = 47) and after (n = 44) the 80-hour limit. Residents also completed a questionnaire about their operative experience. As an additional dimension of the educational experience, resident participation in clinic was assessed. Student's t-test was used.

The total number of cases performed either by senior (before, 1.58 +/- 0.42 versus after, 1.84 +/- 0.82 cases/day) or junior (before, 0.70 +/- 0.21 versus after, 0.71 +/- 0.15) residents did not change (p = NS). Senior residents' vascular access and endoscopy rate increased; other categories remained stable. Residents' perception of their experience was unchanged. But residents' participation in outpatient clinic was significantly decreased (before, 66.0% +/- 14.7% versus after, 17.0% +/- 19.9% of clinics covered, p < 0.005). The 80-hour limit has had minimal impact on residents' operative experience, in case number and variety, and residents' perceptions of their educational experience. Residents' reduction in duty hours may have been achieved at the expense of outpatient clinic experiences.

Zuckerman JD, Kubiak EN, Immerman I, Dicesare P. The early effects of code 405 work rules on attitudes of orthopaedic residents and attending surgeons. J Bone Joint Surg Am. 2005 Apr;87(4):903-8.

The impact of strict enforcement of Section 405 of the New York State Public Health Code to restrict resident work to eighty hours per week and the adoption of a similar policy by the Accreditation Council on Graduate Medical Education in 2002 for orthopaedic residency training have not been evaluated. Adoption of these rules has created accreditation as well as staffing problems and has generated controversy in the surgical training community. The purposes of this study were (1) to evaluate the attitudes of orthopaedic residents and attending surgeons toward the Code 405 work-hour regulations and the effect of those regulations on the perceived quality of residency training, quality of life, and patient care and (2) to quantify the effect of the work-hour restrictions on the actual number of hours worked.

The authors administered a thirty-four-question Likert-style questionnaire to forty-eight orthopaedic surgery residents (postgraduate years [PGY]-2 through 5) and a similar twenty-nine-question Likert-style questionnaire to thirty-nine orthopaedic attending surgeons. All questionnaires were collected anonymously and analyzed. Additionally, resident work hours before and after strict enforcement of the Code 405 regulations were obtained from resident time sheets.

The average weekly work hours decreased from 89.25 to 74.25 hours for PGY-2 residents and from 86.5 to 73.25 hours for PGY-3 residents, and they increased from 61.5 to 68.5 hours for PGY-4 residents. Residents at all levels felt that they had increased time available for reading. There was general agreement between attending and resident surgeons that their operating experience had been negatively impacted. Senior residents thought that their education had been negatively affected, while junior residents thought that their operating experience in general had been negatively affected. Senior residents and attending surgeons felt that continuity of care had been negatively impacted. All agreed that quality of life for the residents had improved and that residents were more rested.

On the basis of the survey data, the implementation of the new work-hour restrictions was found to result in a decrease in the number of hours worked per week for PGY-2 and PGY-3 residents and in an increase in work hours for PGY-4 residents. This could explain the definite difference between the attitudes expressed by the senior residents and those of the junior residents. Senior residents felt that their education was negatively impacted by the work rules, while junior residents expressed a more neutral view. However, senior residents did not believe that their operative experience was as negatively impacted as did junior residents. Although junior and senior residents and attending surgeons agreed that resident quality of life had improved, the study was not able to determine whether this offset the perceived negative impact on education, continuity of care, and operative experience.

Malangoni MA, Como JJ, Mancuso C, Yowler CJ. Life after 80 hours: the impact of resident work hours mandates on trauma and emergency experience and work effort for senior residents and faculty. J Trauma. 2005 Apr;58(4):758-61; discussion 761-2.

The purpose of this study was to evaluate the impact of work hours mandates on (1) senior resident patient exposure and operating experience in trauma and emergency surgery and (2) faculty work effort. The authors measured resident and faculty work on the trauma and emergency surgery services at a Level I trauma center during two comparable 6-month periods. Period 1 (July 1-December 31, 2002) had no call restrictions, separate trauma and emergency service resident call, and some overlap of faculty call responsibilities. Period 2 (July 1-December 31, 2003) had resident work hours compliance and complete integration of resident and faculty trauma and emergency call. Work hours were measured by surveys for faculty and residents. All data were collected prospectively.

Resident exposure to trauma patients was similar during both time periods. Emergency surgery admissions declined during period 2; however, intensive care unit admissions increased. The number of operations performed by senior residents did not change; however, there was a shift in the median number of emergency surgery cases to more senior residents. Faculty work hours increased slightly despite a decrease in faculty call. Work hours compliance resulted in a 50% reduction in senior resident call and a 19% decrease in their work hours with no significant change in trauma/emergency patient care exposure or operative case load. Service call amalgamation reduced faculty call by 21% but did not result in a corresponding change in work hours or productivity.

Lieberman JD, Olenwine JA, Finley W, Nicholas GG. Residency reform: anticipated effects of ACGME guidelines on general surgery and internal medicine residency programs. Curr Surg. 2005 Mar-Apr;62(2):231-6.

The authors explored the opinions of program directors regarding the impact of the changes on residents and residency programs. General surgery and internal medicine program directors were sent a 19-question survey. Questions were asked regarding anticipated effects on patient safety, resident well-being, education, medical errors, implementation costs, and methods needed for compliance. Data were analyzed using the chi-square test, the Mann-Whitney method, and the independent samples t-test where appropriate.

Responses were received from 153 surgery program directors and 126 medicine program directors. Differences noted were hours worked (surgery 84.2 hours vs. medicine 68.7 hours, $p < 0.0005$), current compliance (49% vs. 73%, $p < 0.0005$), and allowance of internal (13% vs. 54%, $p < 0.0005$) and external (24% vs. 58%, $p < 0.0005$) moonlighting. **Program directors anticipate improved resident safety and well-being. However, education, continuity of care, and board certification success are not expected to improve. Increased cost to institutions is anticipated. Surgery program directors feel medical errors will not decrease; medicine program directors are neutral. To facilitate compliance, surgery**

program directors anticipate employing physicians' assistants and technology, whereas medicine program directors may implement night float. Neither surgery nor medicine program directors expects increased quantity or quality of applicants. Program directors agree resident work hour reform is essential; however, varied methodology and outcomes are expected.

Vetto JT, Robbins D. Impact of the recent reduction in working hours (the 80 hour work week) on surgical resident cancer education. J Cancer Educ. 2005 Spring;20(1):23-7.

The authors sought to determine whether the 80-hour limit affected resident learning related to the care of cancer. Of 85 residents in a large, university-based surgical training program, the study focused on the 40 who had been in the clinical program (rather than research) before and after the work hour reduction. Perceived impact on cancer education was determined by survey, and real impact by before (2002) and after (2004) scores on the overall and cancer-specific portion of the annual American Board of Surgery In-Training Examination (ABSITE).

All eligible residents responded to the survey. The majority (83% to 85%) indicated that exposure to cancer patients on wards and in clinics remained the same. Thirty percent felt that their exposure to cancer operations and tumor boards had decreased; 60% to 65% felt that exposure to these activities were unchanged. Approximately half of residents reported an increase in their cancer-related reading and Internet learning activities--the other half felt they had not changed. **The majority (88%) reported no change in their participation in extraprogrammatic cancer-related continuing medical education activities. Of the survey responders, 23 had completed the ABSITE in both 2002 and 2004; their mean scores between the 2 time periods increased by 7% for the overall test and decreased by 3% for the cancer-specific portion. Overall, the recent reduction in work hours does not appear to have changed residents' experience with cancer patient care, although possible early reductions in attendance at cancer operations and tumor boards merits further study and possibly future schedule changes.** The reported perceived increase in cancer-related reading and Internet learning has not yet translated into improved test scores.

Cohen-Gadol AA, Piegras DG, Krishnamurthy S, Fessler RD. Resident duty hour reform: results of a national survey of the program directors and residents in neurosurgery training programs. Neurosurgery. 2005 Feb;56(2):398-403.

New Accreditation Council for Graduate Medical Education (ACGME) requirements regarding resident work hours were implemented in 2003. Neurological surgery training programs have been especially affected because of the limited number of residency positions and the residents' long duty hours. The perceptions of program directors and residents may provide important insight into the evolution of new guidelines for improvement of resident training. The authors conducted a nationwide survey of 93 program directors and 617 residents to characterize their perceptions regarding the changes in their training programs related to compliance with the ACGME requirements. The survey was conducted from July through September 2003 using electronic mail.

The response rates were 45% and 23% among program directors and residents, respectively. Most programs offered one (37%) or two (38%) resident training positions per year. Although 92% of programs had implemented the ACGME work hour requirements before or since July 2003, 8% had not yet implemented these guidelines. Sixty-eight percent of program directors indicated employment of ancillary health care professionals to fulfill the ACGME duty hour reform; 84% (95% confidence interval [CI], 64-94%) thought that this practice has not limited the residents' clinical experience. Eleven percent of respondents (18 of 164 respondents) who provided Level I trauma coverage were unable to maintain compliance with the ACGME guidelines. Ninety-three percent (95% CI, 89-96%) of all respondents thought that the work hour reform has had a negative impact on the continuity of patient care. Fifty-five

percent (95% CI, 46-63%) of the residents and only 33% (95% CI, 20-50%) of the program directors thought that the ACGME requirements are likely to result in improved American Board of Neurological Surgery written test scores. Twenty-nine percent (95% CI, 22-37%) of the residents and 17% (95% CI, 8-32%) of the program directors thought that resident attendance at national conferences would increase. Similarly, although 46% (95% CI, 37-54%) of residents perceived that these work hour limitations would facilitate residents' research/publication-related activities, only 21% (95% CI, 11-37%) of program directors agreed. Forty-one percent (95% CI, 33-49%) of the residents and 74% (95% CI, 58-86%) of the program directors perceived that the chief residents operate on fewer complex cases since the institution of the ACGME duty hour guidelines. Seventy-five percent of residents think they are less familiar with their patients. **Overall, 61% (95% CI, 53-69%) of the residents and 79% (95% CI, 63-89%) of the program directors noted that the ACGME guidelines have had a negative effect on their training programs. The authors concluded that the majority of residents and program directors think that the ACGME duty hour guidelines have had an adverse effect on continuity of patient care and resident training. The effects of these guidelines on neurosurgery programs should be carefully monitored, because more sophisticated solutions may be needed to address house staff fatigue.** Strategies to enhance the educational content of the residents' work hours and to preserve continuity of patient care are necessary.

Mendoza KA, Britt LD. Resident operative experience during the transition to work-hour reform. Arch Surg. 2005 Feb;140(2):137-45.

The operative volume of chief residents would decrease with work-hour reform by the Accreditation Council for Graduate Medical Education (ACGME). The authors used a mixed-design study performed during July and December 2003. Collected data were from programs experimenting with work-hour reform and programs that had not yet implemented reform. New York programs were also included. Telephone conversations were conducted with ten randomly selected program directors. The survey also used operative logs from chief residents graduating in 2002 and 2003 and a survey requesting information on programmatic changes. **Of the 80 programs that responded, statistical analyses revealed the following findings: (1) there were no significant differences in the operative volume of chief residents based on work-hour model, program setting, or graduating class; (2) there was no significant difference in chiefs' operative volume between programs that experimented with work-hour reform and programs that did not experiment with work-hour reform during 2002-2003; (3) there was no relationship found between work hours and volume of operative cases; and (4) there was an inverse relationship found between work hours and operative volume for residents in New York programs.** Several correlates must be considered for effective assessment and evaluation of the impact of work-hour reform on surgical training and education.

Stamp T, Termuhlen P, Miller S, Nolan D, Hutzel P, Gilchrist J, Johnson RM. Before and after resident work hour limitations: an objective assessment of the well-being of surgical residents. Curr Surg. 2005 Jan-Feb;62(1):117-21.

The purpose is to assess the impact of resident work hour limitations on how surgical residents feel about their training, patient care, and their overall well-being. Three surveys were administered to 28 categorical surgery residents before and after implementation of the Accreditation Council on Graduate Medical Education (ACGME) work hour restrictions. The surveys consisted of a Beck Depression Inventory II (BDI-II), a SF-36 Health Status Profile (SF-36), and a custom 20-item Likert scale survey. The results of the surveys were then compiled to evaluate any significant changes in resident attitudes. Only minor differences were noted in the BDI-II and SF-36. The Likert scale survey showed no differences in attitude toward resident education, faculty interaction, operating room exposure, patient

care, or continuity. Significant improvements were noted in the feelings of residents toward time for reading, rest, time with family, and socializing. Although a great deal of concern has existed about the impact of work hour limitations on surgery resident training, residents feel their training has not been affected significantly. Work hour restrictions have, however, had a positive impact on the lives of surgery residents outside of the hospital.

Henry MC, Silverman BL, Moss RL. The impact of the 80-hour workweek on pediatric surgical training: an Association of Pediatric Surgery Program Directors-sponsored study. J Pediatr Surg. 2005 Jan;40(1):60-7; discussion 67-8.

The aim of this study was to determine the preliminary impact of work hour regulations on pediatric surgical training. An anonymous survey was sent to all program directors (PDs) and fellows to identify changes in pediatric surgery fellowship programs. Ninety-three percent of programs and 87% of PDs responded. Thirty programs hired additional personnel, including nurse practitioners, physician assistants, and fellows outside the training program. Thirteen programs reported increased attending coverage. The daily composition of the surgical team has changed, with post-call fellows and residents leaving in the morning. Residents and fellows also take call less frequently. More than 50% of PDs felt that quality of care had declined and three quarters of respondents felt that continuity of care was worse. Half of the respondents feared missed educational opportunities. However, half of the fellows felt more rested, 61% reported more family time, and 22% reported increased social time. In contrast, no PDs perceived life-style improvements. The work hour regulations have resulted in fundamental changes in pediatric surgical training. Ongoing assessment is needed to prioritize quality of care, improve continuity of care, and track changes in operative, clinical, and didactic experiences of the trainees. The added impact of these changes on the time spent available for commitment to teaching by the faculty should be assessed.

Jakubowicz DM, Price EM, Glassman HJ, Gallagher AJ, Mandava N, Ralph WP, Fried MP. Effects of a twenty-four hour call period on resident performance during simulated endoscopic sinus surgery in an Accreditation Council for Graduate Medical Education-compliant training program. Laryngoscope. 2005 Jan;115(1):143-6.

Since the early 1990s, extended resident work hours have undergone increasing scrutiny. Although previous studies have demonstrated conflicting results regarding cognitive decline secondary to fatigue, few studies have specifically examined the effects of fatigue on surgical performance. No previous studies have examined resident performance under current Accreditation Council for Graduate Medical Education (ACGME) work-hour guidelines that limit residents to an average number of work hours of 80 hours per week. The study sought to determine whether an endoscopic sinus surgery simulator (ES3) measured performance changes before and after a 24-hour on-call period in residents following mandated work-hour limitations. Eight general surgical residents were trained on the novice mode of the ES3. These residents were then tested twice both before and after on-call duties. **Performance and hazard scores were compared using a paired t test. No statistically significant change in the number of errors, time to task completion, or overall performance was identified in the study between the pre-call and post-call groups. There was a trend toward improved speed at the expense of accuracy in the post-call group. Post-call score between the two trials improved, on average, by 3.3 (P = .045). The authors concluded that there was no diminution in performance before and after a 24-hour on-call period. There was a trend toward improved speed at the expense of accuracy. Furthermore, repetition on the ES3 in the post-call period can result in improved ES3 proficiency.**

Basu CB, Chen LM, Hollier LH Jr, Shenaq SM. The effect of the Accreditation Council for Graduate Medical Education Duty Hours Policy on plastic surgery resident education and patient care: an outcomes study. *Plast Reconstr Surg.* 2004 Dec;114(7):1878-86.

The Accreditation Council for Graduate Medical Education (ACGME) Work-Hours Duty Policy became effective on July 1, 2003, mandating the reduction of resident duty work hours. The Baylor College of Medicine Multi-Institutional Integrated Plastic Surgery Program instituted a resident duty work-hours policy on July 1, 2002 (1 year ahead of the national mandate). Outcomes data are needed to facilitate continuous improvements in plastic surgical residency training while maintaining high-quality patient care. To assess the effect of this policy intervention on plastic surgery resident education as measured through the six core competencies and patient/resident safety, the investigators surveyed all categorical plastic surgery residents six months after implementation of the policy. This work represents the first empiric study investigating the effect of duty hour reduction on plastic surgery training and education. The categorical plastic surgery residents at the Baylor College of Medicine Multi-Institutional Integrated Plastic Surgery Program completed a 68-item survey on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Residents were asked to rate multiple parameters based on the ACGME six core competencies, including statements on patient care and clinical/operative duties, resident education, resident quality of life, and resident perceptions on this policy. All surveys were completed anonymously. The sample size was n = 12 (program year 3 through program year 6), with a 100 percent response rate. Univariate and bivariate statistical analysis was conducted with SPSS version 10.0 statistical software. Specifically, interquartile deviations were used to find consensus among resident responses to each statement. Descriptive statistics indicated higher percentages of agreement on a majority of statements in three categories, including patient care and clinical/operative duties, academic duties, and resident quality of life. Using interquartile deviation, the highest levels of consensus among the residents were found in positive statements addressing resident alertness (both in and out of the operative environment), time to read/prepare for cases/conferences, efficacy of the didactic curriculum, and overall satisfaction with this policy for surgery resident education. Residents also felt that their patients favored this work hour policy. In addition, there was high consensus that this policy improved overall patient care. The majority of residents identified a negative effect of this policy through an increase in cross-coverage responsibilities, however, and half of the residents perceived that faculty negatively viewed their unavailability post-call. In addition, no consensus among the residents was achieved regarding perceptions on overall weekly operative experience. Plastic surgery residents perceived that the reduction of resident work hours through adherence to the ACGME guidelines has beneficial effects on patient care and clinical/operative duties, academic duties, and resident quality of life. **Residents felt, however, that these benefits may increase cross-coverage workloads. Furthermore, residents were concerned about faculty perception of their changes in post-call duties. In contrast to previously published findings in the general surgery literature, the current results indicate that residents do not believe that this policy negatively affects continuity of patient care. In fact, the current findings suggest that adherence to this policy improves patient care on multiple levels. The effect on the operative experience remains to be elucidated.** Further large-scale and longitudinal research design and analysis is warranted to better assess the results of the ACGME resident duty work-hours policy in plastic surgery resident education.

Chung R, Ahmed N, Chen P. Meeting the 80-hour work week requirement: what did we cut? *Curr Surg.* 2004 Nov-Dec;61(6):609-11.

To meet the new accreditation requirement, small programs with limited manpower must make hard decisions to safeguard quality. The authors devised a system to meet the requirement, making the obligatory cuts in educational components as prioritized by the trainees. This study examined what aspect of training is impacted and the residents' perception of the resulting change. In a fully accredited program where the baseline work hours/week exceeded the new requirement by over 20% even with full deployment of physician's assistants, the strategies used included reducing external rotations, transitioning

PGY-3 into senior responsibility, and integrating senior rotations to 2 hospitals into 1 (2 weeks/month), so that time in a lower volume hospital helped to bring the monthly average to target. Residents were surveyed at 6-month intervals for their perception of the change. Compared with baseline, the new system averaged 77 +/- 5 hours/week, significantly reduced from before (98 +/- 12, $p < 0.01$), but with greatly reduced continuity of care (28 +/- 10% vs. 88 +/- 8%, $p < 0.001$), reduced consultations seen (19 +/- 4 vs. 36 +/- 7 per week, $p < 0.001$), reduced conference attendance (5.7 vs. 3.5 per week, $p < 0.001$), and reduced operations (55 +/- 7 vs. 68 +/- 9 per week for the program). External rotations have been reduced by 3 months, and outpatient clinics merged from 5 to 2. Surveys showed improvement in fatigue-related issues for junior residents. Senior residents were dissatisfied with the reduced educational components. Reducing work hours cannot be accomplished without reducing educational components. Unlike junior residents, senior residents felt less fulfilled with the new system and do not benefit in physical fatigue.

Jarman BT, Miller MR, Brown RS, Armen SB, Bozaan AG, Ho GT, Hartranft TH. The 80-hour work week: will we have less-experienced graduating surgeons? Curr Surg. 2004 Nov-Dec;61(6):612-5.

Our primary concern when modifying the Mount Carmel Medical Center surgical residency to comply with the "80-hour work week" was the effect on operative experience. The goal was to measure the impact that work-hour restrictions have on operative volumes and to evaluate the potential benefit of a night rotation to minimize the number of "lost operations." Categorical surgical residents (PGY I-IV) recorded missed surgical procedures on post-call days from September 1, 2002 to March 31, 2004. The data collection is split between the pre-night rotation (September 1, 2002 to March 31, 2003) and post-night rotation (April 1, 2003 to March 31, 2004) periods. The post-night rotation period is further divided to account for the end of the academic year. Previous graduate operative logs were reviewed for comparison. Mount Carmel Health System is a tertiary referral, community-based hospital in Columbus, Ohio. Participants were categorical general surgery residents (Postgraduate Years I to V). In the 7-month period, extending from September 1, 2002 to March 31, 2003, the average number of missed cases for successive levels was PGY I: 21, PGY II: 31, PGY III: 26, and PGY IV: 40. From April 1, 2003 to June 30, 2003, the average number of missed cases for successive levels was PGY I: 3, PGY II: 7, PGY III: 5, and PGY IV: 6. From July 1, 2003 to March 31, 2004, the average number of missed cases for successive levels was PGY I: 34, PGY II: 8, PGY III: 14, and PGY IV: 30. Before the implementation of a night rotation, residents were projected to miss an average of 202 operations over 4 years. After implementation of a night rotation, the projected loss would drop to 107 operations over 4 years. Work-hour restrictions result in a significant decrease in operative experience. This detriment can be partially alleviated with the institution of a night rotation to better regulate in-house call.

Lund KJ, Alvero R, Teal SB. Resident job satisfaction: will 80 hours make a difference? Am J Obstet Gynecol. 2004 Nov;191(5):1805-10.

This study was undertaken to assess job satisfaction and quality of life among obstetrics and gynecology residents before the 80-hour work week. The authors administered a job satisfaction survey to residents before July 1, 2003, assessing satisfaction with residency training, indicators of current quality of life, and predictions for the effect of reduced work hours. They found that residents were satisfied with training, with important outliers, including leisure time, ability to pursue educational reading, and surgical experience. The authors created job satisfaction facets that were generally reliable constructs and valid predictors for overall residency satisfaction. Residents predict more free time and a healthier lifestyle under the new requirements, but do not anticipate using additional time to study or teach. Job satisfaction facets for residents are proposed here and may be refined through further study. **Lower scores for surgical experience are of concern in light of decreasing work hours. Educators must monitor self-directed learning efforts under new work hours.**

Kort KC, Pavone LA, Jensen E, Haque E, Newman N, Kittur D. Resident perceptions of the impact of work-hour restrictions on health care delivery and surgical education: time for transformational change. *Surgery*. 2004 Oct;136(4):861-71.

The Accreditation Council for Graduate Medical Education has recently enacted an 80-hour workweek, which has been in effect in New York State for several years. The authors surveyed surgical residents from all four State University of New York (SUNY) surgical programs to determine their perceptions of the impact of the 80-hour workweek on patient care, surgical education, and personal life. A survey instrument to address the three areas of concern was developed and administered to all surgical residents at the four SUNY programs. Anonymity of the responders was maintained. Responses to the questions were in numeric rank scores and were analyzed by descriptive statistics, chi-square analysis, and analysis of variance. Response rate was 59%. **Factors perceived to be affected negatively by the residents were continuity and safety of care, their operative experience, and their relations with attendings. The factors affected positively were increased personal time and decreased fatigue at work. Interestingly, the latter did not appear to decrease the rate of medical errors in their perception. The 80-hour workweek has the potential to have adverse effects on patient care despite improving the level of fatigue at work. Reengineering the surgical residencies will be needed to take full advantage of the restricted work hours.**

Ellman PI, Law MG, Tache-Leon C, Reece TB, Maxey TS, Peeler BB, Kern JA, Tribble CG, Kron IL. Sleep deprivation does not affect operative results in cardiac surgery. *Ann Thorac Surg*. 2004 Sep;78(3):906-11; discussion 906-11.

There has been an increasing trend towards the mandatory reduction in work hours for physicians because of the fear that sleep-deprived (SD) surgeons are more prone to make mistakes. The authors hypothesized that sleep deprivation would not be associated with increased morbidity or mortality in cardiac operations. A retrospective review was done of all cases performed by all attending cardiac surgeons from January 1994 to April 2003. Complication rates of cases performed by SD surgeons were compared with cases done when the surgeons were not sleep-deprived (NSD). A surgeon was deemed sleep deprived if he or she performed a case the previous evening that started between 10:00 pm and 5:00 am, or ended between the hours of 11:00 pm and 7:30 am.

A total of 6,751 cases were recorded in the Society of Thoracic Surgeons database over the nine-year period examined. **Of these, 339 cases (5%) were performed by SD surgeons, and 6,412 (95%) cases were performed by NSD surgeons. Mortality rates for coronary artery bypass operations showed no significant differences (1.7% [SD = 4/223] vs. 3.1% [NSD = 133/4206]) p = 0.34). Operative (p = 0.47), pulmonary (p = 0.60), renal (p = 0.93), neurologic (p = 0.11), and infectious (p = 0.87) complications of all cases also failed to show any statistically significant differences in any group. Perfusion times, cross-clamp times, and the use of blood products were also similar between groups. The authors concluded that sleep deprivation does not affect operative morbidity or mortality in cardiac surgical operations. These data do not support a need for work hour restrictions on surgeons.**

Gelfand DV, Podnos YD, Carmichael JC, Saltzman DJ, Wilson SE, Williams RA. Effect of the 80-hour workweek on resident burnout. *Arch Surg*. 2004 Sep;139(9):933-8; discussion 938-40.

With the introduction of the newly mandated restrictions on resident work hours, the authors expected improvement in subjective feelings of personal accomplishment and lessened emotional exhaustion and depersonalization. Residents and faculty members in an urban, university-based department of surgery completed an anonymous online Maslach Burnout Inventory Human Services Survey (3rd ed; Consulting

Psychologist Press Inc, Palo Alto) and work-hour registry before and after implementation of new restrictions. Resident work hours per week decreased from 100.7 to 82.6 ($P < .05$) with introduction of the new schedule. Home call and formal educational activity time within working hours (e.g., clinical conferences) significantly ($P < .05$) decreased from 11.5 and 4.8 hours to 4.6 and 2.5 hours per week, respectively. **Operating room hours, clinic time, and duration of rounds did not show a significant change. Changes in parameters of resident and faculty emotional exhaustion, depersonalization, and personal accomplishment did not show statistical significance ($P > .05$). Despite successful reductions in resident work hours, measures of burnout were not significantly affected. However, important clinical activities such as time spent in the operating room, clinic, and making rounds were maintained. Formal in-hospital education time was reduced.**

Chandra RK. The resident 80-hour work week: how has it affected surgical specialties? *Laryngoscope*. 2004 Aug;114(8):1394-8.

The author sought to identify strategies employed by surgical departments to address recently implemented resident duty hour regulations, and to assess resident and faculty acceptance of these changes. Attendees to the 2003 Residency Program Coordinator/Administrator Workshop for sub-specialties (Denver, CO) were surveyed. **The study population included 46 respondents spanning nine surgical sub-specialties. Forty-eight percent of programs instituted at least one administrative change specifically to comply with duty hour regulations. The most commonly employed strategies were the hiring of nurse practitioners or physician assistants (30%) and the use of Internet-based software to track resident duty hours (30%). Other changes included giving call responsibilities to residents on research rotations (19%), institution of home-call (13%), and assignment of a night-float resident (11%). Perceptions of program coordinators indicated that junior residents and junior faculty accepted changes better than did senior residents and senior faculty ($P=.025$).** The resident 80-hour work week is a major health care policy change that has required academic sub-specialty departments to make significant alterations in their administrative structure. Further study is necessary to determine how these changes affect both quality of training and patient care in the short and long term.

Jensen A, Milner R, Fisher C, Gaughan J, Rolandelli R, Grewal H. Short-term sleep deficits do not adversely affect acquisition of laparoscopic skills in a laboratory setting. *Surg Endosc*. 2004 Jun;18(6):948-53.

Residents often are sleep deprived after being on call. This study evaluated the effects of these sleep deficits on the acquisition of laparoscopic skills in the laboratory setting. The amount of sleep on the preceding night was recorded for 40 residents undergoing surgical skills training. The residents underwent a pretest, training, practice, and a posttest using basic (pegboard, cup drop, rope pass) and task-specific (pattern cutting, clip application, loop application) drills. Time to completion, penalty score, and total score were assessed.

Significant improvements were seen in the time and total score for all six drills, with a significant decrease in penalty scores noted for the pegboard and rope pass drills. No significant differences in skill acquisition were attributable to amount of sleep. Training in the laboratory results in significant improvement of basic laparoscopic skills. Because short-term sleep deficits do not appear to hinder the acquisition of these skills, this model can be effectively applied, even after residents have been on call.

Tami TA. Special features topic: the effects of limited work hours on surgical training in otolaryngology-head and neck surgery. *Curr Opin Otolaryngol Head Neck Surg*. 2004 Jun;12(3):217-21.

This paper reviews the historic events that culminated in the development of duty hour regulations, and then discusses many of the problems being encountered as the regulations are implemented. On July 3, 2003, the Accreditation Council for Graduate Medical Education (ACGME) instituted duty hour requirements for residency training programs in the United States. Although these regulations should have come as no surprise to graduate medical education programs, many were nevertheless unprepared for their implementation. In comparison to duty hour restrictions currently in place in European countries, those being implemented in this country are much more lenient. Both the fiscal and the educational impact of these requirements on graduate medical education are substantial. Recent accreditation actions taken against a training program at Johns Hopkins University clearly demonstrates that the ACGME is prepared to strictly enforce these standards. The impact of the new duty-hour requirements on residency training and education will be a matter of great interest as they are implemented throughout the graduate education system in the United States.

Underwood W, Boyd AJ, Fletcher KE, Lypson ML. Viewpoints from generation X: a survey of candidate and associate viewpoints on resident duty-hour regulations. J Am Coll Surg. 2004 Jun;198(6):989-93.

The American Medical Student Association, the Committee of Interns and Residents, and Public Citizen petitioned the Occupational Safety and Health Administration for national resident duty-hour limitations. Subsequently, federal legislation was introduced to limit resident duty hours. To preempt the federal government, the Accreditation of Graduate Medical Education implemented resident duty-hour guidelines. To evaluate the viewpoints and attitudes of surgical resident and staff physicians as they pertain to the national resident duty-hour guidelines, the authors asked attendees of the American College of Surgeons' Candidate Associate Society Forum during the American College of Surgeons Clinical Congress meeting in 2001 to complete a self-administered questionnaire. Analyses were performed to determine the frequency of response for each survey item. **Eighty-six of the 102 (84%) surgeons who attended the American College of Surgeons Forum completed the survey. Most disagreed with the federal government involvement in regulating duty hours. Although most agreed that residents should not be on call more than every third night, viewpoints varied on the other duty-hour guidelines. Most (63.4%) reported that residents should work 81 to 100 hours per week, but 11% reported that residents should work > 101 hours per week and 25.6% reported that <or= 80 hours per week was optimal.** The authors noted that as future guidelines are considered, further studies must be done to determine the viewpoints and attitudes of surgical resident and staff physicians with regard to resident duty-hour reform. These "front line" individuals may have unique insights into the benefits and barriers of duty-hour regulations.

Barone JE, Ivy ME. Resident work hours: the five stages of grief. Acad Med. 2004 May; 79(5):379-80.

The authors describe their reactions, as surgical educators, to the mandate of the Accreditation Council for Graduate Medical Education to reduce resident work hours. They explain these reactions in terms of Dr. Elizabeth Kubler-Ross' five stages of grief: denial, anger, bargaining, depression, and finally acceptance ("which should not be mistaken for a happy stage"). The authors describe each stage of grief and use it to make specific comments on the difficulties that the mandate imposes. They then reveal that their views about the work-hours regulations differ: Dr. Ivy now sees them as an opportunity to grow and improve, and likens the resistance to the new restrictions to that of Europeans to the printing press. But Dr. Barone ("the older of the coauthors and a known curmudgeon") is not so sure, and shares many of the concerns described earlier in the five stages of grief, even though he has outwardly accepted the work-hours rules and insists on full compliance by his residents and faculty. In particular, he is saddened that

some residents feel they have the absolute right to go home regardless of the situation on the surgery service, and this feeling is validated by the work-hours rules.

Fischer JE. Continuity of care: a casualty of the 80-hour work week. Acad Med. 2004 May;79(5):381-3.

The controversy concerning the limit of residents' work time to 80 hours a week has generated unprecedented dismay for many involved in graduate medical education, particularly surgeons. The author maintains that 80 hours a week is too short a time for surgery residents to provide excellent care and that this new rule undercuts the importance of continuity of care, a principle highly valued by surgeons. General surgeons and those specialty surgeons most closely associated with them think of themselves as the last "complete physicians," who should and can take care of the entire patient, and that when difficulties arise, they should not transfer the patient to another physician but instead ask someone else to help them continue to care for the patient. The author traces the arbitrary choice of an 80-hour work week (instead of a 92-hour one) to several sources, including the leadership of internal medicine, which he feels has largely de-emphasized patient contact for many years and has become focused on research and/or administration. He also maintains that the issue of moonlighting has also driven the push for an 80-hour work week, and that the view of moonlighting by surgical residencies (i.e., that it is almost always counterproductive) is different from that of other residencies. He concludes by acknowledging that the 80-hour work week and the abandonment of the principle of continuity of care are societal decisions, and have occurred because surgeons and other physicians did not make their case strongly enough or in time.

Zara SM, Galanko J, Behrns KE, Koruda MJ, Boyle LM, Farley DR, Evans SR, Meyer AA, Sheldon GF, Farrell TM. Psychological well-being of surgery residents before the 80-hour work week: a multi-institutional study. J Am Coll Surg. 2004 Apr;198(4):633-40.

Accreditation Council for Graduate Medical Education work-hour restrictions are aimed at improving patient safety and resident well-being. Although surgical trainees will be dramatically affected by these changes, no comprehensive assessment of their well-being has been recently attempted. This was designed as a multi-center study of psychological well-being of surgical residents (n = 108) across four US training programs before implementation of the 80-hour work week was performed using two validated surveys (Symptom Checklist-90-R [SCL-90-R] and Perceived Stress Scale [PSS]) during academic year 2002-03. Societal normative populations served as controls. Primary outcomes measures were psychological distress (SCL-90-R) and perceived stress (PSS). Secondary outcomes measures (SCL-90-R) were somatization, depression, anxiety, interpersonal sensitivity, hostility, obsessive-compulsive behavior, phobic anxiety, paranoid ideation, and psychoticism. The impact of personal variables (age, gender, marital status) and programmatic variables (level of training, laboratory experience, institution) was assessed. Mean psychologic distress was significantly higher in general surgery residents than in the normative population ($p < 0.0001$), with 38% scoring above the 90th percentile and 72% above the 50th percentile. Mean perceived stress among surgery residents was higher than historic controls ($p < 0.0001$), with 21% scoring above the 90th percentile and 68% above the 50th percentile. Among secondary outcomes, eight of nine symptom dimensions were significantly higher in surgical residents than in societal controls. In subgroup analyses, male gender was associated with phobic anxiety ($p < 0.001$) and anxiety ($p < 0.05$), and junior level of training (PGY 1 to 3) with anxiety ($p < 0.05$), obsessive-compulsive behavior ($p < 0.05$), and interpersonal sensitivity ($p < 0.05$). More than one-third of general surgery residents meet criteria for clinical psychologic distress. Surgery residents perceive significantly more stress than societal controls. Both personal and programmatic variables likely affect resident well-being and should be considered in assessing the full impact of Accreditation Council for Graduate Medical Education directives and in guiding future restructuring efforts.

Mittal V, Salem M, Tyburski J, Brocato J, Lloyd L, Silva Y, Silbergleit A, Shanley C, Remine S. Residents' working hours in a consortium-wide surgical education program. Am Surg. 2004 Feb;70(2):127-31; discussion 131.

Traditional work schedules of surgical residents have been cited as a factor that negatively influences education and the quality of patient care. Demands by federal and state legislators as well as the general public have forced a re-evaluation of the issue. Long working hours and resulting sleep deprivation affect the lives of residents profoundly, but the question remains does it lower the quality of medical care? The justification for the long hours is that they are vital to medical education, but residents are so drained by their schedules that they are rarely in the best state of mind to learn from their experiences. Under the scrutiny of the Resident Review Committee (RRC), many programs and institutions have been cited in the recent past in violation of resident working hour requirements.

The Oakland Health Education Program Center for Medical Education (OHEP), a consortium of 16 teaching hospitals in Michigan, set out to review the components of general surgery residency training in order to be able to make recommendations that might assist program directors in making appropriate changes where necessary to enhance resident education and the quality of patient care as well as to meet the personal demands of residents. Questionnaires on residents' attitudes concerning their working hours and possible reforms were sent to all general surgery residency programs in the OHEP consortium. The questionnaire consisted of 25 questions divided into three major sections: the first section encompassed demographic information including current work hours and on-call schedules. The second section consisted of questions relating to attitudes toward work hours and the options for change. The third section consisted of questions that viewed the perceived effects of limited work hours. From the seven participating hospitals with surgery residency programs in OHEP, 92 residents responded to the survey.

Residents reported an average of 56 with a range of 0 to 110 hours on call. Variations in the number of hours had to do with the various rotations residents were on, in that during certain elective rotations, residents were not assigned to any call. The on-call schedule varied; alternate nights were reported by 11 per cent, every third night by 33 per cent, and every fourth night or more by 53 per cent. The majority of surgical residents did express the need for reform and did not feel that reforms would affect the quality of resident education. However, residents did not want to lengthen residency training beyond the five years. The results indicate that the majority of residents in general surgery programs in Michigan perceive a need for reform of work schedules. Surgical educators may have underestimated this need in the past. Most residents thought that long hours impaired their educational experience and at times compromised their clinical care.

Whang EE, Perez A, Ito H, Mello MM, Ashley SW, Zinner MJ. Work hours reform: perceptions and desires of contemporary surgical residents. J Am Coll Surg. 2003 Oct;197(4):624-30.

New Accreditation Council for Graduate Medical Education (ACGME) requirements on resident duty hours are scheduled to undergo nationwide implementation in July 2003. General surgery residents, because of their long duty hours, are likely to be among those most affected by changes imposed to comply with the ACGME requirements. There are few contemporary data on their attitudes toward work hour reform. The study entailed a region-wide survey of residents enrolled in general surgery residencies in New England to characterize the perceptions and desires of surgical residents on the issue of work hour reform. **Respondents reported working a mean of 105 +/- 0.7 hours per week, considerably more than the 80-hour limit stipulated by the ACGME. Of the respondents, 81% reported that sleep deprivation had negatively affected their work. A greater percentage of senior residents than junior residents (p < 0.05) have negative perceptions of work hour limitations, particularly with respect to consequences for patient care.**

A strong majority of respondents believe that work hours reform would improve their quality of life but less than one half expect it to have a positive impact on patient care. Other findings suggest that residents who have actually experienced work hour restrictions are less positive about such restrictions than these residents who had not yet experienced them. The authors concluded that changes imposed by residency programs to comply with work hour requirements might have detrimental effects on senior residents and patient care. The impact of such changes should be carefully monitored as the ACGME requirements are implemented.

Podnos YD, Williams RA, Jimenez JC, Stemmer EA, Gordon IL, Wilson SE. Reducing the non-educational and non-clinical workload of the surgical resident; defining the role of the health technician. *Curr Surg.* 2003 Sep-Oct;60(5):529-32.

Recent controversy over excessive resident work hours has prompted surgical educators and program directors to search for more efficient methods to limit the non-clinical and non-educational workload of surgical residents. Health technicians were employed at a large Veteran's Administration Medical Center to allow residents more time for direct patient care in the clinics and wards and in educational activities. In a two-week period, daily data cards were collected from each intern and health technician identifying total hours spent in work, operations, clinics, and conferences. Each intern recorded the number and type of tasks performed and those tasks assigned to the health technician. The number and type of task performed were tabulated and averaged for each health technician and physician. Each intern (n = 3) and health technician (n = 8) completed 100% of the required data forms. In a control survey, each intern worked a mean of 16.9 hours per weekday and 5.0 hours per weekend day. With the addition of the health technicians, interns worked 12.9 hours per weekday and 6.8 hours per weekend day (when the health technicians were not present). Following the addition of the health technicians, resident time in the operating room increased from 3.3 hours per week to 9.8 hours per week. Each health technician aided the intern by performing an average of 20.25 tasks per day. This study shows that health technicians can be effective in reducing the overall hours and workload of surgical residents and increasing time spent in the operating room. Consideration should be given to including the health technician as integral members of the health care team in the teaching hospital.

Promecene PA, Schneider KM, Monga M. Work hours for practicing obstetrician-gynecologists: the reality of life after residency. *Am J Obstet Gynecol.* 2003 Sep;189(3):631-3.

Recently the Accreditation Council for Graduate Medical Education placed restrictions on all residency programs that limited work hours to 80 hours per week. The objective of this study was to determine the work hours for practicing obstetrician-gynecologists in an urban center. A questionnaire about physician demographics and work hours was mailed to all obstetrician-gynecologists in Houston in June 2002. Chi(2) testing was used for statistical analysis.

One hundred eighty-nine surveys were mailed. One hundred surveys (56%) were returned complete and analyzed. Sixty-two physicians reported working >80 hours per week. Physicians were more likely to work >80 hours per week if they were men or if they were >50 years old. Marital status and having children living at home did not affect work hours. The authors concluded that most obstetrician-gynecologists in Houston work longer hours than the number of hours that is imposed by the Accreditation Council for Graduate Medical Education resident work hour guidelines.

Warshaw AL, Sarr MG. The now and future world of restricted work hours for surgeons. *Surgery.* 2003 Jul;134(1):1-2.

Surgical faculty and residents have significantly different attitudes regarding work hour restrictions. The

authors surveyed voluntarily participating surgical faculty and residents in all general surgery residencies approved by the Accreditation Council for Graduate Medical Education (ACGME) regarding their current hours worked, days off per month, and attitudes and opinions regarding the current surgical-training environment. A 17-question survey instrument was mailed to the program directors of all ACGME-approved surgical-training programs in the United States. They were requested to distribute the survey to all faculty and residents for completion and to return the forms for analysis.

Responses (N = 1653) were received from 46% of surgical-training programs. A significant difference was noted between faculty and resident responses in most categories. **Most residents (87%) reported more than 80 duty hours per week, whereas 45% reported working more than 100 hours per week. Only 30% of residents reported an average of 1 day per week free of clinical activities. Although a minority of residents (43%) felt that their workload was excessive, 57% felt that their cognitive abilities had been impaired by fatigue. A significant number of residents (64%) and faculty (39%) believe that duty hour restrictions should be adopted. A minority of residents (20%) and faculty (47%) believe that the duration of residency training should be increased to compensate for duty hour restrictions.** One quarter of residents regret choosing a career in surgery.

The authors commented that current duty hours for most surgical residents exceed the proposed ACGME limits. Although most residents support duty hour limits; surgical faculty are less supportive. Significant alterations in the current design and structure of surgical-training programs will be required to meet the ACGME guidelines.

Niederee MJ, Knudtson JL, Byrnes MC, Helmer SD, Smith RS. A survey of residents and faculty regarding work hour limitations in surgical training programs. Arch Surg. 2003 Jun;138(6):663-9; discussion 669-71.

Surgical faculty and residents have significantly different attitudes regarding work hour restrictions. A study of surgical faculty and residents in general surgery residencies approved by the Accreditation Council for Graduate Medical Education (ACGME) assessed current hours worked, days off per month, and attitudes and opinions regarding the current surgical-training environment. A 17-question survey instrument was mailed to the program directors of all ACGME-approved surgical-training programs in the United States. They were requested to distribute the survey to all faculty and residents for completion and to return the forms for analysis.

Responses (N = 1653) were received from 46% of surgical-training programs. A significant difference was noted between faculty and resident responses in most categories. Most residents (87%) reported more than 80 duty hours per week, whereas 45% reported working more than 100 hours per week. **Only 30% of residents reported an average of 1 day per week free of clinical activities. Although a minority of residents (43%) felt that their workload was excessive, 57% felt that their cognitive abilities had been impaired by fatigue. A significant number of residents (64%) and faculty (39%) believe that duty hour restrictions should be adopted. A minority of residents (20%) and faculty (47%) believe that the duration of residency training should be increased to compensate for duty hour restrictions. One quarter of residents regret choosing a career in surgery.** Current duty hours for most surgical residents exceed the proposed ACGME limits. Although most residents support duty hour limits; surgical faculty are less supportive. Significant alterations in the current design and structure of surgical-training programs will be required to meet the ACGME guidelines.

Greenfield LJ. Limiting resident duty hours. Am J Surg. 2003 Jan;185(1):10-2.

Limitation of resident duty hours continues to be a national concern with weekly work hour limits legislated in New York State. The Residency Review Committee for Surgery monitors programs for

working conditions and will be enforcing new regulations from the Accreditation Council for Graduate Medical Education. Other sources of resident stress must also be addressed.

Barden CB, Specht MC, McCarter MD, Daly JM, Fahey TJ 3rd. Effects of limited work hours on surgical training. J Am Coll Surg. 2002 Oct;195(4):531-8.

Legal mandates to reduce resident work hours have prompted changes in the structure of surgical training programs. Such changes have included modification of on-call schedules and the adoption of "night float" resident coverage. Little is known about the effects of these changes on surgical resident education and perceptions of quality of patient care. The surgical residents and faculty at a single institution completed a 21-point Likert survey. Subjects were asked to compare parameters of resident education, patient care, and resident quality of life before and after institution of a strict 80-hour work week resident training schedule. The number of hours worked per week before and after these changes were reported. American Board of Surgery In-Training Examination (ABSITE) scores were compared for the 2 years before and after implementation of this schedule. **Total number of surgical cases performed by graduating chief residents were recorded and compared for the 3 years before and after the schedule changes. Resident work hours reduced significantly after schedule changes were implemented. A majority of surgical residents reported an improvement in quality of life, but residents and faculty perceived changes to have a negative impact on continuity of patient care. Mean ABSITE composite percentile scores significantly improved after the reduction of working hours. ABSITE scores for junior residents improved significantly; no significant differences were noted in scores for senior residents.**

Reduction in resident work hours has salutary effects on perception of quality of life and basic education for surgical residents. These benefits may come at the expense of patient care, particularly continuity of care. This study did not directly assess patient outcomes but the perceptions of caregivers suggest that patient care may be compromised. Further research is needed to assess the long-term effects of changes on both residents and patients.

Defoe DM, Power ML, Holzman GB, Carpentieri A, Schulkin J. Long hours and little sleep: work schedules of residents in obstetrics and gynecology. Obstetrics and Gynecology 2001 June;97(6):1015-1018.

The authors investigated residents' work schedules and their attitudes toward limiting their hours. They used an anonymous survey regarding resident work hours and call schedules was administered to the 4674 obstetric-gynecologic residents who took the year 2000 Council on Resident Education in Obstetrics and Gynecology in-training examination.

A total of 4510 surveys were analyzed (96.5%). Three of four (75.5%) respondents reported working between 61 and 100 hours each week. Most (71.3%) reported sleeping less than 3 hours while on night call. Eight of ten reported having post call clinical responsibilities. The reported number of hours on call declined and the reported number of hours of sleep increased with year of residency. Three of four residents wanted limits on their work hours. Residents who reported longer on-call hours or less sleep during night shift were significantly more likely to want a restriction on work hours. Fatigue was the most commonly selected reason (77.6%) followed by "need more personal time" (76.3%), and "fear of compromising quality of care" (59.8%). Women were more concerned about fatigue than were men. Among residents who did not want work hour restrictions, "additional surgical experience" was the most commonly selected reason (69.0%).

The authors concluded that residents in obstetrics and gynecology report working long hours, and experiencing periods of little sleep. Most want their work hours to be limited. Fatigue is a major concern among residents that want their hours limited. A sizable minority worries that such limits might also limit

their experience.

Sawyer RG, Tribble CG, Newberg DS, Pruett TL, Minasi JS. Intern call schedules and their relationship to sleep, operating room participation, stress, and satisfaction. Surgery 1999 Aug;126(2):337-342.

The authors noted that the ideal resident call schedule remains unknown. This study assessed the impact of different call schedules on intern performance and education. A year-long, prospective, observational study of first-year residents in a surgery training program was performed with use of intern sleep/operative logs and questionnaires, and faculty questionnaires.

Compared with interns taking call every third or fourth night (and cross-covering a separate service), interns taking call every other night reported the greatest amount of fatigue and stress, the lowest satisfaction, and the fewest operative cases. Errors in patient care were not different between schedules. Multivariate analysis revealed that operative participation was inversely related to frequency of night call and level of fatigue post call, stress was related to fatigue while off call and service census, and overall satisfaction was associated with infrequency of call and operative cases performed. Faculty reported more errors by interns cross-covering other services and less operating room participation by interns taking call every other night. The authors concluded that no single resident schedule optimally balances patient care and resident education and satisfaction. All three patterns of call studied are acceptable; specific decisions regarding the allocation of house staff manpower should be flexible and dependent on individual service and educational needs.

Miller SF. Composite resident work week. American Journal of Surgery Oct;164(4):377-381, 1992.

During a 4-week period, all residents in the Wright State University School of Medicine Department of Surgery residency program were required to keep a log of their daily activities. Times were collected for the following resident activities: patient rounds, work-ups, laboratory data review, consults, meetings with attending physicians or patient families, phone calls, teaching conferences, medical student teaching, library time, clinics, attendance at codes, emergency department visits, on-call time, medical records committee meetings, and time scrubbed. **The composite average weekly hours by resident year were 83.4 hours [postgraduate year (PGY)-1], 78.4 hours (PGY-2), 60.2 hours (PGY-3), 79.6 hours (PGY-4), and 80.9 hours (PGY-5). More than 50 percent of the resident work week cards were for less than 80 hours. Three activities (patient rounds, time scrubbed, and on-call) accounted for the majority of the residents' hours, but the average week, deleting educational and administrative hours, was less than 80 hours for all residents.**

Strunk CL, Bailey BJ, Scott BA, Cummings CW, Lucente FE, Beatty CW, Neel HB, Pillsbury HC 3rd, Rice DH, Bryan MD, et al. Resident work hours and working environment in otolaryngology. Analysis of daily activity and resident perception. JAMA. 1991 Sep 11;266(10):1371-4

The study sought to analyze the working environment and work hours of a cohort of otolaryngology-head and neck surgery residents. It used an environmental analysis questionnaire and a log of daily activities. Residents were on a clinical rotation system, with 59 residents from six programs participating, including three public and three private institutions, from geographically diverse regions of the country were involved in the study. Residents were equally distributed from their second year through their fifth year of postgraduate work. All eligible residents participated in and completed the study.

The environmental analysis survey was designed to elicit resident perception of different aspects of their working environment. The daily activity log required the resident to report on activities for each half-hour period for 7 consecutive days. **Residents were on call an average of 52.8 hours (2.2 days) and worked**

79.4 hours per week. Seventy-five percent believed that the level of faculty supervision and the degree of resident responsibility was about right. Two major inefficiencies were the time involved in completion of paperwork and the lack of nonmedical support services. Thirty-one percent of the residents responded that fatigue resulted in substandard patient care 10% of the time. Forty-seven percent responded that their educational experience was substandard 25% of the time secondary to fatigue. Two thirds responded that the demands of residency training had a negative impact on their family and personal life. Seventy percent of the otolaryngology--head and neck surgery residents surveyed at six institutions believe that an 80-hour workweek, including being on call every third night with no more than 24 hours of continuous work without sleep, approximates a reasonable, maximum work schedule. Residents working the longest hours expressed concern about rendering substandard care and developing negative attitudes toward patients. Noneducational inefficiencies were identified and solutions were proposed. Demands of residency training, even within guidelines established as reasonable, can have detrimental effects on residents' educational activities and personal life.

Foster HW Jr, Seltzer VL. Accommodating to restrictions on residents' working hours. Acad Med. 1991 Feb;66(2):94-7.

In 1988, New York became the first state to implement regulatory measures limiting resident work hours. Because restrictions on residents' work hours will have such profound and far-reaching implications for how obstetrics and gynecology residencies are conducted, the Council on Resident Education in Obstetrics and Gynecology (CREOG) requested that a survey be conducted to solicit information from program directors of U.S. obstetrics and gynecology residencies who had already begun to alter their call schedules. **Two hundred and ninety-six programs were contacted, and representatives of those that had implemented changes were requested to respond. Eighty-two responses were received; 26 of these contained information that could be collated. From these 26 responses the authors have structured a prototypic call schedule and presented its application. A key feature necessary to implement the new type of schedule is the use of a night float system.** It is concluded that changes can and will be made by obstetrics and gynecology residencies. Creative scheduling, as described in this article, is essential and will facilitate the task; however, the current standards of education and patient care will be difficult to maintain without additional economic and human resources.

Scher KS, Peoples JB. A study of the on-duty hours of surgical residents. Surgery 1990. Aug;108(2):393-397.

A time study was done to ascertain the number of hours spent in the hospital and the types of duties performed by residents enrolled in a multiple-institution, university-sponsored surgical training program. **On the average, residents in the Wright State University program spent 90.1 +/- 27.1 hours in the hospital per week. Direct patient care activities required 62.7 +/- 18.8 hours (69.6 percent) of the average workweek. Purely educational endeavors accounted for 10.0 +/- 6.1 hours (11.1 percent) of the workweek. Ancillary tasks consumed an average of 8.5 +/- 8.5 hours (9.4 percent) of the surgical residents' time on duty per week. House officers did obtain a mean of 9.1 +/- 11.0 hours of sleep in those working hours (10.1 percent of the total time spent in the hospital).** Although much variation existed among hospitals in the program, on-duty hours were greater in the private hospitals compared to the federal hospitals; the principal difference was the amount of time spent doing ancillary tasks (10.0 +/- 9.4 hours vs. 5.6 +/- 5.6 hours; p less than 0.01). Hours worked by residents on private surgical services were longer than those of residents assigned to staff services (96.4 +/- 22.1 hours vs. 86.0 +/- 29.3 hours; p less than 0.04).

The major difference was the greater amount of ancillary tasks performed by residents on private services (12.0 +/- 9.5 hours vs. 6.2 +/- 7.0 hours; p less than 0.001). This finding could not be attributed to differences in patient census or turnover rates. Longer hours were noted on the

general/thoracic surgery services compared to other surgical subspecialties (94.1 +/- 27.3 hours vs. 81.5 +/- 24.8 hours; p less than 0.02). More time was spent in direct patient care on general/thoracic surgery (66.3 +/- 19.3 hours vs. 54.9 +/- 15.1 hours; p less than 0.002). Despite the shorter workweek, residents on subspecialty rotations spent more time doing ancillary tasks (11.3 +/- 9.7 hours vs. 7.3 +/- 7.6 hours; p less than 0.02). **More than 60 percent of the residents' working hours in this program exceeded the arbitrary 80-hour limit, emphasizing the challenge of complying with the imposition of maximum work hours.** The authors recommended that each program closely monitor the activities and hours of its residents to best respond to the pressures for regulation.

Ruby ST, Allen L, Fielding LP, Deckers PJ. Survey of residents' attitudes toward reform of work hours. Arch Surg. 1990 Jun;125(6):764-7; discussion 767-8.

Traditional work schedules of surgical residents have been cited as a factor that negatively influences residency education and the quality of patient care. As an adjunct to the formulation of recommendations for the development of the environment for general surgery training, the New England Association of Program Directors in Surgery set out to sample the attitudes of surgical residents in New England relative to their perceived need to reform work hours. **Seventy-two percent of the residents thought there was a need for some level of resident work schedule change. The major variable that correlated with this opinion was the reported amount of sleep that a resident needed before returning to work after a 24-hour shift.** The ultimate effect on education, patient care, and fiscal resources of these potentially sensitive changes remains to be determined.

Warner BW, Hamilton FN, Brunck BS, Bower RH, Bell RH Jr. Study of surgical resident working hours and time utilization. J Surg Res. 1990 Jun;48(6):606-10 .

Recently, changes have been suggested in resident working hours and conditions. Few objective data exist, however, as to how many hours surgical residents work or how they utilize their time. Surgical residents on four every-third-night general surgery services (two services in the University Hospital and two in the Veterans Hospital) kept a log of their activities divided into 15-min intervals 24 hr a day for four weeks. Activity for each 15-min interval was entered into one of nine predesignated categories. **Residents spent an average of 95.8 hr per week in the hospital, working 85.8 hr and sleeping 10 hr.** Overall, residents slept an average of 5.9 hr per night, 4.2 hr on on-call nights and 6.2 hr on off-call nights. Operating and direct patient care activities consumed 8.7 hr per day (10.25 hr Monday to Friday). Patient care activities which residents believed could be performed by non physicians accounted for 1.5 hr per day. An average of 1.8 hr per day was spent in conferences or independent study. This survey provided objective data regarding working hours and time utilization for this residency. Both residents and faculty found that time spent in various activities differed from preconceived notions. The authors suggested that program directors might find a formal survey of this type useful in assessing the structure of their own residency and in providing objective data to compare to or determine compliance with externally generated guidelines.

II. Effect of National Duty Hour Limits on Resident Education in Medical/Hospital Based Specialties

Carek PJ, Gravel Jr JW, Kozakowski S, Pugno PA, Fetter G, Palmer EJ. Impact of Proposed Institute of Medicine Duty Hours: Family Medicine Residency Directors' Perspective. JGME Dec 2009; 1(2):195-200.

See summary on page 133.

Sloan S, Krishnamurthy M, Lyon DT, Mitri G, Chyshkevych I, Livert D. Work Hour Regulations: Do We Need Further Changes Now? A Survey of Internal Medicine Faculty and Residents. . JGME Dec 2009; 1(2):201-7.

See summary on page 134.

Collins J, Hinshaw JL, Simcock E, Rosenberg MA. Radiology faculty compliance with recommended health guidelines: comparison with residents. Acad Radiol. 2009 Nov;16(11):1433-42.

The aims of this study were to determine diagnostic radiology faculty members' compliance with recommended health guidelines for physical activity, body weight, diet, and related health indicators and to compare faculty members' compliance with that of radiology residents. A request to complete an online health survey was electronically sent to members of the Association of University Radiologists in September 2008. Results were compared to those from a similar survey completed by radiology residents in May and June 2007. Frequency counts and Fisher's exact tests were used to summarize results and to determine statistically significant relationships. The sample consisted of 193 of 801 members of the Association of University Radiologists (24%).

A greater percentage of faculty members than residents complied with recommendations for physical activity (52% vs 37%, $P < .001$) and the consumption of vegetables (67% vs 52%, $P < .001$), saturated fat (51% vs 37%, $P < .001$), and sodium (53% vs 37%, $P < .001$). A greater percentage of faculty members felt that they got enough sleep (51% vs 38%, $P = .002$) and did not think about stress on most days (39% vs 26%, $P = .001$). Most faculty members (59%) worked 51 to 60 hours a week, whereas most residents (59%) worked > 60 hours, and greater work hours were correlated with less resident physical activity ($P = .017$). More female than male faculty members (78% vs 57%, $P = .010$) and residents (83% vs 62%, $P < .001$) had body mass indexes < 25 kg/m². A substantial percentage of faculty members were out of compliance with federal health guidelines, although less so than residents in many categories. Comments from both groups suggest a possible benefit from modifications to the work environment.

Olson EJ, Drage LA, Auger RR. Sleep deprivation, physician performance, and patient safety. Chest. 2009 Nov;136(5):1389-96.

See summary on page 2.

Mazotti LA, Vidyarthi AR, Wachter RM, Auerbach AD, Katz PP. Impact of duty-hour restriction on resident inpatient teaching. J Hosp Med. 2009 Oct;4(8):476-80.

Education and patient care are essential to academic hospitalists, and residents are key partners in these goals. The Accreditation Council for Graduate Medical Education (ACGME) duty-hour restrictions (DHR) likely impacted aspects of resident teaching, well-being, and patient care practices that affect the

duties of academic hospitalists. To determine the impact of DHR on resident teaching time and the factors associated with, and impacts of, time spent teaching. DESIGN: Cross-sectional survey. A total of 164 internal medicine residents at University of California, San Francisco (UCSF), San Francisco, CA were queried regarding their time spent teaching, completion of administrative tasks, number of hours worked, frequency of emotional exhaustion, and satisfaction with quality of patient care provided after DHR. Regression analyses identified factors associated with decreased teaching time and determined that there were associations between time spent teaching, emotional exhaustion, and satisfaction with quality of patient care.

A total of 125 residents (76%) responded; 24% reported spending less time teaching. Less time teaching was associated with being a postgraduate year (PGY)-2 (odds ratio [OR], 7.14; 95% confidence interval [CI], 1.56-32.79) or PGY-3 (OR, 8.23; 95% CI, 1.44-47.09), reporting working <80 hours/week (OR, 5.99; 95% CI, 1.11-32.48) and spending a greater percentage of time on administrative tasks (OR, 1.03; 95% CI, 1.00-1.06). Those residents who spent less time teaching also reported less frequent emotional exhaustion (P = 0.003) and more satisfaction with quality of care (P = 0.006). DHR has decreased teaching time for some residents, and those residents are more likely to be less emotionally exhausted and deliver self-perceived higher quality of care. Academic hospitalists should consider these impacts of DHR and make adjustments such as educational and work-life innovations to account for these shifts.

Payette M, Chatterjee A, Weeks WB. Cost and workforce implications of subjecting all physicians to aviation industry work-hour restrictions. Am J Surg. 2009 Jun;197(6):820-5; discussion 826-7.

See summary on page 4.

Lopez L, Katz JT. Perspective: creating an ethical workplace: reverberations of resident work hours reform. Acad Med. 2009 Mar;84(3):315-9.

Medical professionals are a community of highly educated individuals with a commitment to a core set of ideals and principles. This community provides both technical and ethical socialization. The development of ethical physicians is highly linked to experiences in the training period. Moral traits are situation-sensitive psychological and behavioral dispositions. The consequence of long duty hours on the moral development of physicians is less understood. The clinical environment of medical training programs can be so intense as to lead to conditions that may actually deprofessionalize trainees. **The dynamic relationship between individual character traits and the situational dependence of their expression suggests that a systems approach will help promote and nurture moral development. Ethical behavior can be supported by systems that make it more difficult to veer from the ideal. Work hours limits are a structural change that will help preserve public safety by preventing physicians from taking the moral shortcuts that can occur with increasing work and time pressures. Work hours rules are beneficial but insufficient to optimize an ethical work and training environment.** Additional measures need to be put in place to ensure that ethical tensions are not created between the patient's well-being and the resident's adherence to work hours rules. The ethical ideals of physician autonomy, selflessness, and accountability to the patient must be protected through the judicious and flexible use of work hours limits, physician extenders, census caps, nonteaching services, and high-quality handoffs.

Higginson JD. Perspective: limiting resident work hours is a moral concern. Acad Med. 2009 Mar;84(3):310-4.

The author outlines the cross-cultural and widespread expectation that the moral character of physicians is built on dual possession of skill and compassion. The details of the moral makeup of physicians are often hotly debated in the biomedical literature. Despite a lack of consensus regarding the required aspects of character, the author demonstrates that little debate exists that at a minimum physicians should possess not only knowledge but also a willingness to care for and comfort patients. The primacy of the patient in the physician's life is reflected in the panoply of oaths taken by new physicians despite great variability in other aspects of these oaths.

The author details recent worrisome reports demonstrating the erosion of medical trainees' empathy and compassion by long work hours. Further, the continued linkage of these attitude changes and fatigue to poor medical outcomes is a call to action. Changes enacted by the Accreditation Council for Graduate Medical Education to reduce resident work hours are insufficient to achieve the goal of improved patient care while promoting moral development among resident physicians. The debate regarding resident work hours is often framed as an idealistic discussion of placing patients first. However, residents are used as an inexpensive labor force, and efforts to curtail this usage would have a significant economic impact. Economic concerns play a larger part in decision making than is generally discussed. The author calls for further alterations of resident work schedules to improve patient care and ensure the preservation of the moral ethos of medicine.

Fortuna RJ, Palfrey JS, Shelov SP, Samuels RC. Paediatric experiences with work-hour limitations. J Eval Clin Pract. 2009 Feb;15(1):116-20.

To evaluate the perceived impact of work-hour limitations on pediatric residency training programs and to determine the various strategies used to accommodate these restrictions. A three-page pre-tested survey was administered to program directors at the 2004 Association of Pediatric Program Directors meeting. The impact of work-hours was evaluated with Likert-type questions and the methods used to meet work-hour requirements were compared between large programs (≥ 30 residents) and small programs.

Surveys were received from 53 program directors. The majority responded that work-hour limitations negatively impacted inpatient continuity, time for education, schedule flexibility and attending staff satisfaction. Supervision by attending staff was the only aspect to significantly improve. Perceived resident satisfaction was neutral. To accommodate work-hour limitations, 64% of programs increased clinical responsibility to existing non-resident staff, 36% hired more non-resident staff and 17% increased the number of residents. Only one program hired additional non-clinical staff. Large programs were more likely to use more total methods on the inpatient wards ($P < 0.01$) and in the intensive care units ($P < 0.05$) to accommodate work-hour limitations. **Program directors perceived a negative impact of work-hours on most aspects of training without a perceived difference in resident satisfaction. While a variety of methods are used to accommodate work-hour limitations, programs are not widely utilizing non-clinical staff to alleviate clerical burdens.**

Landrigan CP, Fahrenkopf AM, Lewin D, Sharek PJ, Barger LK, Eisner M, Edwards S, Chiang VW, Wiedermann BL, Sectish TC. Effects of the Accreditation Council for Graduate Medical Education duty hour limits on sleep, work hours, and safety. Pediatrics. 2008 Aug;122(2):250-8.

To mitigate the risks of fatigue-related medical errors, the Accreditation Council for Graduate Medical Education introduced work hour limits for resident physicians in 2003. The goal was to determine whether work hours, sleep, and safety changed after implementation of the Accreditation Council for Graduate Medical Education standards. The authors conducted a prospective cohort study in which residents from 3 large pediatric training programs provided daily reports of work hours and sleep. In addition, they completed reports of near-miss and actual motor vehicle crashes, occupational exposures, self-reported medical errors, and ratings of educational experience. They were screened for depression

and burnout. Concurrently, at 2 of the centers, data on medication errors were collected prospectively by using an established active surveillance method.

A total of 220 residents provided 6007 daily reports of their work hours and sleep, and 16 158 medication orders were reviewed. Although scheduling changes were made in each program to accommodate the standards, 24- to 30-hour shifts remained common, and the frequency of residents' call remained largely unchanged. There was no change in residents' measured total work hours or sleep hours. There was no change in the overall rate of medication errors, and there was a borderline increase in the rate of resident physician ordering errors, from 1.06 to 1.38 errors per 100 patient-days. Rates of motor vehicle crashes, occupational exposures, depression, and self-reported medical errors and overall ratings of work and educational experiences did not change. The mean length of extended-duration (on-call) shifts decreased 2.7% to 28.5 hours, and rates of resident burnout decreased significantly (from 75.4% to 57.0%). The authors concluded that total hours of work and sleep did not change after implementation of the duty hour standards. Although fewer residents were burned out, rates of medication errors, resident depression, and resident injuries and educational ratings did not improve.

Jagsi R, Weinstein DF, Shapiro J, Kitch BT, Dorer D, Weissman JS. The Accreditation Council for Graduate Medical Education's limits on residents' work hours and patient safety. A study of resident experiences and perceptions before and after hour reductions. Arch Intern Med. 2008 Mar 10;168(5):493-500.

Limiting resident work hours may improve patient safety, but unintended adverse effects are also possible. The authors sought to assess the impact of Accreditation Council for Graduate Medical Education resident work hour limits implemented on July 1, 2003, on resident experiences and perceptions regarding patient safety. All trainees in 76 accredited programs at 2 teaching hospitals were surveyed in 2003 (pre-implementation) and 2004 (post-implementation) regarding their work hours and patient load; perceived relation of work hours, patient load, and fatigue to patient safety; and experiences with adverse events and medical errors. Based on reported weekly duty hours, 13 programs experiencing substantial hour reductions were classified into a "reduced-hours" group. Change scores in outcome measures before and after policy implementation in the reduced-hours programs were compared with those in "other programs" to control for temporal trends, using 2-way analysis of variance with interaction.

A total of 1770 responses were obtained (response rate, 60.0%). Analysis was restricted to 1498 responses from respondents in clinical years of training. **Residents in the reduced-hours group reported significant reductions in mean weekly duty hours (from 76.6 to 68.0 hours, $P < .001$), and the percentage working more than 80 hours per week decreased from 44.0% to 16.6% ($P < .001$). No significant increases in patient load while on call (patients admitted, covered, or cross covered) were observed. Between 2003 and 2004, there was a decrease in the proportion of residents in the reduced-hours programs indicating that working too many hours (63.2% vs. 44.0%; $P < .001$) or cross covering too many patients (65.9% vs. 46.9%; $P = .001$) contributed to mistakes in patient care.** There were no significant reductions in these 2 measures in the other group, and the differences in differences were significant ($P = .03$ and $P = .02$, respectively). The number of residents in reduced-hours programs who reported committing at least 1 medical error within the past week remained high in both study years (32.9% in 2003 and 26.3% in 2004, $P = .27$). The authors concluded that it is possible to reduce residents' hours without increasing patient load. Doing so may reduce the extent to which fatigue affects patient safety as perceived by these frontline providers.

Rasminsky S, Lomonaco A, Auchincloss E. Work hours regulations for house staff in psychiatry: bad or good for residency training? Acad Psychiatry. 2008 Jan-Feb;32(1):54-60.

The movement to limit work hours for house staff has gained momentum in recent years. The authors set out to review the literature on work hour reform, particularly as it applies to psychiatric residency training, and to provide two different viewpoints on the controversy. The authors present the historical background of work hour reform in the United States and review recent literature about resident work hour limitations. Using a debate format, the authors discuss whether the new regulations are having a positive or negative impact on residency training in psychiatry. **The currently-existing work hours restrictions may have unintended consequences for the health of patients and an untoward impact on residents' professional development and academic medicine's overall structure. At the same time, work hours restrictions do not go far enough in protecting residents and patients from the harmful effects of fatigue, and that our definition of professionalism needs to be reexamined in light of emerging scientific literature.** There should be some limitation on resident work hours, with exact numbers to be determined by growing scientific knowledge about the effects of prolonged wakefulness. More study is needed, particularly in the area of psychiatric residency training.

Swide CE, Kirsch JR. Duty hours restriction and their effect on resident education and academic departments: the American perspective. Curr Opin Anaesthesiol. 2007 Dec;20(6):580-4.

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. 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. 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.

Philibert I, Heard J. Resident duty hours and professionalism--limits and opportunities. Pharos Alpha Omega Alpha Honor Med Soc. 2007 Autumn;70(4):47-8.

See summary on page 10.

Balmer D, Ruzek S, Ludwig S, Giardino A. Pediatric residents' and continuity clinic preceptors' perceptions of the effects of restricted work hours on their learning relationship. Ambul Pediatr. 2007 Sep-Oct;7(5):348-53.

The effects of the Work Hour Standard (WHS) on continuity of care and quality of education has stimulated much discussion, yet little is known about how it affects the resident-continuity clinic preceptor (CCP) dyad, the only longitudinal learning relationship in pediatric residency. This case study explored residents' and CCPs' perceptions of the effects of restricted work hours on their learning relationship. The study involved direct observation of third-year pediatric residents (n = 10) and their CCPs (n = 10) in continuity clinic (CC) for 5 months; both groups attended clinic before and after the WHS. Semi-structured, audio-taped interviews were conducted with residents before and after observation, and with CCPs after resident data were collected. Data from interview transcripts and observational notes were analyzed for major themes.

To comply with the WHS, post-call clinic was eliminated and residents were rescheduled to another afternoon CC. The consequence of eliminating post-call clinic, disruption in the resident-CCP relationship, was perceived differently by residents and CCPs. From the residents' perspective, rescheduling CC in response to the WHS benefited their learning because it exposed them to different CCPs with different practice styles. From the CCPs' perspective, rescheduling CC frustrated their efforts to be learner-centered teachers and effective mentors. Intended changes to limit excessive work hours had unintended effects that were viewed more favorably by residents than by CCPs. Understanding the shared and different perspectives of residents and preceptors regarding WHS-related changes in CC extends the discussion of the effect of restricted work hours.

Gopal RK, Carreira F, Baker WA, Glasheen JJ, Crane LA, Miyoshi TJ, Prochazka AV. Internal medicine residents reject "longer and gentler" training. J Gen Intern Med. 2007 Jan;22(1):102-6.

Increasing complexity of medical care, coupled with limits on resident work hours, has prompted consideration of extending Internal Medicine training. It is unclear whether further hour reductions and extension of training beyond the current duration of 3 years would be accepted by trainees. The authors aimed to determine if further work-hour reductions and extension of training would be accepted by trainees and whether resident burnout affects their opinions. The design entailed a postal survey, sent to all 143 Internal Medicine residents at the University of Colorado School of Medicine in May 2004. The survey contained questions related to opinions on work-hour limits using a 5-point Likert scale ranging from strongly agree to strongly disagree. Burnout was measured using the Maslach Burnout Inventory, organized into three subscales: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment, with burnout defined as high EE or DP. Seventy-four percent (106/143) of residents returned the survey. The vast majority (84%) of residents disagreed or strongly disagreed with extending training to 4 or 5 years. Burnout residents were less averse to extending training (strongly agree or agree, 18.9% vs. 4.3%, $P = .04$). The majority of residents (68.9%) disagreed or strongly disagreed with establishing a 60-hour/week limit. Residents who met the criteria for burnout were more likely to agree that a 60-hour limit would be better than an 80-hour limit (strongly agree or agree, 22% vs. 8%, $P = .02$). In this program, most Internal Medicine residents are strongly opposed to extending their training to 4 or 5 years and would prefer the current 80 hours/week cap. A longer, less intense pace of Internal Medicine training seems to be less attractive in the eyes of current trainees.

Cull WL, Mulvey HJ, Jewett EA, Zalneraitis EL, Allen CE, Pan RJ. Pediatric residency duty hours before and after limitations. Pediatrics. 2006 Dec;118(6):e1805-11.

The authors' goals were to examine pediatric resident and program director experiences implementing the Accreditation Council for Graduate Medical Education work hour limits and to compare duty hours, moonlighting, and fatigue before and after the limits became effective. The study used a national random sample of 500 pediatric residents who graduated in 2002 and in 2004 were surveyed to compare resident duty hours and fatigue before and after the Accreditation Council for Graduate Medical Education limits were implemented. In addition, all US pediatric residency program directors were surveyed at the end of the 2003/2004 academic year, to provide a complementary retrospective examination of limit implementation. Totals of 65%, 61%, and 83% of 2002 residents, 2004 residents, and program directors, respectively, responded. The proportion of residents who reported working >80 hours per week declined from 49% for NICU/PICU rotations before the limits to 18% after limit implementation. Resident well-being was the factor identified most often by both residents and program directors as being improved since the limitations. Multivariate modeling also showed reductions in the proportions of residents who reported falling asleep while driving from work or making errors in patient care because of fatigue. Overall, 89% of pediatric residents and program directors reported that the current system is effective in ensuring appropriate working hours. The study concluded that since the Accreditation Council for

Graduate Medical Education duty hour limits went into effect, pediatric residents report working fewer hours and making fewer patient care errors because of fatigue. Although room for additional improvement remains, the experiences of residents and program directors suggest that implementation of the Accreditation Council for Graduate Medical Education limits in pediatric residency programs is improving resident well-being.

Jagsi R, Shapiro J, Weissman JS, Dorer DJ, Weinstein DF. The educational impact of ACGME limits on resident and fellow duty hours: a pre-post survey study. Acad Med. 2006 Dec;81(12):1059-68.

See summary on page 13.

Longnecker DE. Resident duty hours reform: are we there yet? Acad Med. 2006 Dec;81(12):1017-20.

In 2003, the Accreditation Council for Graduate Medical Education (ACGME) implemented resident duty hour restrictions to address growing concerns about medical errors and resident well-being. Many anticipated that resident duty hour restrictions would improve the quality and safety of care by minimizing the detrimental effects of fatigue on resident performance. Others were concerned that the fundamental clinical and educational principle of continuity of care would be lost or at least eroded, and that more frequent "hand-offs" might result in more clinical errors. Some lamented the loss of the total-immersion residency experience that serves as a forging process to temper the mind and body to create a finely honed clinician. The author draws from the literature to examine the effects of the ACGME resident duty hour restrictions three years after their implementation. From the perspectives of resident perceptions, attending perceptions, organizational approaches, and unintended consequences, the author concludes that far more than simple control of duty hours will be required to achieve the goals of clinical excellence, educational excellence, resident well-being, and professionalism.

Myers JS, Bellini LM, Morris JB, Graham D, Katz J, Potts JR, Weiner C, Volpp KG. Internal medicine and general surgery residents' attitudes about the ACGME duty hours regulations: a multi-center study. Acad Med. 2006 Dec;81(12):1017-20.

See summary on page 13.

Peterson LE, Johnson H, Pugno PA, Bazemore A, Phillips RL Jr. Training on the clock: family medicine residency directors' responses to resident duty hours reform. Acad Med. 2006 Dec;81(12):1032-7.

The Accreditation Council for Graduate Medical Education's 2003 restrictions on resident duty hours (RDH) raised concerns among educators about potential negative impacts on residents' training. In the early wake of these restrictions, little is known about how RDH reform impacts training in primary care. The authors surveyed family medicine (FM) residency program directors (PDs) for their perceptions of the impact of RDH regulations on training in primary care. All PDs of 472 FM residency programs were asked via list-serve to complete an anonymous Internet-based survey in the fall of 2004. The survey solicited PDs' opinions about changes in staff and in residents' training experiences with respect to implementation of RDH regulations. Descriptive and qualitative analyses were conducted. The study included 369 partial and 328 complete responses, for a response rate of 69% (328/472). Effects of the RDH regulations are varied. **Fifty percent of FMPDs report increased patient-care duties for attendings, whereas 42% report no increase. Nearly 80% of programs hired no additional staff.**

Sixty percent of programs eliminated post-call clinics, and nearly 40% implemented a night-float system. Administrative hassles and losses of professionalism, educational opportunity, and continuity of care were common concerns, but a sizeable minority feels that residents will be better off under the new regulations. The results showed that many FMPDs cited increased faculty burden and the risk of lower-quality educational experiences for their trainees. Innovations for increasing the effectiveness of teaching may ultimately compensate for lost educational time. If not, alternatives such as extending the length of residency must be considered.

Carpenter RO, Spooner J, Arbogast PG, Tarpley JL, Griffin MR, Lomis KD. Work hours restrictions as an ethical dilemma for residents: a descriptive survey of violation types and frequency. Curr Surg. 2006 Nov-Dec;63(6):448-55.

See summary on page 14.

Choi D, Dickey J, Wessel K, Girard DE. The impact of the implementation of work hour requirements on residents' career satisfaction, attitudes and emotions. BMC Med Educ. 2006 Oct 176:53.

See summary on page 15.

Horwitz LI, Krumholz HM, Huot SJ, Green ML. Internal medicine residents' clinical and didactic experiences after work hour regulation: a survey of chief residents. J Gen Intern Med. 2006 Sep;21(9):961-5.

Work hour regulations for house staff were intended in part to improve resident clinical and educational performance. The objective was to characterize the effect of work hour regulation on internal medicine resident inpatient clinical experience and didactic education. This was designed as a cross-sectional mail survey. Chief residents at all accredited U.S. internal medicine residency programs outside New York participated. The response rate was 62% (202/324). Most programs (72%) reported no change in average patient load per intern after work hour regulation. Many programs (48%) redistributed house staff admissions through the call cycle. The number of admissions per intern on long call (the day interns have the most admitting responsibility) decreased in 31% of programs, and the number of admissions on other days increased in 21% of programs. Residents on outpatient rotations were given new ward responsibilities in 36% of programs. Third-year resident ward and float time increased in 34% of programs, while third-year elective time decreased in 22% of programs. The mean weekly hours allotted to educational activities did not change significantly (12.7 vs. 12.4, $P = .12$), but 56% of programs reported a decrease in intern attendance at educational activities. In response to work hour regulation, many internal medicine programs redistributed rather than reduced residents' inpatient clinical experience. Hours allotted to educational activities did not change; however, most programs saw a decrease in intern attendance at conferences, and many reduced third-year elective time.

Landrigan CP, Barger LK, Cade BE, Ayas NT, Czeisler CA. Interns' compliance with accreditation Council for Graduate Medical Education work-hour limits. JAMA. 2006 Sep 6;296(9):1063-70.

Sleep deprivation is associated with increased risk of serious medical errors and motor vehicle crashes among interns. The Accreditation Council for Graduate Medical Education (ACGME) introduced duty-hour standards in 2003 to reduce work hours. To estimate compliance with the ACGME duty-hour standards among interns. National prospective cohort study with monthly Web-based survey assessment of intern work and sleep hours using a validated instrument, conducted pre-implementation (July 2002

through May 2003) and post-implementation (July 2003 through May 2004) of ACGME standards. Participants were 4015 of the approximately 37 253 interns in US residency programs in all specialties during this time; they completed 29 477 reports of their work and sleep hours. Outcome measures were overall and monthly rates of compliance with the ACGME standards. **Post-implementation, 1068 (83.6%; 95% confidence interval [CI], 81.4%-85.5%) of 1278 of interns reported work hours in violation of the standards during 1 or more months. Working shifts greater than 30 consecutive hours was reported by 67.4% (95% CI, 64.8%-70.0%). Averaged over 4 weeks, 43.0% (95% CI, 40.3%-45.7%) reported working more than 80 hours weekly, and 43.7% (95% CI, 41.0%-46.5%) reported not having 1 day in 7 off work duties. Violations were reported during 3765 (44.0%; 95% CI, 43.0%-45.1%) of the 8553 intern-months assessed post-implementation (including vacation and ambulatory rotations), and during 2660 (61.5%; 95% CI, 60.0%-62.9%) of 4327 intern-months during which interns worked exclusively in inpatient settings. Post-implementation, 29.0% (95% CI, 28.7%-29.7%) of reported work weeks were more than 80 hours per week, 12.1% (95% CI, 11.8%-12.6%) were 90 or more hours per week, and 3.9% (95% CI, 3.7%-4.2%) were 100 or more hours per week. Comparing pre-implementation to post-implementation responses, reported mean work duration decreased 5.8% from 70.7 (95% CI, 70.5-70.9) hours to 66.6 (95% CI, 66.3-66.9) hours per week (P<.001), and reported mean sleep duration increased 6.1% (22 minutes) from 5.91 (95% CI, 5.88-5.94) hours to 6.27 (95% CI, 6.23-6.31) hours per night (P<.001). However, reported mean sleep during extended shifts decreased 4.5%, from 2.69 (95% CI, 2.66-2.73) hours to 2.57 (95% CI, 2.52-2.62) hours (P<.001). In the first year following implementation of the ACGME duty-hour standards, interns commonly reported noncompliance with these requirements.**

Girard DE, Choi D, Dickey J, Wessel K, Austin D. A mid year comparison study of career satisfaction and emotional states between residents and faculty at one academic medical center. BMC Med Educ. 2006 Jul 76:36.

See summary on page 18.

Ratanawongsa N, Bolen S, Howell EE, Kern DE, Sisson SD, Larriviere D. Residents' perceptions of professionalism in training and practice: barriers, promoters, and duty hour requirements. J Gen Intern Med. 2006 Jul;21(7):758-63.

The Accreditation Council for Graduate Medical Education duty hour requirements may affect residents' understanding and practice of professionalism. The authors explored residents' perceptions about the current teaching and practice of professionalism in residency and the impact of duty hour requirements. DESIGN: Anonymous cross-sectional survey. Internal medicine, neurology, and family practice residents at 3 teaching hospitals (n=312). Using Likert scales and open-ended questions, the questionnaire explored the following: residents' attitudes about the principles of professionalism, the current and their preferred methods for teaching professionalism, barriers or promoters of professionalism, and how implementation of duty hours has affected professionalism.: **One hundred and sixty-nine residents (54%) responded. Residents rated most principles of professionalism as highly important to daily practice (91.4%, 95% confidence interval [CI] 90.0 to 92.7) and training (84.7%, 95% CI 83.0 to 86.4), but fewer rated them as highly easy to incorporate into daily practice (62.1%, 95% CI 59.9 to 64.3), particularly conflicts of interest (35.3%, 95% CI 28.0 to 42.7) and self-awareness (32.0%, 95% CI 24.9 to 39.1). Role-modeling was the teaching method most residents preferred. Barriers to practicing professionalism included time constraints, workload, and difficulties interacting with challenging patients. Promoters included role-modeling by faculty and colleagues and a culture of professionalism.** Regarding duty hour limits, residents perceived less time to communicate with patients, continuity of care, and accountability toward their colleagues, but felt that limits improved professionalism by promoting resident well-being and teamwork. Residents perceive

challenges to incorporating professionalism into their daily practice. The duty hour implementation offers new challenges and opportunities for negotiating the principles of professionalism.

Chang LW, Vidyarthi AR, Kohlwes RJ. Baseline duty hours recorded with time-cards: a pre-regulation study of internal medicine residents. Med Educ. 2006 Jul;40(7):662-6.

The acquisition of data on resident duty hours has been largely dependent on self-report surveys collected in the surgical literature. The authors sought to implement and describe a simple method for monitoring internal medicine resident duty hours by using time-cards. In 2002, internal medicine residents on a 3-site academic program were asked to track their duty hours using time-cards prior to the implementation of system changes according to duty hours reform. **Of participating residents (n = 41), 93% worked at least 1 shift longer than 30 hours, 29% worked an average of more than 80 hours per week, and 56% had less than 1 day off per week. No residents were on call more than once every third day.** This study describes the findings and challenges of using time-cards to track duty hours, and shows that many internal medicine residents on this program were, before implementation of duty hour reforms, in violation of duty hour regulations.

Frankel HL, Foley A, Norway C, Kaplan L. Amelioration of increased intensive care unit service readmission rate after implementation of work-hour restrictions. J Trauma. 2006 Jul;61(1):116-21.

In July 2003, the authors reallocated resident workforce to address mandated duty-hour restrictions. In the subsequent academic year (AY), surgical intensive care unit (SICU) service readmission rates (RR) doubled. The authors hypothesized that a targeted intervention could reduce SICU service RR in academic year (AY) 2004-05. This study was conducted at an urban teaching hospital before (AY02-03, period 1), during (AY03-04, period 2), and after (AY04-05, period 3) implementation of the Accreditation Council for Graduate Medical Education guidelines. Demographics, RR, and reason were culled from Project Impact and a complications database. SICU staff (dedicated intensivist, two or three fellows, and six residents) remained constant. In periods 2 and 3 (versus 1), ward residents cross-covered > or = 3 services every 5 to 6 nights (versus every 3 in period 1) with physician assistant support (versus none in period 1). During period 3, a focused transfer phone call, charted care summary, and discharge checkup defined the intervention. Interperiod comparisons were by chi2 and t test analysis; p < 0.05 (versus period 1) defined significance.

In all, 1,570, 1,705 and 1,681 patients were treated in periods 1, 2, and 3, respectively. There were no demographic or APACHE score differences. RRs were 1.4%, 3.0% and 1.2% in periods 1, 2, and 3, respectively. The percentages of readmissions as a result of ward care were 16.7, 41, and 10%, respectively. The most common readmission indication was respiratory (46% in period 1; 51% in period 2, and 80% in period 3) and was associated with an increased proportion of readmission as a result of patient disease (46% in period 1; 41% in period 2; 80% in period 3). Intervention noncompliance preceded 30% of period 3 readmissions. A targeted intervention can reduce the rate of SICU readmission caused by care inadequacies stemming from a resident reallocation strategy.

Kiernan M, Civetta J, Bartus C, Walsh S. 24 hours on-call and acute fatigue no longer worsen resident mood under the 80-hour work week regulations. Curr Surg. 2006 May-Jun;63(3):237-41.

Studies in on-call residents have shown that mood is worsened by fatigue as indicated by increased scores on measures of depression, anxiety, confusion, and anger using the Profile of Mood States (POMS). In prior sleep deprivation studies, mood has been shown to be more affected than either cognitive or motor performances. The purpose of this study was to examine the effect of the 80-hour work week regulations

on resident mood in general and in a post-call period (PC). Institutional Review Board approval was obtained to survey the residents and publish the results. POMS is a 65-item adjective questionnaire that includes subscales for measuring tension-anxiety, anger-hostility, depression-dejection, vigor-activity, fatigue-inertia, and confusion-bewilderment, with the summation of the scales forming a total mood disturbance score. Surgical residents were tested at a 9 am didactic curriculum session (9 am has been shown to correlate with the nadir of performance). Residents were tested after nights off call (NOC) or after PC. Time asleep in the preceding 24 hours and other demographic data were also collected. Acute fatigue (AF) was defined as <4 hours sleep. The two-sample t-test and linear regression were used to assess differences between groups.

A total of 123 standardized POMS mood questionnaires were administered on 4 occasions to 51 surgical residents, 35 men and 16 women at levels PGY-1 through PGY-5. Overall, 33 tests (27%) were taken after PC and 90 (73%) were taken after NOC. Acute fatigue residents had a mean sleep time of 2.2 (+/- 1.5) hours, whereas rested (R) residents had a mean sleep time of 6.7 (+/-2.2) hours (whether PC or NOC). **No statistical differences in mean values of vigor, anger, depression, concentration, fatigue, tension, or total score were observed between PC and NOC or between AF and R residents. There was no significant relationship between acute sleep deprivation and total mood disturbance, whether PC or NOC.** In linear relationships, NOC total score and hours slept had $r^2 = 0.01$ ($p = 0.44$), whereas PC total score and hours slept had $r^2 = 0.07$ ($p = 0.14$). Although POMS was given 4 times, only 27% were PC, which reflects a 1 in 4 night in-house coverage. In contrast to earlier studies, resident mood, as measured by POMS, is no longer related to PC/NOC or acute fatigue. Previous studies have shown that loss of sleep was associated with declining mood. The lack of such a relationship in this study may be related to the new regulations. It has been assumed that people can adapt to chronic sleep loss but have a harder time coping with the effects of acute sleep deprivation. If, however, the new regulations have relieved chronic sleep deprivation, then a well-rested resident can periodically cope with the effects of acute sleep deprivation. Perhaps by eliminating chronic sleep debt, work hour restrictions seem to have removed the negative impact of PC seen in the prior era. Further studies should increase the number of residents studied, have numerous repeat NOC and PC pairs in same subjects, compare different services with different workloads, junior and senior residents, and in-house and at-home call schedules.

Akl EA, Bais A, Rich E, Izzo J, Grant BJ, Schoenemann HJ. Brief report: Internal medicine residents', attendings', and nurses' perceptions of the night float system. J Gen Intern Med. 2006 May;21(5):494-7.

Residency training programs use the night float system increasingly to meet the new resident work hour regulations. This survey study was to assess and compare residents', attendings', and nurses' perceptions of the night float system. One hundred and seven residents, 48 attendings, and 69 nurses in a university-based multi-center internal medicine residency program participated. Measurements were perceived impact on patient care, resident training, and resident performance. The overall response rate was 75%.

In general, more residents than both attendings and nurses had positive opinions regarding the night float system, particularly in relation to patient care. Only a small proportion of residents and attendings thought positively about the night float's impact on training quality (29.9%; 18.2%), daily feedback (23.0%; 9.1%), and end of rotation evaluation (21.8%; 6.1%). Less than half of the nurses had positive perceptions of the night residents' performance in terms of promptness (40.9%), physical availability (38.6%), familiarity with the patients' cases, and management plans (15.9%), communication of management plans to nurses (36.4%), professional respect and trust (43.2%), and teamwork (45.5%). Residents had more positive perceptions than attendings and nurses. Nurses, in particular, had negative perceptions of resident performance in the setting of the night float system.

Harrison R, Allen E. Teaching internal medicine residents in the new era. Inpatient attending with duty-hour regulations. J Gen Intern Med. 2006 May;21(5):447-52.

Little is known about the impact of resident duty-hour regulations on the inpatient teaching experience. The objective was to provide descriptive information on the effect of resident duty-hour regulations on attendings and the educational environment. The design was a qualitative analysis of attending focus groups and e-mail survey of residents in Internal Medicine. The participants were inpatient attending physicians at 2 academic centers and residents at the affiliated university-based Internal Medicine residency program in Portland, OR. Seventy-two percent of eligible attendings participated in 2 focus groups.

Three themes were generated: increased clinical role, altered time management, and altered teaching. Attending physicians report performing more clinical work, teaching less, using more focused teaching methods, and experiencing an increased perception of intensity. Forty percent of eligible residents completed the e-mail survey. The authors organized residents' data using the same 3 themes as attending physician data. Residents observed attending physicians performing increased clinical work, being more time aware, delivering more focused teaching, and having less time to teach. Participants noted changes in autonomy and professionalism. Strategies to enhance teaching effectiveness in the new environment were described. Duty-hour regulations have increased attending clinical responsibility and decreased teaching time in 1 residency program, leading to the perception of a more intense attending experience. Duty-hour regulations encourage educators to determine what is critical to preserve in the educational experiences of learners and challenge us to reexamine autonomy and professionalism in training.

Vidyarthi AR, Katz PP, Wall SD, Wachter RM, Auerbach AD. Impact of reduced duty hours on residents' educational satisfaction at the University of California, San Francisco. Acad Med. 2006 Jan;81(1):76-81.

The purpose was to assess the impact of the Accreditation Council for Graduate Medical Education duty-hour limitations on residents' educational satisfaction. In 2003, the authors surveyed 164 internal medicine residents at three clinical training sites affiliated with the University of California, San Francisco, after system changes were introduced to reduce duty hours. On a questionnaire that used various rating scales, residents reported the value of educational activities, frequency of administrative tasks interfering with education, and educational satisfaction after duty hours were reduced. The authors compared univariate statistics and developed multivariable models to discern the relationship between hours worked and educational outcomes.

In all, 125 residents (76%) responded. Residents rated the educational activities, morning report, and teaching others most highly. **Answering pages and tasks related to scheduling were the most frequent barriers to educational activities. Residents reported that time spent in administrative activities did not change after duty-hour restrictions, and 68% said that decreased duty hours had no impact or a negative impact on education. In multivariable models, postgraduate year (PGY)-1 residents ($p = .004$), residents who reported feeling overwhelmed at work ($p < .0001$), and residents who reported working more than 80 hours per week ($p < .05$) had lower work satisfaction. However, only PGY-1 residents ($p < .05$) and those who felt overwhelmed with work ($p = .01$) were less satisfied with their education.** In this residency program, duty-hour reduction did not improve educational satisfaction. Educational satisfaction may be more a function of workload than hours worked; therefore, systematic changes to residents' work-life may be necessary to improve educational satisfaction.

Mathis BR, Diers T, Hornung R, Ho M, Rouan GW. Implementing duty-hour restrictions without diminishing patient care or education: can it be done? Acad Med. 2006 Jan;81(1):68-75.

The purpose was to implement and evaluate a new ward team call system that would meet the Accreditation Council on Graduate Medical Education's (ACGME) duty-hour requirements without compromising patient care or detracting from resident education. The new system was implemented in the internal medicine residency program at the University Hospital at the University of Cincinnati Medical Center. In 2003-04, residents and faculty were surveyed about their experiences with the new and old ward systems relative to duty-hour requirements, patient care, and resident education. Responses were given on a five-point scale (5 = strongly agree, 1 = strongly disagree). Data were compiled and compared using a two-sample t-test.

Faculty believed the new system improved compliance with the duty-hour requirements (mean = 4.3, 95% confidence interval [CI]: 4.1-4.6), although were neutral regarding patient care (mean = 3.5, 95% CI: 3.2-3.8) and education (mean = 3.3, 95% CI: 2.9-3.6). Residents were more neutral regarding ACGME requirements (mean = 3.5, 95% CI: 3.3-3.7) and patient care (mean = 3.2, 95% CI 3.0-3.3). Residents reported a slightly negative impact on education (mean = 2.8, 95% CI: 2.5-3.0). In response to an exclusive question, residents reported that the new system did not reduce fatigue (mean = 2.7, 95% CI: 2.6-3.0). Respondents perceived that this ward call system met ACGME requirements and maintained quality patient care but may have sacrificed some traditional resident education tenets.

Lee, CJ. Federal Regulation of Hospital Resident Work Hours: Enforcement with Real Teeth. *Journal of Health Care Law & Policy*, v. 9, no. 1, 2006, p. 162-216.

In recent years, there has been an increase in the public's awareness of medical errors committed by sleep-deprived and overworked hospital residents. This awareness has resulted in increased public concern regarding patient safety in teaching hospitals across the United States, as well as increased concerns regarding the safety and education of hospital residents themselves.

To address these concerns, the Accreditation Council for Graduate Medical Education (ACGME) appointed the Work Group on Resident Duty Hours and the Learning Environment in September 2001 to establish guidelines for appropriate resident work hours. At about the same time, bills establishing federal statutory restrictions on resident work hours were introduced in Congress, and a Public Citizen petition requesting the promulgation of federal regulations restricting resident work hours was submitted to the Occupational Safety and Health Agency (OSHA).

Gopal R, Glasheen JJ, Miyoshi TJ, Prochazka AV. Burnout and internal medicine resident work-hour restrictions. *Arch Intern Med*. 2005 Dec 12-26;165(22):2595-600.

Burnout is very common in internal medicine residents. Effective July 2003, all residents were restricted to work less than an average of 80 hours per week and no more than 30 hours of continuous duty for patient care and educational obligations. The authors evaluated rates of burnout in internal medicine residents before and after the implementation of the new work-hour restriction. University of Colorado Health Science Center internal medicine residents were surveyed in May 2003 and May 2004. The survey contained the Maslach Burnout Inventory, organized into 3 subscales (i.e., emotional exhaustion, depersonalization, and personal accomplishment); the Primary Care Evaluation of Mental Disorders depression screen; and self-reported quality of care and education. The response rate was 87% (121 of 139 residents) and 74% (106 of 143 residents) in 2003 and 2004, respectively. **Self-reported hours worked decreased from a mean of 74.6 to 67.1 (P = .003). In 2004, 13% fewer residents experienced high emotional exhaustion (42% vs. 29%; P = .03). There was a trend toward fewer residents with high depersonalization (61% vs. 55%; P = .13) and fewer residents with a positive depression screen (51% vs. 41%; P = .11).**

Personal accomplishment did not change. The assessment of self-reported quality of care did not significantly change from 2003 to 2004. Residents reported attending fewer educational conferences per month (18.99 vs. 15.56; P = .01). Overall residency satisfaction decreased 6 mm on a 100-mm visual analogue score (P = .02). Burnout continues to be a major problem. Reducing hours may be the first step to reduce burnout but may also affect education and quality of care.

McDonald JM, Berbaum K, Bennett DL, Mullan B. Radiology residency call: residents' perceptions of the on-call experience. J Am Coll Radiol. 2005 Nov;2(11):932-8.

This paper focuses on specific resident perceptions of call, including the compliance of training programs with the Accreditation Council for Graduate Medical Education's (ACGME) resident work rules and the level of comfort residents have in contacting out-of-house staff radiologists for help during on-call hours. The authors designed a Web-based survey to examine radiology residents' perceptions about call conditions with input from the 2003-2004 ACR Resident and Fellow Section Executive Council. The survey instrument was distributed to chief residents in the United States and Canada with the help of the ACR. Eighty-five percent of respondents felt that the amounts of work and responsibility required for call were appropriate to their levels of training.

Ninety-eight percent of US respondents felt that their programs were in complete compliance with the ACGME's resident work guidelines. Eighty-nine percent were comfortable contacting the staff physicians on call when those staff physicians were out of the hospital. Respondents who felt uncomfortable calling their staff physicians were more likely to feel that the work and responsibility of call were excessive to their levels of training ($\chi^2 = 11.301$, $P = .0033$). The majority of residents indicated that they were adequately trained for call. Most residents were on call without in-house staff coverage but felt comfortable contacting on-call staff physicians if needed. Residents who felt uncomfortable contacting on-call staff physicians were more likely to feel that their training had not prepared them for call. A high percentage of radiology resident programs are in compliance with the ACGME's resident work guidelines.

Fletcher KE, Underwood W 3rd, Davis SQ, Mangrulkar RS, McMahon LF Jr, Saint S. Effects of work hour reduction on residents' lives: a systematic review. JAMA. 2005 Sep 7;294(9):1088-100.

See summary on page 27.

Zonia SC, LaBaere RJ, Stommel M, Tomaszewski DD. Resident attitudes regarding the impact of the 80-duty-hours work standards. J Am Osteopath Assoc. 2005 Jul;105(7):307-13.

The authors report on results from a survey assessing the attitudes of medical residents toward the American Osteopathic Association and the Accreditation Council for Graduate Medical Education duty-hour standards that became effective for all accredited residency programs on July 1, 2003. Data were gathered from 128 residents in four medical specialties: family medicine, general surgery, internal medicine, and obstetrics and gynecology. Participating residents worked at four teaching hospitals with allopathic, osteopathic, or dual-accredited programs. The dominant response of medical residents to duty-hour restrictions is clearly though not uniformly positive. Residents tend to agree that there are safety benefits for patients and quality-of-life benefits for themselves. A consistent pattern of positive responses toward the standards among internal medicine residents contrasts with less favorable responses among residents in general surgery programs. Gender differences are noted as well, with women generally more positive about duty-hour restrictions than their male colleagues. Male residents in surgery and obstetrics especially tend to agree that duty-hour restrictions could have negative effects on physician education with regard to their continuity of experience. The most consistent pattern in resident survey responses

appears to be by medical specialty, perhaps reflecting variations in the nature of patient care and contact in each specialty.

Lieberman JD, Olenwine JA, Finley W, Nicholas GG. Residency reform: anticipated effects of ACGME guidelines on general surgery and internal medicine residency programs. Curr Surg. 2005 Mar-Apr;62(2):231-6.

See summary on page 32.

Saunders DL, Kehoe KC, Rinehart VH, Berg BW. Self-reporting of internal medicine house staff work hours. Hawaii Med J. 2005 Jan;64(1):14-6.

The 80-hour workweek became a reality for residency programs nationwide on July 1, 2003. In this review of administrative data, the authors examine the self-reported work hours by a cohort of Internal Medicine residents. Data was collected from 27 residents in training at Tripler Army Medical Center over a 4 month period from September 1 to December 31 2002. House staff reported their hours on a daily basis by responding to an email message, as well as on a monthly basis utilizing the Army's UCAPERs (Uniform Chart of Account Personnel System) mandatory monthly workload tracking system. Data from the two separate reporting systems was compared for accuracy, completeness and internal consistency.

Compliance with daily reporting was variable (67-97% with overall compliance rate of 86%) but lower when compared with the mandatory military monthly reporting system (95-100%). **There were large differences in reporting of average weekly work hours among individual residents when monthly reporting was compared to daily reporting of data with higher averages with monthly data reporting. Weekly totals averaged nearly 12 hours higher when reported monthly compared to reporting on a daily basis ($p < 0.0001$). A total of 18 residents reported that they worked more than 80 hours per week during one month using monthly data, while only 7 reported that they averaged more than 80 hours with the daily reporting data. When average weekly hours reported on a daily basis were compared with the total number of inpatient days worked over the four month period using a simple regression model, there was a significant relationship with average hours increasing with increasing number of inpatient days worked (adjusted R square = 0.19, $p = 0.01$).**

Little internal consistency was found in the comparison of daily versus monthly work hour reporting, indicating that self-reporting may not provide accurate data. Complying with the 80-hour workweek is crucial for residency programs to maintain accreditation, and thus programs will need a way to accurately capture consistent resident work hour data. Further studies are indicated to determine the most accurate way of assessing house staff work hours.

Jagsi R, Surender R. Regulation of junior doctors' work hours: an analysis of British and American doctors' experiences and attitudes. Soc Sci Med. 2004 Jun;58(11):2181-91.

Regulations of junior doctors' work hours were first enacted in the United States (US) and United Kingdom (UK) over a decade ago, with the goals of improving patient care and doctors' well-being while maintaining a high quality of medical training. This study examines experiences and attitudes regarding the implementation of these regulations among physicians and surgeons at two teaching hospitals, one in South-East England, and the other in New England, US. This paper presents the findings of a survey questionnaire and a series of in-depth interviews administered to a sample of junior doctors and the consultants responsible for their supervision.

The study finds that the different policy mechanisms employed in the two countries have had different degrees of success in reducing the work hours of junior doctors. The results also indicate,

however, that even in settings in which hours have been reduced significantly, the regulations have only had limited effects on the quality of medical care, junior doctors' well-being, and the quality of medical education. A number of barriers to the success of the regulations in achieving their objectives are identified, and the relative merits of political action and professional self-regulation are discussed. This research suggests that recently enacted policies requiring further reductions in junior doctors' hours in both the US and UK may face similar barriers when implemented. Understanding the lessons that emerge from implementation of the original regulations is essential if future reforms are to succeed and a high-quality system of health care is to be sustained.

Barone JE, Ivy ME. Resident work hours: the five stages of grief. Acad Med. 2004 May; 79(5):379-80.

See summary on page 40.

Rosen IM, Bellini LM, Shea JA. Sleep behaviors and attitudes among internal medicine house staff in a U.S. university-based residency program. Acad Med. 2004 May;79(5):407-16.

Physicians-in-training are susceptible to fatigue given their prolonged duty hours. Sleep deprivation has been shown to alter perceptions of sleepiness and performance. This study examined the state of sleepiness and attitudes about sleep and performance of work- and non-work-related tasks among incoming and current house staff; and how rotation, call cycle, and call status are related to acute and chronic sleep deprivation and perceptions of sleepiness.

A survey instrument was administered in June 2001 to 53 incoming interns and 79 current house staff at the University Pennsylvania School of Medicine, a university-based internal medicine residency program. All 132 participants (100%) completed the instrument. Acute sleep deprivation was experienced by 34% of the current house staff and 64% of current house staff were chronically sleep deprived. **Current house staff admitted to the possibility of dozing while performing various work-related tasks such as writing notes in charts (69%), reviewing medication lists (61%), interpreting labs (51%), and writing orders (46%). At least half of all respondents felt their patients received good care despite residents' sleepiness and as many believed sleep deprivation was a necessary part of training. Nearly half (48%) of current house staff rotating on a ward service reported acute sleep deprivation, as did 81% of those who were post-call. Over two-thirds of the house staff on wards and in the ICU reported chronic sleep deprivation. Subjective sleepiness did not vary much across rotations, call cycle, and call status. Chronic and acute sleep deprivation contribute to residents' fatigue.** Education could be targeted at attitudes. Further investigation of factors contributing to chronic sleep deprivation in this population is warranted.

Bhananker SM, Cullen BF. Resident work hours. Curr Opin Anaesthesiol. 2003 Dec;16(6):603-9.

The Accreditation Council for Graduate Medical Education has mandated new requirements for work hours for all US resident physicians that became effective in July 2003. Member countries of the European Union are also implementing a reduction in work hours for trainee physicians as per the European Work Time Directives. The following review provides a summary of the basis of limiting work hours for residents, steps taken towards limiting the working hours for resident doctors, and implications to residents, institutions, and states.

The authors concluded that reduction of work hours for physicians in training is a much awaited and necessary change. Though the framework for such a reduction is in place in most countries, implementation of the policies has been slow thus far, mainly due to financial and manpower constraints. Setting of deadlines for compliance and legislation to penalize the defaulting institutions and

programs may help to put the recommendations on work hours into practice. Long work hours contribute to stress, fatigue, and mood changes in trainee physicians that are potentially deleterious to the physician and patients. Recommendations have been made across the globe to reduce resident doctor work hours and legislation is in place to monitor institutional compliance with these recommendations. Once these regulations are complied with, follow-up studies will be needed to evaluate their effects on physician well-being and patient care.

Lawrence III HC. The Impact of Residents' Work-hour Restrictions. Curr Womens Health Rep. 2003 Dec;3(6):487-91.

Graduate medical education continues to deal with multiple stressors. The new work-hour regulations only add to the program directors' and department chairs' difficulty of ensuring adequate educational, didactic, and clinical training for the residents. Appropriately, patient safety has been a concern in the discussion pertaining to resident work hours. Ensuring that the training of residents is adequate prior to their entering practice will also have a direct impact on patient safety. In this article, areas of concern are identified, and ways of continuing to evaluate and document the adequacy of resident training are proposed.

Baldwin DC Jr, Daugherty SR, Tsai R, Scotti MJ Jr. A national survey of residents' self-reported work hours: thinking beyond specialty. Acad Med. 2003 Nov;78(11):1154-63.

The authors' purpose was to interpret data from residents regarding residency work hours and correlates. A national, random sample of postgraduate year 1 (PGY1) and year 2 (PGY2) residents in the 1998-1999 training year was identified using the American Medical Association's Graduate Medical Education database. Residents completed a five-page survey with 44 questions and 144 separate data elements relating to their residency experience. **Completed surveys were received from 3,604 of 5,616 (64.2%) residents contacted. PGY1 residents reported working an average of 83 hours a week versus 76.2 hours for PGY2 residents (p <.0001). Total work hours were significantly correlated with reported stress and hours of sleep per week. Residents averaging more than 80 work hours per week were more likely to be involved in a personal accident or injury, a serious conflict with other staff members, and making a significant medical error.** Cluster analysis revealed four different types of residency experience: high intensity, moderate intensity, low intensity, and moonlighters, suggesting that residents may have some choice in selecting a residency experience suited to their particular personal and professional needs. **Nearly half of PGY1 and one third of PGY2 residents reported working more than 80 hours per week.** These extended hours are significantly correlated with a number of patient care and personal health variables. Given the variety of program and specialty requirements and demands, it seems unlikely that an arbitrary limit or a simple decrease in work hours will provide a satisfactory solution to many resident and patient care concerns.

Boex JR, Leahy PJ. Understanding residents' work: moving beyond counting hours to assessing educational value. Acad Med. 2003 Sep;78(9):939-44.

The authors sought to understand how residents' work affects their own educations and the hospitals in which most of their training takes place. They used a systematic review of the literature analyzing residents' activities. This review sought to analyze resident physicians' activities to assess the educational value of residents' work. The published literature was searched in 2001 using the Medline and Science Citation Index databases, and the unpublished literature was searched using bibliographies and key informants. One hundred six studies were rated for methodological rigor using the Cochrane Collaboration protocol, as modified by Bland et al. for nonclinical trials. Only those studies undertaken following the Bell Commission's report in 1987 and whose methodological rigor score fell at or above the

median for all studies rated were included in the data synthesis. Results data from 16 studies that included over 1,000 residents in six different specialties, were combined under the definitions of types of residents' activities: marginal, patient care, teaching and learning, and other.

The analysis found that residents devoted approximately 36% of their effort to direct patient care necessary to achieve specialty-specific learning objectives, 15% to the residency program's organized teaching activities, and potentially as much as 35% to delivering patient care of marginal or no educational value. An additional 16% of residents' waking time on duty was spent in other, unspecified activities. The authors concluded that it is possible and potentially valuable to consider not only the number of hours worked by residents, but the educational content of their work when considering residency work and hour reforms.

Lowenstein J. Where have all the giants gone? Reconciling medical education and the traditions of patient care with limitations on resident work hours. *Perspect Biol Med.* 2003 Spring;46(2):273-82.

The Accreditation Council for Graduate Medical Education recently approved regulations that would prohibit residents from working more than 80 hours per week and more than 24 hours at a stretch. These regulations are scheduled to take effect in all U.S. teaching hospitals on 1 July 2003. Those who approve of the proposed regulations argue that house staff fatigue is responsible for physician error, depression, anger, and a lack of compassion for patients. But critics point to the adverse effects on key goals of house staff training—the development of accountability and responsibility. Can the rigorous discipline of medical education and the long tradition of medicine as a profession be reconciled with the current calls for limiting resident duty hours and on-call schedules? **The intensity of patient care in teaching hospitals today is far greater than it was in the past. These changes in medical care make it critical to develop new programs that will reconcile rigorous, scientifically based humanistic medicine with the needs of patients and physicians. This will require imaginative and creative solutions that take a larger view of medical education and medical care than mere manpower calculations and numerical solutions focused simply on compliance with an 80-hour workweek.**

Daugherty SR, Baldwin DC, Rowley BD. Learning, satisfaction, and mistreatment during medical internship: a national survey of working conditions. *JAMA.* 1998 Apr 15;279(15):1194-9.

Concerns about the working and learning environment of residency training continue to surface. Previous surveys of residents have focused on work hours and income, but have shed little light on how residents view their training experience. The objective is to provide a description of the internship year as seen by a large cross section of second-year residents. This was a mail survey conducted in 1991 in residency programs in the United States. Random 10% sample (N=1773) of all second-year residents listed in the American Medical Association's medical research and information database. What and who contributes most to residents' learning during internships, degree of satisfaction with the internship experience, on-call and sleep schedules, incidents of perceived mistreatment or abuse, observations of unethical behavior, and experiences of harassment or discrimination. A total of 1277 surveys (72%) of 1773 mailed were returned.

Overall, respondents reported a moderate level of satisfaction with their first year of residency. On a scale of 0 to 3, residents rated other residents as contributing most (score of 2.3) to their learning, with special patients ranked second (2.1). During a typical work week, residents reported that they spent an average of 56.9 hours on call in the hospital. A total of 1185 (93%) residents reported experiencing at least 1 incident of perceived mistreatment, with 53% reporting being belittled or humiliated by more senior residents. Among women residents, 63% reported having experienced at least 1 episode of sexual harassment or discrimination. A total of 45% of residents reported having observed another individual falsifying medical records, and 70% saw a colleague working in an impaired condition, most often lack of sleep. **Regression**

analyses suggest that satisfaction with the residency experience was associated with the presence of factors that enhanced learning, and fewer experiences of perceived mistreatment. Residents report significant problems during their internship experience. Satisfaction with internship is enhanced by positive learning experiences and lack of mistreatment.

Green MJ. What (if anything) is wrong with residency overwork? Ann Intern Med. 1995 Oct 1;123(7):512-7.

Long work hours during residency are a time-honored tradition. Efforts have recently been made to shorten work hours. This paper examines the main arguments supporting reform: that sleep deprivation is harmful to patients and residents and that it is exploitative. **Because the data on the harms and benefits are mixed and because exploitation is difficult to prove, a stronger argument for reducing work hours is an ethical one: that overwork interferes with the development of professional values and attitudes that are an essential part of the moral curriculum of residency. Providing a climate that promotes moral growth during training is an important curricular objective that may be better achieved by shortening work hours, providing better resident supervision, and using substitute workers for some of the non-educational tasks of residency.**

Wols M, Kramer D, Strange GR. Resident service hours in emergency medicine. SAEM Education Committee. Acad Emerg Med. 1995 Feb;2(2):124-7.

The number of hours worked by residents in all specialties has become a controversial issue. Residents often are expected to competently conduct patient care activities and to take educational advantage of clinical experiences in spite of frequent fatigue and sleep deprivation. This survey of residency directors was designed to assess the scheduled clinical time for emergency medicine (EM) residents. A 13-question survey dealing with time commitments of EM residents was sent to the residency directors of all accredited EM residency programs in the United States in the fall of 1991. Residency directors were asked to indicate the number of shifts, hours, and days off per week; and the number of night shifts and weekend days off per month for each postgraduate year of residency training (PGY1-PGY4). Directors also were asked whether shifts were scheduled randomly or predictably with progression from days to nights with time off after nights.

Seventy of 71 (98.6% response rate) residency directors responded. **Residents were scheduled for an average of 49.1 hours per week. Scheduled hours decreased from an average of 51.9 at the PGY1 level to an average of 44.5 at the PGY4 level. A similar progression with year of training was noted for scheduled night shifts/month, days off/week, and weekend days off/month. A PGY1 trainee averaged 7.0 night shifts/month, 1.9 days off/week, and 3.0 weekend days off/month; while a PGY4 trainee averaged 5.3, 2.4, and 3.2, respectively. Only 40% of the directors reported predictable scheduling progressing from days to nights.**

Emergency medicine resident schedules, as reported by residency directors, fall well within current specialty-specific requirements and compare favorably with the reported numbers for other specialties. However, because large ranges in scheduling parameters were reported, the data may be of value to residency directors, residents, and prospective residents. Most programs did not report a predictable schedule progression of shifts.

Wood VC, Markert RJ, McGlynn TJ. Internal medicine residents' perceptions of the balance between service and education in their night-call activities. Acad Med. 1993 Aug;68(8):640-2.

The authors sought to quantify the workload of residents on night call and to determine the residents' perceptions of the balance between service and education in their night-call activities. Twenty-two

internal medicine residents – nine first-year residents and 13 senior residents (i.e., in their second, third, or fourth year – kept logs of their night-call activities for two periods of 16 days each in 1991-92, at a 772-bed teaching hospital affiliated with Wright State University School of Medicine. The residents used the following five-point scale to rate each activity: 1, strictly service; 3, even balance; 5, strictly education. They also recorded the total times spent on various activities. Data were analyzed by using the independent and paired t-tests.

Ninety-eight percent of the logs were returned. The first-year and senior residents did not differ significantly in times spent on logged events. Both the first-year and the senior residents perceived many night-call activities to be weighted toward education, especially those involving evaluation of acutely ill patients being considered for hospital admission (overall mean rating of 3.3). There was no striking difference between the first-year and senior residents' perceptions of the balance between service and education in their activities.

The residents' perceptions of the relationship between service and education indicate that there was an even balance between the two. The educational aspects of night-call duties can and should remain an integral part of residents' training.

Berry AJ, Hall JR. Work hours of residents in seven anesthesiology training programs. *Anesthesia and Analgesia*. 1993 Jan;76(1):96-101, 1993.

Medical educators and credentialing organizations recently have called attention to the long hours that some house staff is required to spend in the hospital during training. To determine the average duration of in-hospital work hours of anesthesiology residents, 148 residents at seven, university-affiliated training programs kept daily logs of their activities for one week. **Residents in clinical anesthesia years 1, 2, and three spent an average of 66, 65, and 64 hours per week, respectively, in the hospital with a range of 43 to 104 hours per week.** Although there was not a difference in in-hospital work time among years of training, there was a statistical difference between two of the seven programs studied. The largest portion of the in-hospital time was devoted to patient care activities in the operating room. Residents had time for educational activities, conferences, and reading while in the hospital. The overall work hours of the residents in the anesthesiology training programs included in this survey appeared to be within current guidelines.

American College of Physicians. Working conditions and supervision for residents in internal medicine programs: recommendations. *Ann Intern Med*. 1989 Apr 15;110(8):657-63.

Changes intended to improve resident working conditions and supervision must take into account the complex realities governing teaching services. The American College of Physicians supports the ongoing reexamination of these issues, and recommends the following: 1) change be systematic and coordinated, balancing patient care and teaching needs; 2) changes in the medical care system itself are necessary in this process; 3) efforts be continued to reduce preventable medical error on teaching services within the limits of uncertainty intrinsic to medical practice; 4) reasonable restriction be placed on total continuous duty hours, but residents not disengage themselves prematurely from care of their patients; 5) residency training specifically teach techniques for balancing patient service, education, and personal life; 6) the issue of resident workload be addressed; and 7) evaluation of supervisory competence, explicit attention to the spirit of resident-supervisor relationships, respect for the principle of meaningful patient responsibility, and resident credentialing all be taken into account in improving resident supervision.

III. Effect/Predicted Effect of the National Duty Hour Limits on Patient Care

Nakayama DK, Thompson WM, Wynne JL, Dalton ML, Bozeman AT, Innes BJ. The effect of ACGME duty hour restrictions on operative continuity of care. Am Surg. 2009 Dec;75(12):1234-7.

Resident work restrictions limit participation in operations that address problems created by a prior operation, because complications occur at any time. We compared resident and attending surgeon staffing of operative complications. We reviewed all complications that required a second operation reported at our Morbidity and Mortality Conference over 1 year, noting surgeons present, their postgraduate year level, and call shift. Comparisons were done using chi². Of 142 cases, 39 involved a second operation. The same attending surgeon was present for both in 79 per cent of cases, whereas the same resident was present in only 44 per cent ($P = 0.002$). Postgraduate year 4 to 5 were less likely to be present for second operations than attendings (48% vs 87%, $P = 0.011$). Resident shift (day, night float, and weekend) was known in 32 cases. When the first operation occurred during day hours, attendings and residents were equally likely to be present at the second (55% and 45%, $P = 0.16$). When original operations took place during night float or weekend shifts, residents were less likely to be present (33%) than attendings (83%) at second operations ($P = 0.036$). Duty hour restrictions interfere with operative continuity of care. Reoperations should be exempted from duty hour restrictions.

Silber JH, Rosenbaum PR, Rosen AK, Romano PS, Itani KM, Cen L, Mi L, Halenar MJ, Even-Shoshan O, Volpp KG. Med Care. Prolonged hospital stay and the resident duty hour rules of 2003. 2009 Dec;47(12):1191-200.

Resident duty hour reforms of 2003 had the potential to create a major impact on the delivery of inpatient care. We examine whether the reforms influenced the probability of a patient experiencing a prolonged hospital length of stay (PLOS), a measure reflecting either inefficiency of care or the development of complications that may slow the rate of discharge. The design entails conditional logistic models to compare PLOS in more versus less teaching-intensive hospitals before and after the reform, adjusting for patient comorbidities, common time trends, and hospital site. Subjects were Medicare ($N = 6,059,015$) and Veterans Affairs (VA) ($N = 210,276$) patients admitted for medical conditions (acute myocardial infarction, heart failure, stroke, or gastrointestinal bleeding) or surgical procedures (general, orthopedic, and vascular) from July 2000 to June 2005. The measure was prolonged length of stay.

Modeling all medical conditions together, the odds of prolonged stay in the first year post reform at more versus less teaching intensive hospitals was 1.01 (95% CI: 0.97-1.05) for Medicare and 1.07 (0.94-1.20) for the VA. Results were similarly negative in the second year post reform. For "combined surgery" the post year 1 odds ratios were 1.04 (0.98-1.09) and 0.94 (0.78-1.14) for Medicare and the VA respectively, and similarly unchanged in post year 2. Isolated increases in the probability of prolonged stay did occur for some vascular surgery procedures. Hospitals generally found ways to cope with duty hour reform without increasing the prevalence of prolonged hospital stays, a marker of either inefficient care or complications.

Prasad M, Iwashyna TJ, Christie JD, Kramer AA, Silber JH, Volpp KG, Kahn JM. Effect of work-hours regulations on intensive care unit mortality in United States teaching hospitals. Crit Care Med. 2009 Sep;37(9):2564-9.

To examine the association of the resident work-hours reform with mortality for patients in medical and surgical intensive care units. The United States instituted restrictions on resident work-hours in July 2003. The clinical impact of this reform on critically ill patients is unknown. A retrospective cohort study, comparing mortality trends before and after July 1, 2003, in teaching and nonteaching hospitals. The

study included 230,151 adult patients admitted to 104 different intensive care units at 40 hospitals participating in the Acute Physiology and Chronic Health Evaluation IV clinical information system from July 1, 2001, to June 30, 2005.

The primary exposure was the date of admission, relative to the implementation of the work-hours regulations. The primary outcome was in-hospital mortality; a secondary outcome was intensive care unit mortality. The analysis included 79,377 patients in 12 academic hospitals; 73,580 patients in 12 community hospitals with residents; and 77,194 patients in 16 nonteaching hospitals. Risk-adjusted mortality improved in hospitals of all teaching levels during the study period. **There were no significant differences in the mortality trends between hospitals of different teaching intensities, as demonstrated by nonsignificant interaction between time and teaching status (global test of interaction, $p = .56$). There was a decrease in in-hospital mortality in intensive care unit patients during the years of observation.** This decrease was not associated with hospital teaching status, suggesting no net positive or negative association of the resident work-hours regulations with a major patient-centered outcome.

West CP, Tan AD, Habermann TM, Sloan JA, Shanafelt TD. Association of resident fatigue and distress with perceived medical errors. JAMA. 2009 Sep 23;302(12):1294-300.

Fatigue and distress have been separately shown to be associated with medical errors. The contribution of each factor when assessed simultaneously is unknown. OBJECTIVE: To determine the association of fatigue and distress with self-perceived major medical errors among resident physicians using validated metrics. Prospective longitudinal cohort study of categorical and preliminary internal medicine residents at Mayo Clinic, Rochester, Minnesota. Data were provided by 380 of 430 eligible residents (88.3%). Participants began training from 2003 to 2008 and completed surveys quarterly through February 2009. Surveys included self-assessment of medical errors, linear analog self-assessment of overall quality of life (QOL) and fatigue, the Maslach Burnout Inventory, the PRIME-MD depression screening instrument, and the Epworth Sleepiness Scale. Main outcome measures included frequency of self-perceived, self-defined major medical errors was recorded. Associations of fatigue, QOL, burnout, and symptoms of depression with a subsequently reported major medical error were determined using generalized estimating equations for repeated measures.

The mean response rate to individual surveys was 67.5%. **Of the 356 participants providing error data (93.7%), 139 (39%) reported making at least 1 major medical error during the study period. In univariate analyses, there was an association of subsequent self-reported error with the Epworth Sleepiness Scale score (odds ratio [OR], 1.10 per unit increase; 95% confidence interval [CI], 1.03-1.16; $P = .002$) and fatigue score (OR, 1.14 per unit increase; 95% CI, 1.08-1.21; $P < .001$). Subsequent error was also associated with burnout (ORs per 1-unit change: depersonalization OR, 1.09; 95% CI, 1.05-1.12; $P < .001$; emotional exhaustion OR, 1.06; 95% CI, 1.04-1.08; $P < .001$; lower personal accomplishment OR, 0.94; 95% CI, 0.92-0.97; $P < .001$), a positive depression screen (OR, 2.56; 95% CI, 1.76-3.72; $P < .001$), and overall QOL (OR, 0.84 per unit increase; 95% CI, 0.79-0.91; $P < .001$).** Fatigue and distress variables remained statistically significant when modeled together with little change in the point estimates of effect. Sleepiness and distress, when modeled together, showed little change in point estimates of effect, but sleepiness no longer had a statistically significant association with errors when adjusted for burnout or depression. Among internal medicine residents, higher levels of fatigue and distress are independently associated with self-perceived medical errors.

Privette AR, Shackford SR, Osler T, Ratliff J, Sartorelli K, Hebert JC. Implementation of resident work hour restrictions is associated with a reduction in mortality and provider-related complications on the surgical service: a concurrent analysis of 14,610 patients. Ann Surg. 2009 Aug;250(2):316-21.

To determine the effect of implementation of work hour restrictions on the rates of morbidity, mortality, and provider-related complications in surgical patients and to determine the incremental personnel costs associated with implementation. In 2003, the Accreditation Council for Graduate Medical Education enacted resident work hour restrictions (RWHR) to improve patient safety by decreasing errors attributed to resident fatigue. There are no quantitative data on surgical patients to validate whether this objective has been achieved and, if so, at what cost. Retrospective observational cohort analysis of data gathered concurrently with patient care for 30 days after admission or surgical intervention before implementation (prerestriction: July 2001-June 2003) and after (postrestriction: July 2005-June 2007). Main outcome measures: mortality, surgical complications, percentage of complications judged to be provider-related, and incremental personnel costs (salary and fringe of providers).

A total of 14,610 patients were admitted during the 2 periods. Compared with the prerestriction period, there was a significant reduction in the percentage of complications attributed to providers (pre: 48.3%; post: 38.6%, $P < 0.001$) and a significant reduction in mortality rate (pre: 1.9%; post: 1.1%, $P = 0.002$) in the postrestriction period. **Postrestriction the clinical care hours provided by attending surgeons increased significantly and was associated with a 1250% increase in the RVU-82 billing modifier ("no qualified resident available") from 523 RVUs pre-RWHR to 6542 post-RWHR. There was an increase in annual personnel costs postrestriction of \$1.466 million.** Implementation of RWHR was associated with reduced provider-related complications and mortality suggesting improved patient safety. This was likely due to several factors including reduced resident fatigue and greater attending involvement in clinical care.

O'Donoghue K, Sheridan CP, O'Sullivan K, Greene RA, Higgins JR. Timing of birth related to obstetric practice and neonatal outcome. Ir Med J. 2008 Jul-Aug;101(7):205-7.

See summary on page 174.

Fletcher KE, Wiest FC, Halasyamani L, Lin J, Nelson V, Kaufman SR, Saint S, Schapira M. How do hospitalized patients feel about resident work hours, fatigue, and discontinuity of care? J Gen Intern Med. 2008 May;23(5):623-8.

Patient-centered care requires that physicians understand patients' perspectives. Since the resident work hour rules were instituted, little information is available about how patients perceive these issues. The objectives were to explore patients' knowledge, concerns, and attitudes about resident work hours, fatigue, and continuity of inpatient care and to evaluate the association between patients' trust and satisfaction with these concerns and attitudes. The authors conducted a cross-sectional survey of 134 internal medicine inpatients at 3 institutions including a tertiary care academic health center, a Veterans Affairs medical center, and a private community teaching hospital. Mean age was 59 (range, 24-90), with 60% men and 70% white.

Most patients agreed (50%) or felt neutral (38%) toward resident work hours being limited. Patients estimated that residents worked 60 h per week but thought that they should work no more than 51 h per week ($p < .01$ for the difference). Twenty-seven percent of patients had some concern about fatigue in the residents, and 28% reported concern about how often hand-offs of care occurred. Factor analysis yielded 3 factors: "worried about discontinuity/fatigue," "attitude toward resident/nurse work hours," and "perceived resident/nurse fatigue." In multivariable analyses, the "worried about fatigue/discontinuity" factor significantly predicted trust and

satisfaction, and the "perceived resident/nurse fatigue" factor also predicted satisfaction. Some inpatients are concerned about both fatigue in resident physicians and discontinuity of care. This may play a role in trust and satisfaction for patients. Taking steps to design systems to minimize fatigue and discontinuity would be ideal.

Committee on Patient Safety and Quality Improvement. ACOG committee opinion number 398, February 2008: fatigue and patient safety. Obstet Gynecol. 2008 Feb;111(2 Pt 1):471-4.

It has long been recognized that fatigue can affect human cognitive and physical function. Although there are limited published data on the effects of fatigue on health care providers, including full-time practicing physicians, there is increasing awareness within the patient safety movement that fatigue, even partial sleep deprivation, impairs performance. Most of the current literature reviews resident function after recent work reform changes. However, the information available from many studies in health care and other occupations can be applied to the work habits of practicing obstetrician-gynecologists.

Davenport DL, Henderson WG, Mosca CL, Khuri SF, Mentzer RM Jr. Risk-adjusted morbidity in teaching hospitals correlates with reported levels of communication and collaboration on surgical teams but not with scale measures of teamwork climate, safety climate, or working conditions. J Am Coll Surg. 2007 Dec;205(6):778-84.

Since the Institute of Medicine patient safety reports, a number of survey-based measures of organizational climate safety factors (OCSFs) have been developed. The goal of this study was to measure the impact of OCSFs on risk-adjusted surgical morbidity and mortality. Surveys were administered to staff on general/vascular surgery services during a year. Surveys included multi-item scales measuring OCSFs. Additionally, perceived levels of communication and collaboration with coworkers were assessed. The National Surgical Quality Improvement Program was used to assess risk-adjusted morbidity and mortality. Correlations between outcomes and OCSFs were calculated and between outcomes and communication/ collaboration with attending and resident doctors, nurses, and other providers. Fifty-two sites participated in the survey: 44 Veterans Affairs and 8 academic medical centers.

A total of 6,083 surveys were returned, for a response rate of 52%. **The OCSF measures of teamwork climate, safety climate, working conditions, recognition of stress effects, job satisfaction, and burnout demonstrated internal validity but did not correlate with risk-adjusted outcomes. Reported levels of communication/collaboration with attending and resident doctors correlated with risk-adjusted morbidity.** Survey-based teamwork, safety climate, and working conditions scales are not confirmed to measure organizational factors that influence risk-adjusted surgical outcomes. Reported communication/ collaboration with attending and resident doctors on surgical services influenced patient morbidity. This suggests the importance of doctors' coordination and decision-making roles on surgical teams in providing high-quality and safe care. The authors propose risk-adjusted morbidity as an effective measure of surgical patient safety.

Meltzer DO, Arora VM. JAMA. 2007 Sep 5;298(9):1055-7. Evaluating resident duty hour reforms: more work to do.

The long work hours of medical residents have received increasing attention in recent years due to concerns about patient safety and the health and education of residents themselves. Although patient safety has been heavily emphasized in the media coverage of duty hour reforms, the evidence that long resident duty hours adversely affect patient outcomes is relatively poor. Indeed, when the Accreditation Council for Graduate Medical Education (ACGME) decided to implement duty hour reforms, some

expressed concern that patient care could suffer, emphasizing increased discontinuities of care, or the costs of added staffing needed to provide coverage following duty hour restrictions. The authors noted that such concerns make empirical analyses of the consequences of duty hour restrictions especially important.

Volpp KG, Rosen AK, Rosenbaum PR, Romano PS, Even-Shoshan O, Wang Y, Bellini L, Behringer T, Silber JH. Mortality among hospitalized Medicare beneficiaries in the first 2 years following ACGME resident duty hour reform. JAMA. 2007 Sep 5;298(9):975-83.

The Accreditation Council for Graduate Medical Education (ACGME) implemented duty hour regulations for physicians-in-training throughout the United States on July 1, 2003. The association of duty hour reform with mortality among patients in teaching hospitals nationally has not been well established. The study sought to determine whether the change in duty hour regulations was associated with relative changes in mortality among Medicare patients in hospitals of different teaching intensity.

The authors conducted an observational study of all unique Medicare patients (N = 8 529 595) admitted to short-term, acute-care, general US nonfederal hospitals (N = 3321) using interrupted time series analysis with data from July 1, 2000, to June 30, 2005. All Medicare patients had principal diagnoses of acute myocardial infarction, congestive heart failure, gastrointestinal bleeding, or stroke or a diagnosis related group classification of general, orthopedic, or vascular surgery. Logistic regression was used to examine the change in mortality for patients in more vs less teaching-intensive hospitals before (academic years 2000-2003) and after (academic years 2003-2005) duty hour reform, adjusting for patient comorbidities, common time trends, and hospital site. Outcome measures included all-location mortality within 30 days of hospital admission.

In medical and surgical patients, no significant relative increases or decreases in the odds of mortality for more vs less teaching-intensive hospitals were observed in either post-reform year 1 (combined medical conditions group: odds ratio [OR], 1.03; 95% confidence interval [CI], 0.98-1.07; and combined surgical categories group: OR, 1.05; 95% CI, 0.98-1.12) or post-reform year 2 (combined medical conditions group: OR, 1.03; 95% CI, 0.99-1.08; and combined surgical categories group: OR, 1.01; 95% CI, 0.95-1.08) compared with the pre-reform years. The only condition for which there was a relative increase in mortality in more teaching-intensive hospitals post-reform was stroke, but this association preceded the onset of duty hour reform. Compared with non-teaching hospitals, the most teaching-intensive hospitals had an absolute change in mortality from pre-reform year 1 to post-reform year 2 of 0.42 percentage points (4.4% relative increase) for patients in the combined medical conditions group and 0.05 percentage points (2.3% relative increase) for patients in the combined surgical categories group, neither of which were statistically significant. The ACGME duty hour reform was not associated with either significant worsening or improvement in mortality for Medicare patients in the first 2 years after implementation.

Shetty KD, Bhattacharya J. Changes in hospital mortality associated with residency work-hour regulations. Ann Intern Med. 2007 Jul 17;147(2):73-80.

In 2002, the Accreditation Council on Graduate Medical Education enacted regulations, effective 1 July 2003, that limited work hours for all residency programs in the United States. The study sought to determine whether work-hour regulations were associated with changes in mortality in hospitalized patients. It entailed a comparison of mortality rates in high-risk teaching service patients hospitalized before and after July 2003, with non-teaching service patients used as a control group. The settings were 551 U.S. community hospitals included in the Healthcare Cost and Utilization Project's Nationwide Inpatient Survey between January 2001 and December 2004. Patient encompassed 1,511,945 adult patients admitted for 20 medical and 15 surgical diagnoses.

In 1,268,738 medical patients examined, the regulations were associated with a 0.25% reduction in the absolute mortality rate (P = 0.043) and a 3.75% reduction in the relative risk for death. In subgroup analyses, particularly large improvements in mortality were observed among patients admitted for infectious diseases (change, -0.66%; P = 0.007) and in medical patients older than 80 years of age (change, -0.71%; P = 0.005). By contrast, in 243,207 surgical patients, regulations were not associated with statistically significant changes (change, 0.13%; P = 0.54). Teaching status was assigned according to hospital characteristics because direct information on each patient's provider was not available. Results reflect changes associated with the sum of regulations, not specifically with caps on work hours.

The work-hour regulations were associated with decreased short-term mortality among high-risk medical patients in teaching hospitals but were not associated with statistically significant changes among surgical patients in teaching hospitals.

Horwitz LI, Kosiborod M, Lin Z, Krumholz HM. Changes in outcomes for internal medicine inpatients after work-hour regulations. *Ann Intern Med.* 2007 Jul 17;147(2):97-103.

Limits on resident work hours are intended to reduce fatigue-related errors, but may raise risk by increasing transfers of responsibility for patients. The study sought to examine changes in outcomes for internal medicine patients after the implementation of work-hour regulations. The study design was a retrospective cohort study in an urban academic medical center. It involved data for 14,260 consecutive patients discharged from the teaching (housestaff) service and 6664 consecutive patients discharged from the non-teaching (hospitalist) service between 1 July 2002 and 30 June 2004. Outcome data included intensive care unit utilization, length of stay, discharge disposition, 30-day readmission rate to the study institution, pharmacist interventions to prevent error, drug-drug interactions and in-hospital death.

The results showed that the teaching service had net improvements in 3 outcomes. Relative to changes experienced by the non-teaching service, the rate of intensive care unit utilization decreased by 2.1% (95% CI, -3.3% to -0.7%; P = 0.002), the rate of discharge to home or rehabilitation facility versus elsewhere improved by 5.3% (CI, 2.6% to 7.6%; P < 0.001), and pharmacist interventions to prevent error were reduced by 1.92 interventions per 100 patient-days (CI, -2.74 to -1.03 interventions per 100 patient-days; P < 0.001). Teaching and non-teaching services had similar changes over time in length of stay, 30-day readmission rate, and adverse drug-drug interactions. In-hospital death was uncommon in both groups, and change over time was similar in the 2 groups. After the implementation of work-hour regulations, 3 of 7 outcomes improved for patients in the teaching service relative to those in the non-teaching service. The authors found no evidence of adverse unintended consequences after the institution of work-hour regulations. Limitations include the fact that the study used a retrospective, nonrandomized design that assessed a limited number of outcomes. Teaching and non-teaching cohorts may not have been affected similarly by secular trends in patient care.

Feddock CA, Hoellein AR, Wilson JF, Caudill TS, Griffith CH. Do pressure and fatigue influence resident job performance? *Med Teach.* 2007 Jun;29(5):495-7.

Global surveys of residents have consistently identified stress variables as important factors in resident job performance. Determine whether an association exists between resident stress and job performance. Over a three month period, interns on our inpatient ward services were surveyed regarding their current call schedule, whether their prior night's sleep was sufficient, whether they felt pressed by other commitments, whether they spent enough time teaching medical students and whether they had completed all patient care issues on a given day. Multiple logistic regression was used to assess the association

between call status, pressure and sleep adequacy with reported omissions in patient care and adequacy of teaching.

In the regression analysis, ratings of high pressure and insufficient sleep but not call status independently predicted outcomes. For example, if an intern felt both pressed and tired, they were over eight times more likely to omit a patient care issue and over four times more likely to report inadequate teaching. Subjective ratings of high pressure and insufficient sleep are associated with poor job performance in medical residents.

Vidyanthi AR, Auerbach AD, Wachter RM, Katz PP. The impact of duty hours on resident self reports of errors. J Gen Intern Med. 2007 Feb;22(2):205-9.

Resident duty hour limitations aim, in part, to reduce medical errors. Residents' perceptions of the impact of duty hours on errors are unknown. The authors sought to determine residents' self-reported contributing factors, frequency, and impact of hours worked on suboptimal care practices and medical errors. The design was a cross-sectional survey. Subjects included 164 Internal Medicine Residents at the University of California, San Francisco. Residents were asked to report the frequency and contributing factors of suboptimal care practices and medical errors, and how duty hours impacted these practices and aspects of resident work-life. One hundred twenty-five residents (76%) responded.

The most common suboptimal care practices were working while impaired by fatigue and forgetting to transmit information during sign-out. In multivariable models, residents who felt overwhelmed with work ($p = 0.02$) and who reported spending >50% of their time in non-physician tasks ($p = 0.002$) were more likely to report suboptimal care practices. Residents reported work-stress (a composite of fatigue, excessive workload, distractions, stress, and inadequate time) as the most frequent contributing factor to medical errors. In multivariable models, only engaging in suboptimal practices was associated with self-report of higher risk for medical errors ($p < 0.001$); working more than 80 hours per week was not associated with suboptimal care or errors. The findings suggest that administrative load and work stressors are more closely associated with resident reports of medical errors than the number of hours work. Efforts to reduce resident duty hours may also need to address the nature of residents' work to reduce errors.

de Virgilio C, Yaghoobian A, Lewis RJ, Stabile BE, Putnam BA. The 80-hour resident workweek does not adversely affect patient outcomes or resident education. Curr Surg. 2006 Nov-Dec;63(6):435-9; discussion 440.

See summary on page 14.

Jagsi R, Kitch BT, Weinstein DF, Campbell EG, Hutter M, Weissman JS. Residents report on adverse events and their causes. Arch Intern Med. 2005 Dec 12-26;165(22):2607-13.

Resident physicians are frontline providers with a unique vantage point from which to comment on patient safety-related events. The authors surveyed trainees at 2 teaching hospitals about experiences with adverse events (AEs), mistakes, and near misses, as well as the potential causes. Responses were obtained from 821 (57%) of 1440 eligible trainees. Analysis was restricted to 689 clinical trainees. More than half (55%) reported ever caring for a patient who had an AE. The most common types of AEs were procedural and medication related. More than two thirds of AEs were considered significant. **Of the most recent AEs, 24% were attributed to mistakes. The most common reasons for mistakes, as perceived by residents, were excessive work hours (19%), inadequate supervision (20%), and problems with handoffs (15%). In the last week, 114 respondents (18%) reported having a patient with an AE; of these, 42 (37%) reported AEs involving a mistake for which they considered themselves**

responsible. In addition, 141 (23%) reported near-miss incidents in the last week for which they considered themselves responsible. In multivariate analyses, significant predictors of AEs in the last week were inpatient rotation, duty hours in the last week, and procedural specialty. Predictors of near-miss errors in the last week were inpatient rotation, days of fatigue in the last month, and postgraduate year 1 status. **CONCLUSIONS:** These findings support the perception that AEs are commonly encountered by physicians and often associated with errors. Causes of errors in teaching hospitals appear to be multi-factorial, and a variety of measures are necessary to improve safety. Eliciting residents' perspectives is important because residents may perceive events, actions, and causal relationships that medical record reviewers or observers cannot.

Nuckols TK, Escarce JJ. Residency work-hours reform. A cost analysis including preventable adverse events. J Gen Intern Med. 2005 Oct;20(10):873-8.

In response to proposed federal legislation, the Accreditation Council for Graduate Medical Education limited resident work-hours in July 2003. The cost may be substantial but, if successful, the reform might lower preventable adverse event costs in hospital and after discharge. This study sought to estimate the reform's net cost in 2001 dollars, and to determine the reduction in preventable adverse events needed to make reform cost neutral from teaching hospital and societal perspectives.: Cost analysis using published literature and data. Net costs were determined for 4 reform strategies and over a range of potential effects on preventable adverse events. **Nationwide, transferring excess work to task-tailored substitutes (the lowest-level providers appropriate for noneducational tasks) would cost 673 million dollars; mid-level providers would cost 1.1 billion dollars. Reform strategies promoting adverse events would increase net teaching hospital and societal costs as well as mortality. If task-tailored substitutes decrease events by 5.1% or mid-level providers decrease them by 8.5%, reform would be cost neutral for society. Events must fall by 18.5% and 30.9%, respectively, to be cost neutral for teaching hospitals.**

Because most preventable adverse event costs occur after discharge, a modest decline (5.1% to 8.5%) in them might make residency work-hours reform cost neutral for society but only a much larger drop (18.5% to 30.9%) would make it cost neutral for teaching hospitals, unless additional funds are allocated. Future research should evaluate which reform approaches prevent adverse events and at what cost.

Mycyk MB, McDaniel MR, Fotis MA, Regalado J. Hospitalwide adverse drug events before and after limiting weekly work hours of medical residents to 80. Am J Health Syst Pharm. 2005 Aug 1;62(15):1592-5.

Adverse drug events (ADEs) at a hospital before and after the weekly work hours of medical residents were limited to 80 were studied. The study population included all adults admitted to a 750-bed academic tertiary care hospital where resident physicians provide direct care under the supervision of faculty attending physicians. The six-month period after implementation of the 80-hour work limit (July 1 to December 31, 2003) was compared with the same six-month period one year before implementation (July 1 to December 31, 2002).

There were no significant differences between study periods in any measured variables, including number of confirmed ADEs (194 before, 172 after), number of ADEs per 1000 patient days (1.3 before, 1.1 after), and number of preventable ADEs (21 before, 22 after). Hospital wide ADEs remained constant despite limiting of resident physician weekly work hours to 80.

Fletcher KE, Davis SQ, Underwood W, Mangrulkar RS, McMahon LF Jr, Saint S. Systematic review: effects of resident work hours on patient safety. Ann Intern Med. 2004 Dec 7;141(11):851-7.

The Accreditation Council for Graduate Medical Education (ACGME) mandated new work hours rules for all residency programs in July 2003. To critically evaluate the evidence that adhering to the ACGME standards will improve patient safety. The authors identified articles in the English-language literature for studies on resident work hours for the years 1966 to 2004. **STUDY SELECTION:** Studies that assessed a system change designed to counteract the effects of work hours, fatigue, or sleep deprivation and that included an outcome related to patient safety were included. Seven studies met these criteria. Two investigators abstracted data from all included studies by using a standard data abstraction form; each study was rated according to established criteria to assess study design quality. Interventions used were float systems, other cross-coverage systems, or unspecified schedule changes. Outcomes included mortality, adverse events, and medication errors. **The results suggest that introducing such interventions has an unclear effect on selected patient safety indicators. Specifically, some indicators (such as mortality) may not change after interventions, while other indicators may improve or worsen. This analysis is limited by the study designs of the included studies, the diversity of interventions in the studies, and the possibility of publication bias favoring studies that demonstrated statistically significant differences. Evidence on patient safety is insufficient to inform the process of reducing resident work hours.**

Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, Lilly CM, Stone PH, Lockley SW, Bates DW, Czeisler CA. Effect of reducing interns' work hours on serious medical errors in intensive care units. N Engl J Med. 2004 Oct 28;351(18):1838-48.

Although sleep deprivation has been shown to impair neurobehavioral performance, few studies have measured its effects on medical errors. The authors conducted a prospective, randomized study comparing the rates of serious medical errors made by interns while they were working according to a traditional schedule with extended (24 hours or more) work shifts every other shift (an "every third night" call schedule) and while they were working according to an intervention schedule that eliminated extended work shifts and reduced the number of hours worked per week. Incidents were identified by means of a multidisciplinary, four-pronged approach that included direct, continuous observation. Two physicians who were unaware of the interns' schedule assignments independently rated each incident.

During a total of 2203 patient-days involving 634 admissions, interns made 35.9 percent more serious medical errors during the traditional schedule than during the intervention schedule (136.0 vs. 100.1 per 1000 patient-days, $P < 0.001$), including 56.6 percent more non-intercepted serious errors ($P < 0.001$). The total rate of serious errors on the critical care units was 22.0 percent higher during the traditional schedule than during the intervention schedule (193.2 vs. 158.4 per 1000 patient-days, $P < 0.001$). Interns made 20.8 percent more serious medication errors during the traditional schedule than during the intervention schedule (99.7 vs. 82.5 per 1000 patient-days, $P = 0.03$). Interns also made 5.6 times as many serious diagnostic errors during the traditional schedule as during the intervention schedule (18.6 vs. 3.3 per 1000 patient-days, $P < 0.001$). Interns made substantially more serious medical errors when they worked frequent shifts of 24 hours or more than when they worked shorter shifts. Eliminating extended work shifts and reducing the number of hours interns work per week can reduce serious medical errors in the intensive care unit.

Lockley SW, Cronin JW, Evans EE, Cade BE, Lee CJ, Landrigan CP, Rothschild JM, Katz JT, Lilly CM, Stone PH, Aeschbach D, Czeisler CA. Effect of reducing interns' weekly work hours on sleep and attentional failures. N Engl J Med. 2004 Oct 28;351(18):1829-37.

Knowledge of the physiological effects of extended (24 hours or more) work shifts in postgraduate medical training is limited. The study quantified work hours, sleep, and attentional failures among first-year residents (postgraduate year 1) during a traditional rotation schedule that included extended work shifts and during an intervention schedule that limited scheduled work hours to 16 or fewer consecutive hours. Twenty interns were studied during two three-week rotations in intensive care units, each during both the traditional and the intervention schedule. Subjects completed daily sleep logs that were validated with regular weekly episodes (72 to 96 hours) of continuous polysomnography ($r=0.94$) and work logs that were validated by means of direct observation by study staff ($r=0.98$).

Seventeen of 20 interns worked more than 80 hours per week during the traditional schedule (mean, 84.9; range, 74.2 to 92.1). All interns worked less than 80 hours per week during the intervention schedule (mean, 65.4; range, 57.6 to 76.3). On average, interns worked 19.5 hours per week less ($P<0.001$), slept 5.8 hours per week more ($P<0.001$), slept more in the 24 hours preceding each working hour ($P<0.001$), and had less than half the rate of attentional failures while working during on-call nights ($P=0.02$) on the intervention schedule as compared with the traditional schedule. Eliminating interns' extended work shifts in an intensive care unit significantly increased sleep and decreased attentional failures during night work hours.

Howard DL, Silber JH, Jobes DR. Do regulations limiting residents' work hours affect patient mortality? J Gen Intern Med. 2004 Jan;19(1):1-7.

The authors conducted a statewide analysis of the effect of New York's regulations, limiting internal medicine and family practice residents' work hours, on patient mortality. They used a retrospective study of inpatient discharge files for 1988 (before the regulations) and 1991 (after the regulations). Adult patients discharged from New York teaching hospitals (170214) and non-teaching hospitals (143,455) with a principal diagnosis of congestive heart failure, acute myocardial infarction, or pneumonia, for the years 1988 and 1991 (periods before and after Code 405 regulations went into law) were used in the analysis. Patients from non-teaching hospitals served as controls. **This showed that combined unadjusted mortality for congestive heart failure, acute myocardial infarction, and pneumonia patients declined between 1988 and 1991 in both teaching (14.1% to 13.0%; $P=.0001$) and non-teaching hospitals (14.0% to 12.5%; $P=.0001$). Adjusted mortality also declined between 1988 and 1991 in both teaching (odds ratio [OR], death 1991/1988, 0.868; 95% confidence interval [CI], 0.843 to 0.894; $P=.0001$) and non-teaching hospitals (OR, death 1991/1988, 0.853; 95% CI, 0.826 to 0.881; $P=.0001$). This beneficial trend toward lower mortality over time was nearly identical between teaching and non-teaching hospitals ($P=.4348$). New York's mandated limitations on residents' work hours do not appear to have positively or negatively affected in-hospital mortality from congestive heart failure, acute myocardial infarction, or pneumonia in teaching hospitals.**

Philibert I, Barach P. Residents' hours of work. BMJ. 2002 Nov 23;325(7374):1184-5.

Accreditation is a voluntary approach of professional self regulation. The consequences of failed self regulation are often regulatory interventions, which are costly. The United States spends about \$200bn annually towards regulations related to health, safety, and the environment. Whether these achieve the desired outcome is quantified for only a third. The consequence of not assessing outcomes is that it is not known whether regulations have the intended effect. Fifteen years after New York State limited duty hours for resident doctors in 1989. Fifteen years later, the impact of this reduction on the safety of patients, education, and the professional lives of residents is still the subject of opinion and guesswork. Articles on New York's experience show the conflicting nature of the reports. Reports that doctors trained under the limits were less familiar with their obligations to patients were countered by findings that residents did not want to leave patients until the process of care was completed.

The academic community must not ignore the opportunity to benefit from the natural experiment that will result from the implementation of the new standards for hours of duty. Beyond showing whether the standards will achieve their intended public goals, the results will help in developing new models for providing care with fewer hours for residents. Collecting data on costs, outcomes for patients, resident education and satisfaction will not be easy, and exploring the link between errors in health care and residents' hours or the interventions put in place to limit them is a needed, but complex, undertaking. Systematic research to address the causes of errors in health care is just beginning. Data are often incomplete and ill suited to making inferences about sleep deprivation in residents or that of interventions, such as more frequent transfers of the care of patients among physicians, as causes or contributing factors.

Hillson SD, Rich EC, Dowd B, Luxenberg MG. Call nights and patients care: effects on inpatients at one teaching hospital. J Gen Intern Med. 1992 Jul-Aug;7(4):405-10.

To determine whether the timing and number of patients admitted by internal medicine housestaff under a traditional call schedule affect the resource utilization and outcome of care for those patients. Retrospective cohort study, using existing computerized records in a university-affiliated 340-bed city/county teaching hospital. This encompassed 22,112 patients discharged from the internal medicine service who had been admitted by an on-call first-year resident between January 1, 1980, and December 31, 1987.

Admission after 5:00 PM was associated with decreased hospital length of stay (8.1%, p less than 0.0001), but increased total charges (3.1%, p = 0.007). The relative risk of inpatient mortality for patients admitted at night was 1.21 (p = 0.03). Patients of busier residents, as indicated by a larger number of on-call admissions, had lower total charges (1.7% decreased per admission) and no change in risk of inpatient mortality. While no linear relation was found between number of admissions and length of stay, analysis of nonlinear effects revealed that length of stay first rises, then falls as interns receive more on-call admissions. The number and timing of admissions by on-call internal medicine housestaff are significantly related to length of hospital stay, total charges, and likelihood of inpatient mortality at one teaching hospital. These variations should be considered in planning the reform of residency training programs.

Gottlieb J, Parenti CM, Peterson CA, Lofgren RP. Effect of a change in house staff work schedule on resource utilization and patient care. Arch Intern Med. Gottlieb 1991 Oct;151(10):2065-70

Concern is frequently expressed by health care providers and consumers that the work environment of physicians-in-training may adversely affect their performance. This article documents the effects of changing from a traditional rotational overnight call schedule for house staff to a schedule designed to reduce sleep deprivation, distribute admissions more evenly throughout the week, and improve continuity of inpatient care on the internal medicine service of a large, university-affiliated Veterans Affairs Medical Center. In a prospective, time-series study, the hypothesis that this change would improve the efficiency and quality of medical care was evaluated by comparing the hospital course of the patients admitted during 4-week periods prior to and following the change in work schedule.

The patients in the preintervention group do not differ significantly from those in the postintervention group in any identifiable clinical characteristics. The length of stay was shorter (10.9 vs 9.3 days) and the number of laboratory tests ordered per patient was smaller (24.0 vs 19.0) for patients cared for under the new work schedule compared with those cared for under the traditional work schedule. Resident physicians also committed fewer medication errors under the new work schedule (16.9 vs 12.0 per 100 patients discharged). We conclude that altering the house staff work schedule affects patient care and can lead to a decrease in utilization of health care resources.

IV. Effect/Predicted Effect of the National Duty Hour Limits in Teaching Hospitals

Nuckols TK, Bhattacharya J, Wolman DM, Ulmer C, Escarce JJ. Cost implications of reduced work hours and workloads for resident physicians. N Engl J Med. 2009 May 21;360(21):2202-15.

Although the Accreditation Council for Graduate Medical Education (ACGME) limits the work hours of residents, concerns about fatigue persist. A new Institute of Medicine (IOM) report recommends, among other changes, improved adherence to the 2003 ACGME limits, naps during extended shifts, a 16-hour limit for shifts without naps, and reduced workloads. We used published data to estimate labor costs associated with transferring excess work from residents to substitute providers, and we examined the effects of our assumptions in sensitivity analyses. Next, using a probability model to represent labor costs as well as mortality and costs associated with preventable adverse events, we determined the net costs to major teaching hospitals and cost-effectiveness across a range of hypothetical changes in the rate of preventable adverse events.

Annual labor costs from implementing the IOM recommendations were estimated to be \$1.6 billion (in 2006 U.S. dollars) across all ACGME-accredited programs (\$1.1 billion to \$2.5 billion in sensitivity analyses). From a 10% decrease to a 10% increase in preventable adverse events, net costs per admission ranged from \$99 to \$183 for major teaching hospitals and from \$17 to \$266 for society. With 2.5% to 11.3% decreases in preventable adverse events, costs to society per averted death ranged from \$3.4 million to \$0. Implementing the four IOM recommendations would be costly, and their effectiveness is unknown. If highly effective, they could prevent patient harm at reduced or no cost from the societal perspective. However, net costs to teaching hospitals would remain high.

Resident productivity: does shift length matter? Jeanmonod R, Jeanmonod D, Ngiam R. Am J Emerg Med. 2008 Sep;26(7):789-91.

It has been established that residents are able to evaluate more patients per hour as they progress through training. However, it is unknown if shift length influences resident productivity. The aim of this study is to assess whether there is a difference in second-year resident productivity as a function of shift length. This is a retrospective chart review of patients evaluated in the emergency department (ED) by second-year residents in a 65,000 volume center; 9- and 12-hour shifts were included. Nine-hour shifts provide a 1-hour overlap, such that three 9-hour shifts provide 24 hours of resident coverage. Shifts on weekly conference day were excluded. A patient was determined as having been evaluated by a resident if the resident initiated care on the patient and dictated the chart. Data were analyzed using 2-tailed t test.

A total of 193 nine-hour shifts and 90 twelve-hour shifts met inclusion criteria. Residents working 12-hour shifts evaluated 1.06 patients per hour, and residents working 9-hour shifts evaluated 1.15 patients per hour (95% confidence interval, 0.031-0.151). In an ED with 120 hours of resident coverage per day, this results in 10 additional patients seen by residents working 9-hour shifts. In our department with 9 ED months in the second year of residency, this results in 180 additional patient encounters per resident during that year. Shorter shift lengths appear to result in more patients evaluated per hour by second-year residents and an increase in patient encounters.

Mitchell CC, Ashley SW, Zinner MJ, Moore FD Jr. Predicting future staffing needs at teaching hospitals: use of an analytical program with multiple variables. Arch Surg. 2007 Apr;142(4):329-34.

The authors aimed to develop a model to predict future staffing for the surgery service at a teaching hospital. The setting was a tertiary hospital, and the intervention used a computer model with potential future variables. Some of the variables were distribution of resident staff, fellows, and physician

extenders; salary/wages; work hours; educational value of rotations; work units, inpatient wards, and clinics; future volume growth; and efficiency savings. Outcomes Number of staff to be hired, staffing expense, and educational impact. The authors estimated the impact of changes in resident work hours, service growth, and workflow efficiency on a busy general surgery service over the next 5 years.

Projecting a reduction in resident duty hours to 60 hours per week will require the hiring of 10 physician assistants at a cost of \$1 134 000, a cost that is increased by \$441,000 when hiring hospitalists instead. Implementing a day of didactic and simulator time (10 hours) will further increase the costs by \$568,000. A 10% improvement in the efficiency of floor care, as might be gained by advanced information technology capability or by regionalization of patients, can mitigate these expenses by as much as 21%. On the other hand, a modest annual growth of 2% will increase the costs by \$715,000 to \$2,417,000. To simply replace residents with alternative providers requires large amounts of human and fiscal capital. The potential for simple efficiencies to mitigate some of this expense suggests that traditional patterns of care in teaching hospitals will have to change in response to educational mandates.

Jagsi R, Shapiro J, Weissman JS, Dorer DJ, Weinstein DF. The educational impact of ACGME limits on resident and fellow duty hours: a pre-post survey study. Acad Med. 2006 Dec;81(12):1059-68.

See summary on page 13.

Nuckols TK, Escarce JJ. Residency work-hours reform. A cost analysis including preventable adverse events. J Gen Intern Med. 2005 Oct;20(10):873-8.

See summary on page 76.

Johnson T. Limitations on residents' working hours at New York teaching hospitals: a status report. Acad Med. 2003 Jan;78(1):3-8.

Teaching hospitals in New York have been subject to regulations that limit the working hours of residency trainees since July 1989. Following a period of enhanced survey activity by the State Department of Health in the late 1990s, the state awarded a contract to a third-party organization to conduct annual audits of the state's teaching hospitals to assess compliance with the regulations. **As of October 2002, preliminary results indicate that 75 of the 118 teaching hospitals in the state (63.6%) were found to be out of compliance with some component of the regulations. The most common citations for noncompliance were (1) working in excess of 24 consecutive hours (45%), and (2) working in excess of 80 hours per week, averaged over four weeks (28%). For New York teaching hospitals, the key factors identified as posing significant challenges to achieving full compliance with the regulations included (1) assuming responsibility for the work schedules of residents; (2) scheduling and monitoring difficulties; (3) the education efforts associated with the regulations; (4) the documentation requirements; (5) variations in learning abilities among the residents; and (6) mistaking verbal compliance for actual compliance.** As the state begins a new round of surveys, it will be expecting better compliance efforts, and New York teaching hospitals are committed to this difficult but worthy goal.

Pisetsky MA, Lubarsky DA, Capehart BP, Lineberger CK, Reves JG. Valuing the work performed by anesthesiology residents and the financial impact on teaching hospitals in the United States of a reduced anesthesia residency program size. Anesth Analg. 1998 Aug;87(2):245-54.

The authors performed a financial analysis at a large university tertiary care hospital to determine the incremental cost of replacing its anesthesiology residents with alternative dependent providers (i.e., certified registered nurse anesthetists in the operating room, advanced practice nurses and physician assistants outside the operating room). The annual average net cost of an anesthesiology resident during a 3-yr residency is approximately \$38,000, and residents performed an average of \$89,000 of essential clinical work annually based on replacement costs. **The incremental cost (replacement labor cost minus net resident cost) to replace all essential clinical duties performed by an anesthesiology resident at Duke University Medical Center and affiliated hospitals is approximately \$153,000 throughout three years of clinical anesthesiology training. If this approach were applied nationwide, incremental costs of substitution would range from \$36,000,000 to \$93,000,000 per year.** The authors concluded that maintaining clinical service in the face of anesthesiology residency reductions could have a marked impact on the overall cost of providing anesthesiology services in teaching hospitals. Simply replacing residents with alternate non-physician providers is a very expensive option. The authors sought to calculate the financial burden resulting from a decreased number of anesthesiology residents. Replacing each resident's essential clinical work with similarly skilled healthcare providers would cost hospitals approximately \$153,000 over the course of a 3-yr residency. Varying projections yield future nationwide costs of \$36,000,000 to \$93,000,000 per year. Simply replacing residents with alternate non-physician providers is a very expensive option.

Stoddard JJ, Kindig DA, Libby D. Graduate medical education reform. Service provision transition costs. JAMA. 1994 Jul 6;272(1):53-8.

The authors sought to analyze the potential strategies and costs of house staff substitution under a reformed system of graduate medical education. They developed an economic model using two scenarios for substitution of house staff (residents and fellows): (1) a lower-cost model under which nonphysician providers assume many house staff responsibilities, but additional aspects of their workload are taken over by staff physicians, nurses, and ancillary personnel; and (2) a higher-cost traditional model that relies more heavily on staff physicians to replace house officers. Main outcome measures were the projected net substitution costs of house staff on a per full-time equivalent basis and aggregate national cost estimates of substitution. **The results showed that net annual house staff substitution costs were estimated to be \$58,000 and \$77,000 per replaced full-time equivalent house officer, respectively, under the two scenarios. Assuming elimination of approximately 23,200 house staff under a reformed system, total (net) substitution costs to teaching hospitals were estimated at approximately \$1.4 billion to \$1.8 billion nationally on an annual basis.**

The authors concluded that graduate medical education reform, while likely to result in substantial long-term cost savings, will necessitate transitions in service provision that are likely to generate some new costs in the short term.

Thorpe KE. House staff supervision and working hours. Implications of regulatory change in New York State. JAMA. 1990 Jun 20;263(23):3177-81.

In July 1989, New York State adopted new rules that limit the hours worked by residents and mandate continuous, on-site supervision of junior residents. In addition, all New York hospitals must provide 24-hour coverage for intravenous, phlebotomy, and messenger/transporter services. This article examines the impact of New York's landmark changes on hospital staffing, graduate medical education, the demand for ancillary personnel, and hospital expenditures. **Based on a statewide survey, the results indicate that implementation of these rules would require hospitals to hire an additional 5358 full-time equivalent personnel at a yearly cost that would exceed \$358 million.** The broader implications of these rules on financing graduate training are also explored.

V. Effect/Predicted Effect of the National Duty Hour Limits in Medical Students

Lindquist LA, Tschoe M, Neely D, Feinglass J, Martin GJ, Baker DW. Medical Student Patient Experiences Before and After Duty Hour Regulation and Hospitalist Support. J Gen Intern Med. 2009 Dec 1. [Epub ahead of print]

With the growth of hospitalist services and the reduction in residency work hours, medical education has changed dramatically. The objective of this study was to examine changes in junior medical student-patient encounters after initiation of residency work hours and implementation of a large hospitalist practice at our academic medical center. Medicine clerkship students from 2002-2007 recorded the number of hospital patients and their principal diagnoses cared for during a 6-week block rotation. Comparisons were made between clerkship experiences among students in 2002-2004 and 2005-2007 for number of patients and diversity of patient diagnoses seen. Data from the 2004-2005 transition period, when teams fluctuated during implementation of the hospitalist service, were excluded.

A total of 4,697 patients were seen by students during the two periods, and patient logs for 154 students (3,253 patients in 2002-2004) and 120 students (1,444 patients in 2005-2007) were compared. **The mean number of patients directly cared for by students on their junior medicine clerkship dropped from 21 patients (2002-2004) to 12 patients (2005-2007) per student ($p < 0.001$). Compared to 2002-2004, fewer students from 2005-2007 helped manage patients with chest pain (85.7% vs. 74.2%, $p = 0.016$), pancreatitis (66.9% vs. 23.3%, $p < 0.001$), pneumonia (69.5% vs. 54.2%, $p = 0.009$), gastroenteritis (45.5% vs. 20.8%, $p < 0.001$), or cellulitis (46.8% vs. 19.2%, $p < 0.001$). Alternatively, students from 2005-2007 saw more patients with abdominal pain (64.9% vs. 79.2%, $p = 0.010$), anemia (44.8% vs. 70.8%, $p < 0.001$), mental status changes (32.5% vs. 51.7%, $p = 0.001$), failure to thrive (16.2% vs. 53.3%, $p < 0.001$), and endocrine disorders (including diabetes, thyroid disorders, Addison's, 51.3% vs. 74.2%, $p < 0.001$).** With institutional and residency changes, junior medicine clerkship students had fewer opportunities for direct care of patients and encountered a different mix of patient diagnoses. Increasingly during their junior medicine clerkship, students may not have exposure to basic medical conditions, which may affect their ability to care for future patients.

Zahn CM, Dunlow SG, Alvero R, Parker JD, Nace C, Armstrong AY. Too little time to teach? Medical student education and the resident work-hour restriction. Mil Med. 2007 Oct;172(10):1053-7.

The purpose of this study was to examine the impact of the resident duty-hour restriction on medical student education through a survey of faculty, residents, and interns, with interns providing experience as students relative to implementation of work-hour restrictions. A survey was performed at two (one military and one civilian) obstetrics and gynecology residency programs, and added surveys were obtained at a faculty workshop. **The majority of faculty reported spending 5 to 10 hours per week in medical education before and after implementation of the work-hour restriction. Residents reported less time teaching students after work-hour restrictions were instituted. Nearly all interns, responding about their clinical clerkship experience as students, believed their educational experience would have been improved if residents were more involved in teaching.** This pilot study suggests residents are less involved in medical student education following implementation of the limits.

Nixon LJ, Benson BJ, Rogers TB, Sick BT, Miller WJ. Effects of Accreditation Council for Graduate Medical Education work hour restrictions on medical student experience. J Gen Intern Med. 2007 Jul;22(7):937-41.

Residents have a major role in teaching students, yet little has been written about the effects of resident

work hour restrictions on medical student education. The authors' objective was to determine the effects of resident work hour restrictions on medical student education. The study compared student responses pre work hour restrictions with those completed post work hour restrictions. Participants were students on required Internal Medicine, Surgery, and Pediatric clerkships at the University of Minnesota. Two thousand eight hundred twenty-five student responses on end-of-clerkship surveys.

Students reported 1.6 more hours per week of teaching by residents (95%CI 0.8-2.6) in the post work hour era. Students' ratings of the overall quality of their teaching on the ward did not change appreciably, 0.05 points' decline on a 5-point scale (P = .05). Like the residents, students worked fewer hours per week (avg. 1.5 hours less, 95%CI 0.4-2.6). There was no change in quality or quantity of attending teaching, students' relationships with their patients, or the overall value of the clerkships. Whereas resident duty hour restrictions have had minimal effect on students' ratings of the overall teaching quality, they do report being taught more by their residents. This may be a factor of decreased resident fatigue or an increased sense of well-being; but more study is needed to clarify the causes of the authors' observations.

Kogan JR, Pinto-Powell R, Brown LA, Hemmer P, Bellini LM, Peltier D. The impact of resident duty hour reform on the internal medicine core clerkship: results from the clerkship directors in internal medicine survey. Acad Med. 2006 Dec;81(12):1038-44.

In July 2003, resident duty hour regulations were implemented. The impact of these regulations on medical student education has received minimal attention. The objective of this study was to evaluate the perceptions of internal medicine clerkship directors about the impact of resident physician duty hour reform on medical student teaching, assessment, and clerkship structure. A survey was sent to 114 institutional members of Clerkship Directors in Internal Medicine in May 2004. The survey included 17 attitude items rated on a 5-point Likert scale, five items related to clerkship structure, and four open-ended questions. Descriptive statistics were performed on the responses.

Ninety-six surveys were returned (84%). **The majority of respondents did not believe duty hour reform had a positive impact on clerkship students' educational experiences, whereas 48.3% agreed or strongly agreed that residents had more difficulty evaluating students' clinical skills. There was not a significant change in inpatient clerkship structure after duty hour implementation.** Time for teaching students, concerns about a shift-work mentality, and student continuity with their teams were major challenges. Impact on ambulatory internal medicine rotations was minimal. Internal medicine clerkship directors are concerned about the impact of resident duty hour reform on student education. Additional studies of this educational impact are needed.

White CB, Haftel HM, Purkiss JA, Schigelone AS, Hammoud MM. Multidimensional effects of the 80-hour work week at the University of Michigan Medical School. Acad Med. 2006 Jan;81(1):57-62.

To examine the effects of the new resident work-hour restrictions on medical students, as measured by their perceptions of the quality of their experiences during the required clerkships. Evaluations of four clerkships were compared for two student cohorts at the University of Michigan Medical School. The first cohort, from the class of 2002-03, completed their clinical clerkships the year before the work-hour restrictions were implemented, and the second cohort, from the class of 2003-04, completed their clerkships the same year the restrictions were implemented. **There were significant and notable differences in the experiences of the two cohorts. Students' perceptions of the quality of their experiences in the surgery-oriented clerkships (obstetrics-gynecology and surgery) in particular were significantly lower (i.e., more negative) in the 2003-04 cohort than in the previous cohort for the same clerkships. The non-surgery-oriented clerkships (internal medicine and pediatrics) hired hospitalists, who offset the residents' workload (internal medicine) and assumed teaching**

responsibilities (pediatrics). **Between 2002-03 and 2003-04, students' perceptions of the quality of their experience in the internal medicine clerkship remained mostly stable, and increased in several areas for the students in the pediatrics clerkship. Implementation of resident work-hour restrictions had significant effects on the education of the medical students studied.** These effects need to be carefully analyzed and considered to ensure quality education for medical students. The findings also highlight that the nature of students' perceptions was related to preparations made (or not) by specific clerkships as restricted work-hour regulations were adopted.

Brasher AE, Chowdhry S, Hauge LS, Prinz RA. Medical students' perceptions of resident teaching: have duty hours regulations had an impact? *Ann Surg.* 2005 Oct;242(4):548-53; discussion 553-5.

This study describes medical students' perceptions about resident teaching on a surgery clerkship and examines student perceptions before and after the implementation of duty hour regulations (DHR). There has been much discussion about the impact of DHR on surgical education. One area that merits evaluation is the effect that DHR have had on student education. Learners perceive the clinical teacher role as comprised of 4 roles: teacher, person, physician, and supervisor. This model served as the basis for examining resident teaching before and after DHR. Students completed end-of-rotation evaluations about residents' teaching effectiveness, amount of feedback, and quality of interactions. Student comments were compiled into individual resident reports, and reports were collected from pre-(2002-2003) and post-(2003-2004) DHR. A coding scheme was developed to describe resident performance in 4 roles: teacher, person, physician, and supervisor. Three coders independently reviewed 124 resident reports maintaining an interrater agreement of 80%. Analyses of variance were conducted to compare data from pre- and post-DHR. **After implementation of DHR, there were significantly more negative comments ($P = 0.005$), including comments about residents as supervisor ($P = 0.001$), teacher ($P = 0.027$), and teaching activities ($P = 0.001$). Positive comments about bedside teaching decreased ($P = 0.007$). Although total positive comments about resident as person increased ($P = 0.01$), total negative comments about resident as person also increased ($P = 0.02$). Findings of this study indicate that DHR have had a negative impact on medical students' perceptions of resident teaching.** Surgical educators must develop programs that address resident teaching skills in a different environment.

Jagsi R, Shapiro J, Weinstein DF. Perceived impact of resident work hour limitations on medical student clerkships: a survey study. *Acad Med.* 2005 Aug;80(8):752-7.

To assess medical students' perceptions of the impact of recent Accreditation Council for Graduate Medical Education policies limiting resident work hours on students' clerkship experiences, resident teaching, and quality of patient care. In May/June 2003 and May/June 2004, an original questionnaire was administered to 252 medical students completing required clinical rotations at two teaching hospitals to assess students' perceptions of endpoints that might be affected by resident work hours limits. Response data were analyzed to determine statistical significance of differences between the two years studied.

Questionnaires were completed by 129 students in 2003 (98%) and 112 students in 2004 (93%), for an overall response rate of 96%. A higher proportion of students perceived limits on work hours in 2004 [46 (41%)] than 2003 [36 (28%), $p = .03$]. **Ratings of resident availability and primary resident's interest in teaching improved in 2004. Otherwise, ratings of the interest, skill, and availability of resident teachers and attending physicians remained stable between 2003 and 2004. Students reported spending similar amounts of time in formal teaching sessions and rated feedback similarly between 2003 and 2004. In 2004, fewer students [28 (25%)] reported considering leaving medicine due to long hours in training than in 2003 [49 (38%), $p = .04$]. No significant differences in the proportion of students reporting suboptimal care were found [44 (34%) in 2003, 34 (35%) in 2004, $p = .57$].** This small, early study suggests that reductions in resident work hours might be implemented without a

significant negative impact upon medical students' self-assessed learning experiences, and that limiting resident work hours may even have a positive impact on medical students.

Arnold MW, Patterson AF, Tang AS. Has implementation of the 80-hour work week made a career in surgery more appealing to medical students? Am J Surg. 2005 Feb;189(2):129-33.

This study was conducted to determine if a surgical career became more appealing to medical students with the resident work week limited to 80 hours. At the start and conclusion of each surgery clerkship rotation, students completed a survey addressing perception of surgeons, and surgery as a career. They were divided into the control groups (rotations before July 2003; n = 109) and the experimental group (rotations after July 2003; n = 108). Students in the experimental group had a significantly more favorable impression of a surgeon's lifestyle and work hours than those in the control group. This was especially true of female students post-rotation, who responded more positively to the statement that a surgical career would allow for a good balance between professional and personal life (1.87 vs. 2.45, $P < .01$). **The new Accreditation Council for Graduate Medical Education (ACGME) regulation has had a positive impact on students' perceptions of the surgeon's lifestyle, but does not necessarily increase their interest in a surgical career.**

Kogan JR, Bellini LM, Shea JA. The impact of resident duty hour reform in a medicine core clerkship. Acad Med. 2004 Oct;79(10 Suppl):S58-61.

Residency programs have changed to comply with resident duty hour regulations. This study's purpose was to determine if there are differences in medicine clerkship students' activities, associations, and perceptions of educational value before and after duty hour reform. Medicine clerkship students, both before (n = 36) and after (n = 33) duty hour reform, wore random reminder pagers for one week and completed time allocation surveys with each signal. Event proportions were calculated and analysis of variance assessed group differences. A total of 804 and 912 surveys were completed before and after reform, respectively. **No differences existed in proportion of time for direct patient care (.13 versus .14, $p = .35$), indirect patient care (.35 versus .32, $p = .21$), and education (.38 versus .37, $p = .69$) activities, students' associations, educational value, and time in the hospital before and after reform.** The authors concluded that residency program changes had minimal impact on medicine clerkship students.

Miller G, Bamboat ZM, Allen F, Biernacki P, Hopkins MA, Gouge TH, Riles TS. Impact of mandatory resident work hour limitations on medical students' interest in surgery. J Am Coll Surg. 2004 Oct;199(4):615-9.

The number of US medical students applying for general surgery residency has been declining. Recent studies have shown that the issue of "controllable lifestyle" has become a critical factor in medical students' decision-making process. The authors postulate that widespread implementation of resident work hour limitations would bolster medical students' interest in pursuing surgical careers. Students from New York University School of Medicine were surveyed about their attitudes toward work hour limitations and its effect on their interest in pursuing a surgical residency. One hundred thirty-two students participated.: **Nearly 95% of respondents believed that work hour limitations were a positive change and, if all other factors were equal, they would choose a training program that used work hour limitations over one that did not. The most common reasons cited in favor of limits were improvements in resident lifestyle (42%) and patient safety (34%). Fifty-three percent of respondents indicated that presence of work hour limitations alone would increase their interest in considering a surgical residency and only 2% of medical students indicated that it would lessen their interest in surgery. Not surprisingly, intellectual interest in a specialty was the most important**

factor in choosing a residency for 86% of students. Nevertheless, work hour limitations were designated a higher priority than future salary by 55% of medical students. The presence of work hour limitations has a positive impact on medical students' interest in surgery. Widespread implementation of work hour limitations may bolster the number of applications for surgical residency.

Dorsey ER, Jarjoura D, Rutecki GW. Influence of controllable lifestyle on recent trends in specialty choice by US medical students. JAMA. 2003 Sep 3;290(9):1173-8.

Recent specialty choices of graduating US medical students suggest that lifestyle may be an increasingly important factor in their career decision-making. The authors sought to determine whether and to what degree controllable lifestyle and other specialty-related characteristics are associated with recent (1996-2002) changes in the specialty preferences of US senior medical students.

Specialty preference was based on analysis of results from the National Resident Matching Program, the San Francisco Matching Program, and the American Urological Association Matching Program from 1996 to 2002. Specialty lifestyle (controllable vs. uncontrollable) was classified using earlier research. Log-linear models were developed that examined specialty preference and the specialty's controllability, income, work hours, and years of graduate medical education required. **The findings showed that the proportion of variability in specialty preference from 1996 to 2002 explained by controllable lifestyle. The specialty preferences of US senior medical students, as determined by the distribution of applicants across selected specialties, changed significantly from 1996 to 2002 (P<.001). In the log-linear model controllable lifestyle explained 55% of the variability in specialty preference from 1996 to 2002 after controlling for income, work hours, and years of graduate medical education required (P<.001).** The authors concluded that the perception of controllable lifestyle accounts for most of the variability in recent changing patterns in the specialty choices of graduating US medical students.

VI. *Effect/Predicted Effect of the National Duty Hour Limits on Faculty*

St Peter SD, Calkins CM, Holcomb GW 3rd, Snyder CL, Ostlie DJ. Financial impact of an in-house attending surgeon: a prospective study. J Pediatr Surg. 2008 Jun;43(6):994-7.

Financial impact of in-house attending surgeon: a prospective study. Current work hour restrictions have required some programs to have staff surgeons cover in-house call. Other programs have considered in-house staff coverage at night for the billable tasks performed during these hours. However, there have been no data published describing the load or value of work that an in-house team performs at night. Therefore, the authors prospectively recorded tasks performed in a pediatric surgery training center after staff had left for the night. Between April 2005 and March 2006, all services rendered from 6:00 PM to 6:00 AM that would require staff presence were prospectively recorded by a pediatric surgical fellow on-call. Tasks performed while staff was in the hospital were excluded. Time of service was recorded and assigned to an hour of the night. Billing codes were identified for each task, and relative value units were assigned. The collectable amount for services was calculated using 2006 Medicare reimbursement. Data were analyzed in functional blocks (6:00-10:00 PM, 10:00 PM-4:00 AM, and 4:00-6:00 AM).

Data from 111 call nights were collected over the year. Attending staff was in-house 10 of those nights. **Of the remaining 101 nights, peak hour of activity was from 12:00 AM to 1:00 AM (35 nights). In the 10:00 PM to 4:00 AM time block, service was rendered 80 nights considering all activity, 68 nights if trauma/burns were excluded, and 45 nights excluding trauma/burns and non-operative admissions. The sum collectable for all overnight services for the year was \$25,855. The in-house resident team performs tasks through the middle of the night on most nights. However, billable revenue generated by these tasks is very small compared with revenue generated from the normal operative schedule.**

Vanderveen K, Chen M, Scherer L. Effects of resident duty-hours restrictions on surgical and non-surgical teaching faculty. Arch Surg. 2007 Aug;142(8):759-64; discussion 764-6.

The authors sought to evaluate the effects of resident duty-hours restrictions on teaching faculty, patient care, and the institutional climate at a single center. An anonymous questionnaire was provided to all teaching faculty (N = 606) at a single institution from March through October 2006. The questionnaire focused on perceptions of job satisfaction, workload changes, and effects on patient care and the institution. Overall response rate was 41% (n = 248). More than half of faculty (n = 140 [56%]) feel they have less time for teaching, 33% report less time for extracurricular activities, and 42% report increased work hours. Forty-three percent of respondents (n = 106) were less satisfied with their jobs after implementation of resident duty-hours restrictions, while only 2% (n = 5) were more satisfied.

Of the respondent faculty, surgeons were more likely than non-surgeons to report increased work hours (54% vs. 34%; P = .002), decreased time for teaching (66% vs. 51%; P = .03), lower job satisfaction (55% vs. 35%; P = .003), and negative effects on their personal relationships outside of work (24% vs. 12%; P = .01). Although most responses suggest that the restrictions on resident duty hours have not adversely affected patient care or the institutional climate, 33% of respondents (n = 82) felt that patient care was worse. Surgeons reported a particularly negative effect from resident duty-hours reform, especially within the areas of job satisfaction, time for teaching, and workload. Efforts to counteract these effects will be critical to maintain and recruit teaching faculty.

Choby B, Passmore C. Faculty Perceptions of the ACGME Resident Duty Hour Regulations in Family Medicine. Fam Med. 2007 Jun;39(6):392-8.

Accreditation Council for Graduate Medical Education (ACGME) duty hour regulations have significantly changed residency education. Initial research focused heavily on resident experiences, while changes in faculty roles and effects on patient care and resident education have received less attention. This survey examines faculty perceptions of the effect of duty hour changes in academic family medicine. Family medicine faculty members from 15% of ACGME-accredited residencies were surveyed. The survey included demographic information and Likert-type questions about changes in faculty duties, patient care, resident education, and satisfaction with academic medicine.

A total of 368 of 672 surveys were returned; 97% of the 69 surveyed programs were represented. **The average faculty workweek was 66 hours, including call. Of respondents, 81% felt that weekly faculty hours were unchanged since duty hours; 19% thought work hours had increased. Faculty felt that residency education and patient care were not positively affected by duty hours. Statistically significant differences were found between perceptions of faculty who did and did not deliver babies. Twenty percent of faculty members are considering leaving academic medicine in relation to duty hours.** Consistent with research from other specialties, many faculty members perceive that their work roles have increased in certain areas. Resident performance and patient care are not seen to be improved as a result of duty hours. Further research into the unexpected findings involving labor and delivery responsibilities is needed.

Klingensmith ME, Winslow ER, Hamilton BH, Hall BL. Impact of resident duty-hour reform on faculty clinical productivity. Curr Surg. 2006 Jan-Feb;63(1):74-9.

Prior data have shown that resident duty-hour reform has not affected faculty work hours; yet the preservation of faculty hours may have been at the expense of productivity. The authors sought to examine change in clinical productivity. An anonymous survey was distributed to surgical faculty at a single, large academic medical center 18 months after reform and compared with surveys taken before and after reform. Opinions regarding productivity and working hours were solicited. P values were determined by chi-square or Student t-tests. Relative value unit data, reflecting clinical productivity, were compared before and after reform. Regression was performed with dependent variable "lnRVU" and independent variables "calendar month," "pre/post" July 2003, and "surgeon." **The coefficient on "pre/post" reflected average change in RVUs. A total of 49 of 73 surveys were returned (67% response). Faculty reported an average of 68.0+/-7.0 weekly work hours (p=NS compared with previous survey). In the current survey, 35% felt their overall productivity had fallen due to reform. Among these, 83% felt academic productivity had suffered, 11% were unsure, and 1 person (6%) believed academic productivity was preserved. The majority (82%) reported preserved clinical productivity, 6% reported a decrease, and 12% were unsure. Overall, 60% reported doing work previously done by residents. When RVU data were examined, the coefficient on change pre- and post-reform indicated a 5.7% increase in productivity (p=0.005). However, this effect was driven by 5 surgeons with a greater than 75% increase in productivity, all young faculty, early in practice. Excluding these, there was no significant change (0.6% increase, p=0.77). Faculty have preserved work hours and clinical productivity, despite a tendency to take on work previously done by residents. This suggests that academic activities may have suffered.**

Coverdill JE, Finlay W, Adrales GL, Mellinger JD, Anderson KD, Bonnell BW, Cofer JB, Dorner DB, Haisch C, Harold KL, Termuhlen PM, Webb AL. Duty-hour restrictions and the work of surgical faculty: results of a multi-institutional study. Acad Med. 2006 Jan;81(1):50-6.

To examine whether duty-hour restrictions have been consequential for various aspects of the work of surgical faculty and if those consequences differ for faculty in academic and nonacademic general surgery residency programs. Questionnaires were distributed in 2004 to 233 faculty members in five academic and four nonacademic U.S. residency programs in general surgery. Participation was restricted to those who had been faculty for at least one year. Ten items on the questionnaire probed faculty work experiences. Results include means, percentages, and t-tests on mean differences. Of the 146 faculty members (63%) who completed the questionnaire, 101 volunteered to be interviewed. Of these, 28 were randomly chosen for follow-up interviews that probed experiences and rationales underlying items on the questionnaire. Interview transcripts (187 single-spaced pages) were analyzed for main themes.

Questionnaire respondents and interviewees associated duty-hour restrictions with lowered faculty expectations and standards for residents, little change in the supervision of residents, a loss of time for teaching, increased work and stress, and less satisfaction. No significant differences in these perceptions ($p < \text{or} = .05$) were found for faculty in academic and nonacademic programs. Main themes from the interviews included a shift of routine work from residents to faculty, a transfer of responsibility to faculty, more frequent skill gaps at night, a loss of time for research, and the challenges of controlling residents' hours. Duty-hour restrictions have been consequential for the work of surgical faculty. Faculty should not be overlooked in future studies of duty-hour restrictions.

Winslow ER, Berger L, Klingensmith ME. Has the 80-hour work week increased faculty hours? Curr Surg. 2004 Nov-Dec;61(6):602-8.

The 80-hour work week has affected not only surgical residents but also faculty. The aim of this study was to determine the effect of resident hour restrictions on faculty hours and attitudes. All faculty in the Departments of Surgery, Neurosurgery, Orthopedics, and Otolaryngology at one academic medical center participated in the survey. Faculty was surveyed six months before and six months after the institution of the resident 80-hour work week. Surgeons detailed hours worked over one week and answered yes/no questions about changes in patient care and resident education. P values were determined by Chi-square tests or Student t-tests as appropriate. Of the 118 surveys distributed, 88 were returned (75%). Respondents were evenly divided between general surgeons (GS) and subspecialists (SS). Initially, 70% of faculty predicted that resident work-hour restrictions would increase faculty hours; however, only 47% of faculty felt that this had occurred. When current faculty work hours were compared with previously collected data, no differences were found. Faculty reported working an average of 69.9 +/- 12.2 hours per week this year, compared with 70.4 +/- 12.5 hours last year. **When asked about the global impact of the 80-hour work week on faculty, 46% viewed the changes as harmful to the faculty. More concerning, 50% of all faculty felt the care their patients received was worse than previously, with only 2% feeling patient care had improved. This perception was significantly more common among GS faculty (70% GS vs. 37% SS; $p < 0.01$), 94% of whom felt that the current lack of continuity compromises patient care. When the data were stratified by faculty work hours, interesting differences are seen. Of faculty with workweeks less than 60 hours, only 6% thought the changes were harmful to patients and 64% thought resident training had suffered. In contrast, of those faculty who worked greater than 80 hours per week, 56% thought patients were harmed ($p = 0.03$) and 100% thought training had suffered ($p < 0.01$). The authors concluded that faculty work hours have not increased in the six months after the institution of the 80-hour resident work week. However, the majority of the faculty feels that both patient care and resident education have deteriorated.**

Winslow ER, Bowman MC, Klingensmith ME. Surgeon work hours in the era of limited resident work hours. J Am Coll Surg. 2004 Jan;198(1):111-7.

Resident work hours have received much attention, yet there is little information concerning faculty work hours. In addition, the perspectives of surgical faculty on the anticipated effects of reducing resident hours have not been studied. An anonymous survey was distributed to all clinical faculty in the Departments of Surgery, Neurosurgery, Orthopaedics, and Otolaryngology at a single, large academic institution. Surgeons completed a detailed retrospective report of hours worked during a 1-week period. Opinions regarding resident work hour restrictions were also elicited. Chi-square or Student's t-tests were used to determine p values as appropriate, with $p \leq 0.05$ considered significant. Of 120 surveys distributed, 102 (85%) were returned. Subspecialty departments comprised 51% of respondents with 49% from general surgeons.

The mean number of hours worked per week by faculty was 70.4 +/- 12.5 (SD) (73.8 +/- 14.1 for general surgeons versus 67.1 +/- 9.9 for subspecialists, $p = 0.006$), with only 44.1% having at least 1 day per week free from clinical duties. Up to 95% of general surgeons are paged overnight at least once per week (mean 13.6 +/- 11.2 calls/week), with 73% returning from home at least once during the week (mean 1.8 +/- 1.1 returns/week). Importantly, 84% of general surgeons believe reducing resident work hours will increase faculty hours, compared with 57% of subspecialists ($p = 0.004$). In addition, 87% predict that reducing resident hours will compromise surgical education, with only 11% believing the benefits of hour reduction will outweigh the negatives. The recommended limit for resident work hours closely approximates the average number of hours worked by surgical faculty in an academic center. Despite this, significant concern exists among the majority of surgical faculty regarding the impact of resident work hour restriction, both on faculty work hours and on resident education.

Zwemer FL, Schneider S. The demands of 24/7 coverage: using faculty perceptions to measure fairness of the schedule. Acad Emerg Med. 2004 Jan;11(1):111-4.

Ensuring fair, equitable scheduling of faculty who work 24-hour, 7-day-per-week (24/7) clinical coverage is a challenge for academic emergency medicine (EM). Because most emergency department care is at personally valuable times (evenings, weekends, nights), optimizing clinical work is essential for the academic mission. To evaluate schedule fairness, the authors developed objective criteria for stress of the schedule, modified the schedule to improve equality, and evaluated faculty perceptions. They hypothesized that improved equality would increase faculty satisfaction. Perceived stress was measured for types of clinical shifts. The seven daily shifts were classified as weekday, weekend, or holiday (plus one unique teaching-conference coverage shift). Faculty assigned perceived stress to shifts (ShiftStress) utilizing visual analog scales (VAS). Faculty schedules were measured (ShiftScores) for two years (1998-1999), and ShiftScore distribution of faculty was determined quarterly. Schedules were modified (1999) to reduce inter-individual ShiftScore standard deviation (SD).

The survey was performed pre- and post-intervention. Pre-intervention, 26 faculty (100% of eligible) assigned VAS to 22 shifts. **Increased stress was perceived in progression (weekday data, 0-10 scale) from day to evening to night (2.07, 5.00, 6.67, respectively) and from weekday to weekend to holiday (day-shift data, 2.07, 4.93, 5.87). The intervention reduced inter-individual ShiftScore SD by 21%. Post-intervention survey revealed no change in perceived equality or satisfaction.** Faculty perceived no improvement despite scheduling modifications that improved equality of the schedule and provided objective measures. Other predictors of stress, fairness, and satisfaction with the demanding clinical schedule must be identified to ensure the success of EM faculty.

VII. Resident/Faculty Activities, Work Sampling and Work Intensity

Ferrera MH, Beaman ST, Metro DG, Handley LJ, Walker JE Jr. What is an anesthesiology resident worth? J Clin Anesth. 2009 Aug;21(5):317-21.

To determine the cost of replacing an anesthesiology resident with a certified registered nurse anesthetist (CRNA) for equal operating room (OR) work. Retrospective financial analysis. Academic anesthesiology department. Clinical anesthesia-1 through -3 residents. Measurement included the cost of replacing anesthesiology residents with CRNAs for equal OR work was determined.

The cost of replacing one anesthesiology resident with a CRNA for the same number of OR hours ranged from \$9,940.32 to \$43,300 per month (\$106,241.68 to \$432,937.50 per yr). Numbers varied depending on the CRNA pay scale and whether the calculations were based on the number of OR hours worked at our residency program or OR hours worked in a maximum duty hour model. **CONCLUSIONS:** A CRNA is paid substantially more per OR hour worked, at all pay levels, than an anesthesiology resident.

Yen K, Shane EL, Pawar SS, Schwendel ND, Zimmanck RJ, Gorelick MH. Time motion study in a pediatric emergency department before and after computer physician order entry. Ann Emerg Med. 2009 Apr;53(4):462-468.e1.

To determine the effect of computer physician order entry on pediatric emergency department (ED) care providers allocation of time. We seek to determine whether the increase in time by ED care providers on the computer will decrease time spent with patients. **METHODS:** This was a before-and-after observational time-and-motion study conducted at an urban pediatric ED. Observers recorded how caregivers allocated their time during 180-minute observation periods at 30-second increments the summers before after computer physician order entry introduction. Time on the computer was recorded in seconds. Observations were placed into 3 categories (direct patient care, indirect patient care, other), each with its own subcategories.

For attending physicians, median computer time increased from 5.0 minutes before computer physician order entry to 9.5 minutes after computer physician order entry (P=.01). For resident physicians, median computer time increased from 5.5 minutes before computer physician order entry to 14.3 minutes after computer physician order entry (P=.001). For nurses, time on the computer was not significantly different before and after computer physician order entry (P=.15), although it appears there was still some change in time allocation. After computer physician order entry, nurses' talking with staff about patient care decreased from 24.5 minutes to 13.3 minutes (P=.01). Computer physician order entry did not decrease time with patients for any of the caregiver types. The addition of computer physician order entry to a pediatric ED increases time spent on the computer by both attending and resident physicians but not for emergency nurses. This additional time on the computer is allocated from nonpatient care activities. The addition of computer physician order entry decreases nurses' time talking with other staff for patient care.

Block AE, Norton DM. Nurse labor effects of residency work hour limits. Nurs Econ. 2008 Nov-Dec;26(6):368-73.

Hospitals employing large numbers of residents increased their hiring of registered nurses, (including nurse practitioners, nurse anesthetists, and other RNs with greater training) significantly more than hospitals with smaller numbers of residents as a result of the ACGME work hours reforms. Patient safety was the main intent of the regulation and should remain the central concern when discussing the merits of resident work-hours limitations. The regulations also reduced the number of resident labor hours available

to hospitals. **This analysis suggests that nurses have compensated for reduced resident workload, with an additional full-time nurse for every 5.5 residents.** This finding contributes to a better understanding of the hospital labor response to the regulation that resulted in the reduction in resident hours.

Stahlfeld KR, Robinson JM, Burton EC. What do physician extenders in a general surgery residency really do? J Surg Educ. 2008 Sep-Oct;65(5):354-8.

The 80-hour workweek has forced surgical training programs to employ physician extenders to reduce work hours and improve the educational environment. The purpose of our study was to document objectively the specific workload provided by physician extenders and to evaluate any objective or subjective benefit provided to the residency program. Over 4 consecutive months, all orders written by 2 physician extenders associated exclusively with the general surgery residency program at our institution were reviewed. They were categorized as daytime or evening orders and were subdivided into admission, routine preoperative and postoperative, acute care, daily laboratories, pain medications, Pro re nata (PRN), wound care, and discharge orders. Acute care issues and PRN orders were individually examined and subdivided. The appropriateness, total volume, and the orders for each category were totaled and reviewed.

Overall, 3101 total orders (1128 daytime and 1973 nighttime) were reviewed in a 4-month time period. **On average, physician extenders at night wrote 35 orders per shift, compared with only 18.8 orders during the day. During the night, admission orders totaled 547 (27.7%), preoperative orders 442 (22%), acute care issues 324 (16.4%), PRN orders 239 (12%), and pain medication and PRN sleeping pills 156 (8%). During the day, routine postoperative orders totaled 305 (27%), daily laboratories 184 (16%), and discharge orders 253 (22%).** Physician extenders wrote appropriate orders and reduced resident workload. Educational opportunities increased because fewer residents left conference for acute patient care issues, and 1 fewer resident was absent during the day secondary to 1 less resident being sent home postcall. Performance on the American Board of Surgery In-Training Examination (ABSITE) increased dramatically for a focused group of residents. As the expense of each extender is approximately \$90,000, justification to administration is dependent on the institutional support and efficiency of the residency program. A clear simple outcome is that by improving standing orders and clinical pathways, and by using an electronic medical record system, noneducational work hours can be reduced significantly.

Arora VM, Georgitis E, Siddique J, Vekhter B, Woodruff JN, Humphrey HJ, Meltzer. Association of workload of on-call medical interns with on-call sleep duration, shift duration, and participation in educational activities. JAMA. 2008 Sep 10;300(10):1146-53.

Further restrictions in resident duty hours are being considered, and it is important to understand the association between workload, sleep loss, shift duration, and the educational time of on-call medical interns. To assess whether increased on-call intern workload, as measured by the number of new admissions on-call and the number of previously admitted patients remaining on the service, was associated with reductions in on-call sleep, increased total shift duration, and lower likelihood of participation in educational activities. Prospective cohort study of medical interns at a single US academic medical center from July 1, 2003, through June 24, 2005. Of the 81 interns, 56 participated (69%), for a total of 165 general medicine inpatient months resulting in 1100 call nights. Outcome measures included on-call sleep duration, estimated by wrist watch actigraphy; total shift duration, measured from paging logs; and participation in educational activities (didactic lectures or bedside teaching), measured by experience sampling method via a personal digital assistant.

Mean (SD) sleep duration on-call was 2.8 (1.5) hours and mean (SD) shift duration was 29.9 (1.7)

hours. Interns reported spending 11% of their time in educational activities. Early in the academic year (July to October), each new on-call admission was associated with less sleep (-10.5 minutes [95% confidence interval {CI}, -16.8 to -4.2 minutes]; $P < .001$) and a longer shift duration (13.2 minutes [95% CI, 3.2-23.3 minutes]; $P = .01$). A higher number of previously admitted patients remaining on the service was associated with a lower odds of participation in educational activities (odds ratio, 0.82 [95% CI, 0.70-0.96]; $P = .01$). Call nights during the week and early in the academic year were associated with the most sleep loss and longest shift durations. In this study population, increased on-call workload was associated with more sleep loss, longer shift duration, and a lower likelihood of participation in educational activities.

Dassinger MS 3rd, Eubanks JW 3rd, Langham MR Jr. Full work analysis of resident work hours. J Surg Res. 2008 Jun 15;147(2):178-81.

Resident duty hour restrictions, while intended to improve patient safety and resident well-being, may decrease time available for patient care and education. The objective was to perform in-depth analysis of how a pediatric surgical resident utilizes his time in hopes of eliminating waste, and in effect, add educationally relevant hours. Work done by a senior pediatric surgical resident was prospectively collected using three methods. The duty hours logged by the resident for a full academic year were analyzed. A detailed work analysis was performed by an independent observer who videotaped the resident. Finally, the resident recorded and categorized his daily activities during the month in which the videotaping occurred. The authors collected 18.9 h (1134.9 min) of videotaped data.

Total time spent directly related to patient care, including the operating room, was 656 min. One hundred seventy-five min were spent on education, both didactic and teaching on the wards. The resident spent 139.8 min traveling within the hospital; 132.7 min were categorized as communication; only 1.5% of time was deemed pure waste. A total of 344.75 h (20,685 min) were self-reported and categorized. Didactic education comprised 6.7% of total time while less formal teaching is embedded in the clinical activities of consultation, rounds, and clinic. Increased efficiency in the operating room, where the most time was spent, coupled with workflow redesigns that decrease travel and time spent on the phone would increase time available for education and patient care.

Levin S, Aronsky D, Hemphill R, Han J, Slagle J, France DJ. Shifting toward balance: measuring the distribution of workload among emergency physician teams. Ann Emerg Med. 2007 Oct;50(4):419-23.

The objective of this investigation is to determine time-dependent workload patterns for emergency department (ED) physician teams across work shifts. A secondary aim was to demonstrate how ED demand patterns and the timing of shift changes influence the balance of workload among a physician team. Operational measurements of an adult ED were collected from a clinical information system to characterize physician workload patterns during all current work shifts. Plots of patient load versus time were developed for each physician shift, in which patient load was defined as the number of patients a physician simultaneously managed at a point in time. Patient-load curves for each shift were superimposed during 24 hours to display how patient load was distributed among a team of physicians.

Resident shift changes during daily peak occupancy periods caused patient load imbalances so that residents on a particular shift consistently managed a disproportionate number of patients (mean 9.4 patients; 95% confidence interval [CI] 6.7 to 12.1 patients) compared with other residents on duty (mean 3.4 patients; 95% CI 2.1 to 4.7 patients). Physician patient load patterns and ED demand patterns should be taken into consideration when physician shift times are scheduled so that patient load may be balanced among a team. Real-time monitoring of physician patient load may reduce stress and prevent physicians from exceeding their safe capacity for workload.

Chung RS, Ahmed N. How surgical residents spend their training time: the effect of a goal-oriented work style on efficiency and work satisfaction. Arch Surg. 2007 Mar;142(3):249-52; discussion 252.

When work hours are limited, improving residents' work efficiency allows more time for key training activities, reduces frustration, and improves work satisfaction. This was designed as prospective control study in a general surgical service with a trauma program. Participants were five full-time attending physicians, a resident team of 9 members, and 3 surgical assistants. The intervention was a reorganization of work habits based on a goal-oriented work style. The main outcome measures were changes of time spent in key activities; punctuality for operations, clinics, and conferences; residents' work satisfaction, physical fatigue, and mental stress; and attending physician and patient evaluations of residents.

A goal-oriented work style reduced round time and non-purposeful time and improved punctuality for key education activities. More operative time could be accommodated within the work-hours limits. Residents' work satisfaction improved while mental stress was reduced. Patient satisfaction scores also increased. Residents' work is generally inefficient. Reduced work hours should be accompanied by work-habit reform to make the best use of residents' training time.

Gabow PA, Karkhanis A, Knight A, Dixon P, Eisert S, Albert RK. Observations of residents' work activities for 24 consecutive hours: implications for workflow redesign. Acad Med. 2006 Aug;81(8):766-75.

The article examines resident workflow as part of an institutional approach to redesigning the processes of health care delivery. In 2003 the authors observed the workflows for 24 hours of seven residents who were at various levels of training (two each from the internal medicine, pediatrics, and obstetrics and gynecology programs, and one from general surgery) at Denver Health Medical Center, an urban, public teaching hospital. **Although the residents spent varying proportions of their time in various activities, all had extremely fragmented workflows as they engaged in from 5.0 to 11.3 different activities per hour of non-sleeping time, many of which required only minutes to complete. All residents experienced frequent interruptions and changes in focus. The internal medicine and surgery residents spent large amounts of time traveling, covering three and six miles, respectively, during their 24-hour shifts. Three of the residents slept between one-quarter and one-third of their time on duty (one without any interruption).** The authors suggest that fragmented workflow exists in all residency programs and that applying the same work limitations to all residents in all training programs (to reduce fatigue-related errors) may be overly restrictive. Improving these processes of care will be difficult and will likely require analytic skills and knowledge of systems engineering that most physicians do not have.

Chung RS. How much time do surgical residents need to learn operative surgery? Am J Surg. 2005 Sep;190(3):351-3.

The authors calculated the time a resident spent to acquire the average operative experience before mandated duty hours, to generate a standard for curriculum redesign. By using data from 2002 to 2003 furnished by the Residency Review Committee for Surgery, and the operation times of attending surgeons in a hospital consortium, the time devoted to operative surgery over 5 years of training were calculated.: **An average of 2753 hours or 14.3% of 19,200 hours (5 years of 80-hour work weeks) were spent as a chief surgeon, 272 hours as an assistant, and another 938 hours for immediate preoperative and postoperative attendance. The average total time for operative training was 3963 hours or 20.6% of 5 years of 80-hour weeks (16.5 h/wk).** The database is useful for redesigning the surgical curriculum for the mandated duty hours. It also may be used to determine rapidly if a program currently is providing sufficient time for operative surgery.

Mitchell J, Hayhurst C, Robinson SM. Can a senior house officer's time be used more effectively? Emerg Med J. 2004 Sep;21(5):545-7.

To determine the amount of time senior house officers (SHO) spent performing tasks that could be delegated to a technician or administrative assistant and therefore to quantify the expected benefit that could be obtained by employing such physicians' assistants (PA). SHOs working in the emergency department were observed for one week by pre-clinical students who had been trained to code and time each task performed by SHOs. Activity was grouped into four categories (clinical, technical, administrative, and other). Those activities in the technical and administrative categories were those we believed could be performed by a PA.

The SHOs worked 430 hours in total, of which only 25 hours were not coded due to lack of an observer. **Of the 405 hours observed 86.2% of time was accounted for by the various codes. The process of taking a history and examining patients accounted for an average of 22% of coded time. Writing the patient's notes accounted for an average of 20% of coded time. Discussion with relatives and patients accounted for 4.7% of coded time and performing procedures accounted for 5.2% of coded time. On average across all shifts, 15% of coded time was spent doing either technical or administrative tasks.**

In this department an average of 15% of coded SHOs working time was spent performing administrative and technical tasks, rising to 17% of coded time during a night shift. This is equivalent to an average time of 78 minutes per 10 hour shift/SHO. Most tasks included in these categories could be performed by PAs thus potentially decreasing patient waiting times, improving risk management, allowing doctors to spend more time with their patients, and possibly improving doctors' training.

Morton JM, Baker CC, Farrell TM, Yohe ME, Kimple RJ, Herman DC, Udekwu P, Galanko JA, Behrns KE, Meyer AA. What do surgery residents do on their call nights? Am J Surg. 2004 Sep;188(3):225-9.

Surgical resident education is entering a critical era of achieving core competencies despite work hour restrictions. An assessment of on-call activity is needed to maximize educational merit. The authors conducted a time-motion study of resident on-call activity was performed at a university medical center and an urban affiliate hospital. Residents were followed by "shadow" residents who concurrently recorded resident activity.

Activities of daily living and patient evaluation comprised the majority of on-call activity. Residents slept a median of 200 minutes per night. Cross-coverage activities accounted for 41% of pages and 19% of patient evaluation. Direct patient contact comprised only 7% of call night duties. Communication activity occupied 15% of total minutes, and a mean of 16 pages were received nightly. Significant differences in activities existed between resident levels and hospitals. Call activity consists primarily of activities of daily living, patient evaluation, and communication. Sleep accounts for nearly one third of all on-call activity. These data may be useful in improving both patient care and resident call experience.

Brasel KJ, Pierre AL, Weigelt JA. Resident work hours: what they are really doing. Arch Surg. 2004 May;139(5):490-3.

The authors attempted to better quantitate resident work within the system of care. A work-hour survey was developed defining five areas of activity: patient care related to educational objectives, required educational activities, patient care activities unrelated to educational objectives, off-duty educational activity, and off-duty hours. Total work hours and non-educational work hours were analyzed by resident level, rotation, and category. The survey response rate was 52%, covering 110 workweeks. **Residents**

worked 80 hours or less for 57 weeks and more than 80 hours for 53 weeks. The mean number of hours worked was 77. Less than one quarter (21.9%) of work hours were unrelated to educational activities. The amount of time spent in non-educational activities was lowest at community hospitals (17%) and similar at the Veterans Affairs (23%) and academic (22%) medical centers. It did not vary by total hours worked, averaging 21% for rotations of more than 80 h/wk and 23% for rotations of 80 h/wk or less. The authors concluded that residents spend a large amount of time in non-educational activities. Eliminating these activities would bring the rotations into compliance with the 80-hour work week. It would also generate a large amount of time for educational activities within the program.

Hoffman LA, Tasota FJ, Scharfenberg C, Zullo TG, Donahoe MP. Management of patients in the intensive care unit: comparison via work sampling analysis of an acute care nurse practitioner and physicians in training. Am J Crit Care. 2003 Sep;12(5):436-43.

Little is known about aspects of practice that differ between acute care nurse practitioners and physicians that might affect patients' outcomes. To determine if time spent in work activities differs between an acute care nurse practitioner and physicians in training (pulmonary/critical care fellows) managing patients' care in a step-down medical intensive care unit. Work sampling techniques were used to collect data when the nurse practitioner had 6 months' or less experience in the role (T1), after the nurse practitioner had 12 months' experience in the role (T2), and when physicians in training provided care on a rotational schedule (nurse practitioner not present, T3). These data were used to estimate the time spent in direct management of patients, coordination of care, and nonunit activities.

Results for T1 and T2 were similar. When T2 and T3 were compared, the nurse practitioner and the physicians in training spent approximately half their time in activities directly related to management of patients (40% vs 44%, not significantly different). The nurse practitioner spent more time in activities related to coordination of care (45% vs 18%; $P < .001$) and less time in nonunit activities (15% vs 37%; $P < .001$). The nurse practitioner and the physicians in training spent a similar proportion of time performing required tasks. Because of training requirements, physicians spent more time than the nurse practitioner in nonunit activities. Conversely, the nurse practitioner spent more time interacting with patients and patients' families and collaborating with health team members.

Melgar T, Schubiner H, Burack R, Aranha A, Musial J. A time-motion study of the activities of attending physicians in an internal medicine and internal medicine-pediatrics resident continuity clinic. Acad Med. 2000. Nov;75(11):1138-43

To describe the activities of attending physicians in a residency-based continuity clinic and to examine factors that affect their teaching of, supervision of, and interaction with residents. Six full-time board-certified faculty members (three internal medicine, three internal medicine-pediatrics) in an urban residency program participated in a descriptive observational time-motion study. The attending faculty were directly observed by "shadow" technique for 30 half-day sessions from April 1994 through September 1994. Each activity was measured by a trained research assistant using a digital stopwatch. The observed activities were assigned to one of 16 subcategories.

6,389 minutes of activities were observed. Activities were distributed among four general categories: direct contact with residents (43.1%), clinic operations (33.7%), personal and/or professional activities (18.0%), and miscellaneous time (5.2%). Attending physicians spent the most time in direct contact with residents when the patient-to-attending ratio was 10-14:1. The activities of the clinic's attending physicians were quite varied. Less than half of their time in the clinic was spent in contact with residents. This contact time may be significantly increased by changes to clinic policies, such as optimizing the patient-to-faculty ratio and increasing administrative support for the clinic. These

findings can be used as a reference point for studies of attending physicians' activities since the federally mandated rules changes regarding their responsibilities for supervising residents.

Moore SS, Nettleman MD, Beyer S, Chalasani K, Fairbanks RJ, Goyal M, Carter M. How residents spend their nights on call. Acad Med. 2000 Oct;75(10):1021-4.

The authors examined night call, which is a significant part of residents' education, but little information about their night-call activities is available. This study recorded residents' activities during night-call rotations on internal medicine and pediatrics wards. In June and July 1997, on-call pediatrics and internal medicine residents at an urban academic medical center were accompanied by trained observers on the general wards between the hours of 7 PM and 7 AM. The types and duration of activities were recorded.

Residents were observed for 106 nights. Internal medicine and pediatrics residents spent their time similarly. They spent 5.3 hours and 5.7 hours per night, respectively, on "basic" activities such as eating, resting, chatting, and sleeping, and an average of 2.6 hours and 2.2 hours, respectively, on chart review and documentation. In both programs, discussing the case with team members averaged 1.5 hours per night and use of the computer averaged slightly more than half an hour. Internal medicine residents spent approximately 1.5 hours on patients' history and physical examinations while pediatrics residents spent 1.3 hours. With each new patient, internal medicine residents spent an average of 19.7 minutes and pediatrics residents spent 16.5 minutes. The only significant difference between the two groups of residents was that the pediatrics residents spent more time per night on procedures than did the internal medicine residents (37 minutes versus 14 minutes, $p < 0.01$). The findings showed that residents from both programs spent a surprising amount of time each night on chart review and documentation. In fact, they spent more time with charts than with patients. Whether this activity truly contributes to residents' education or improved patients' outcomes is not clear.

Dresselhaus TR, Luck J, Wright BC, Spragg RG, Lee ML, Bozzette SA. Analyzing the time and value of housestaff inpatient work. J Gen Intern Med. 1998 Aug;13(8):534-40.

The authors sought to determine time allocation and the perceived value to education and patient care of the weekday activities of internal medicine residents on inpatient rotations and to compare the work activities of interns and residents. In an observational study, they classified activities along five dimensions (association, location, activity, time, and value), developed a computer-assisted self-interview survey, and demonstrated its face and content validity, internal consistency, and interrater reliability. Subjects were assigned survey computers for 5 consecutive weekdays over a 24-week period, into which they entered data when prompted several times a day. Participants were 60 residents (36 interns, 24 residents) rotating on the inpatient wards.

The study analyzed activities according to content (direct patient care, indirect patient care, education), association, and location. Likert-scale ratings of perceived value to education and patient care were also obtained. Residents provided complete responses to 3,812 (95%) of 3,992 prompts by a median of 11 seconds; 93% of responses were logically consistent across the measured dimensions. **Residents spent more time in indirect patient care (56%) than in direct patient care (14%) or educational activities (45%). Formal educational activities had the highest educational value (66 on 0-100 scale), and direct care had the highest value to patient care (81). Over 30% of time was spent in administrative activities, which had low educational value(40). Compared with residents, interns allocated significantly less time to educational activities (38% vs. 57%) and more time to lower-value activities such as documentation (19% vs. 12%).** Improved data collection methods demonstrate that residents in the program under study, particularly interns, spend much of their workday in activities that are low in educational and patient care value. Selective elimination or delegation of such activities would

preserve higher-value experiences during reductions in overall inpatient training time. Planners can use automated random sampling to guide the rational redesign of resident work.

Magnusson AR, Hedges JR, Harper RJ, Greaves P. First-postgraduate-year resident clinical time use on three specialty rotations. Acad Emerg Med. 1999 Sep;6(9):939-46.

To compare in-hospital time uses by first-postgraduate-year (PGY1) residents during rotations in emergency medicine (EM), internal medicine (IM), and surgery (S). This article reports the clinical components of residency time use. A cross-sectional, observational study of the clinical activities of EM PGY1 residents was performed while the residents were on duty during the three specialty rotations. The activities were recorded by an observer using a log with predetermined categories for clinical activities. A time-blocked, convenience sample of resident shifts was observed for each service rotation. The sample was proportional to the total number of hours for which a PGY1 resident was expected to be in the hospital during a rotation on that service. No attempt was made to sample the same resident at all time periods or on all rotations. Proportions were compared by chi²; alpha = 0.0001.

Twelve PGY1 residents were observed for a total of 166 hours on S, 156 hours on IM, and 120 hours on EM. These hourly amounts were representative of a typical two-week span of service on each rotation for the residents. On average, the residents spent 57% of their time on clinical or service-oriented activities. During EM and IM rotations, the residents spent most of their time performing clinical information gathering and engaging in case management and data synthesis (52% of total clinical effort). Within this category, residents on EM were more involved with case discussion and review of ancillary test results than on IM (34% vs. 20% of time in this category). Conversely, proportionately less time in this category was devoted to documentation on the EM vs. IM rotation (56% vs. 80%; p < 0.0001). The greatest opportunity to perform procedures was on the S rotation (31% of total clinical time vs. 6% for other specialties; p < 0.0001). The authors concluded that awareness of the clinical activities performed on PGY1 rotations can help residency directors anticipate educational needs to balance their residents' experience. Since 29% and 42% of total clinical time on PGY1 EM and IM rotations, respectively, is focused on documentation, efforts to enhance charting skills and efficiency are warranted. Also, efforts to enhance PGY1 procedural experience outside of the S rotation appear warranted.

Magnusson AR, Hedges JR, Ashley P, Harper RJ. Resident educational time study: a tale of three specialties. Acad Emerg Med. 1998 Jul;5(7):718-25

To compare amounts of in-hospital time use by PGY1 residents during rotations in emergency medicine (EM), internal medicine (IM), and surgery. This article reports the general study methodology and focuses on the educational aspects of residency time use. A cross-sectional, observational study of the activities of EM PGY1 residents was performed while the residents were on duty during the 3 specialty rotations. The activities were recorded by an observer using a log with predetermined categories for clinical/service, educational, and personal areas. A time-blocked, convenience sample of resident shifts was observed for each service rotation. The sample was proportional to the total number of hours for which a PGY1 resident was expected to be in the hospital during a rotation on that service. No attempt was made to sample the same resident at all time periods or on all rotations. Twelve PGY1 residents were observed for a total of 166 hours on surgery, 156 hours on IM, and 120 hours on EM. These hourly amounts were representative of a typical 2-week span of service on each rotation for the residents. On average, the residents spent 57% of their time on clinical or service-oriented activities, 24% on educational activities, and 19% on personal activities.

The proportions of time devoted to the 3 major areas were similar for the 3 rotations. In all 3 rotations, the largest proportion of time was spent on patient-focused education (81% to 92% of

total educational time). Only 2% to 11% of educational time was devoted to self-education. Within the patient-focused education category, proportionately less resident time with faculty occurred on the surgery rotation than on the EM and IM rotations (18% vs 30% and 27%, respectively). The general breakdowns of clinical/service, educational, and personal time use by PGY1 residents are proportionately similar for the 3 service rotations. Patient-focused education is the primary mode of education for all services. In-hospital, self-education time is limited. Clinical teaching is largely by nonfaculty. The educational implications of these findings are discussed.

Steele MT, Watson WA. Emergency medicine residency faculty scheduling: current practice and recent changes. *Ann Emerg Med.* 1995 Mar;25(3):321-4.

The study objective was to assess current emergency medicine faculty scheduling practices, preferences, and recent changes. All emergency medicine residency program directors and full-time faculty participated in this mail survey. Questions were asked about current faculty scheduling practices, preferences, and recent changes. **Eighty-five percent (79 of 93) of the programs and 63% (606 of 961) of the full-time faculty responded. Faculty most commonly worked a combination of 8- and 12-hour shifts. Seventy-five percent of full-time faculty stated that they would prefer to work 8-hour shifts. Eighty-three percent of those who work some or all 8-hour shifts preferred 8-hour shifts; 21% of those working 12-hour shifts preferred the same (P < .0005; test of proportions difference, 62%; 95% confidence interval, 55% to 69%). Over the past 5 years, 40% of programs had shortened shift lengths, and the number of night shifts worked per month and/or the number of nights in a row worked per faculty decreased for 34%.** Residency faculty prefers and has moved toward working shorter shifts. They are also working fewer night shifts per month and fewer night shifts in a row.

Guarisco S, Oddone E, Simel D. Time analysis of a general medicine service: results from a random work sampling study. *J Gen Intern Med.* 1994 May;9(5):272-7.

The authors described a novel method of time analysis for health care settings by quantifying internal medicine residents' work activities and contacts. The study used observational work sampling study based on random sampling technique, and was conducted at in general medicine service in a university hospital. All residents (18 interns, 18 residents) rotating through the general medicine service during a 12-week period participated.

Outcome measures included the proportion of time spent doing 22 work activities and proportion of time spent with 13 work contacts, reported separately for interns and residents and for on-call days and off-call days. **The authors sampled 6,599 unique time observations (3,533 from on-call days, 3,066 from off-call days) during 193 resident workdays. The residents spent a majority of their time engaged in direct patient care activities (81% of the interns' workdays, and 64.5% of the residents' workdays), primarily in patient evaluation and follow-up (48% of the interns' and 39% of the residents' workdays). Compared with the interns, the residents spent relatively more time in direct educational activities (conferences, reading, teaching): 27% of the residents' workdays versus 10% of the interns' workdays. Analysis of work contacts showed that the residents spent a large portion of the workday alone: 27% of the residents' and 34% of the interns' workdays. The residents also spent a large portion of the workday with attending physicians: 23% of the residents' and 11% of the interns' workdays. This translates into 21 hours/week of attending supervision for the residents and 10 hours/week for the interns.** Using random work sampling, the authors found that the vast majority of the house officer's workday was spent in direct patient care. This method of time analysis may be used to describe resident training and supervision, as well as to evaluate administrative interventions designed to change residents' work experience.

Weinger MB, Herndon OW, Zornow MH, Paulus MP, Gaba DM, Dallen LT. An objective methodology for task analysis and workload assessment in anesthesia providers. *Anesthesiology*. 1994 Jan;80(1):77-92

Administering anesthesia is a complex task in which either human or equipment failure can have disastrous consequences. An improved understanding of the nature of the anesthesiologist's job could provide a more rational basis for improvements in provider training as well as the design of anesthesia equipment. The objective of this study was to develop a set of techniques to evaluate anesthesiologist performance and to determine what information could be obtained from performing real-time task assessment and workload analysis tests in the operating room. The methodology used included time-motion analysis, secondary task probing, and subjective workload assessment. The time-motion data was subjected to subsequent analysis to generate quantitative measures such as task duration (time spent focused on an individual task) and task density (the number of tasks initiated per minute). The latency of response to a "vigilance light" was used as a secondary task probe. Finally, both the observer and the subjects themselves scored workload at 10-15-min intervals throughout the case. Two groups of anesthesia providers performing general endotracheal anesthesia for simple ambulatory surgical cases (1-4 h duration) were examined using this methodology. In the first group, 3rd-yr anesthesia residents and experienced certified registered nurse anesthetists (n = 11) performed cases under limited supervision by an attending anesthesiologist. In the second group, novice residents in their first 8 weeks of training (n = 11) performed similar cases under nearly constant attending supervision.

The two groups seemed to manifest different patterns of task behavior, task density, subjective workload, and latency of response to the vigilance task. Response latency to the vigilance task increased at times of increased workload (e.g., during induction of anesthesia). **The experienced (less supervised) providers spent significant amounts of time observing the monitors and the surgical field, whereas the novice subjects spent more time conversing with the supervising attending. Despite performing fewer tasks per minute (lower task densities), the novice subjects exhibited longer latencies of response to the vigilance light and increased subjective workload. Novice subjects also had longer task duration values. For example, postintubation, novices focused on their monitors for an average of twice as long as did experienced subjects (13 +/- 2 vs. 7 +/- 1 s) before moving on to another task.** These techniques permitted an objective description of task characteristics, workload, and vigilance in anesthesia personnel under actual work conditions. This methodology could aid in understanding the factors that affect anesthesiologists' performance and may prove useful in assessing the progress of training.

Finkler SA, Knickman JR, Hendrickson G, Lipkin M Jr, Thompson WG. A comparison of work-sampling and time-and-motion techniques for studies in health services research. *Health Serv Res*. 1993 Dec;28(5):577-97.

This study compares results and illustrates trade-offs between work-sampling and time-and-motion methodologies. Data are from time-and-motion measurements of a sample of medical residents in two large urban hospitals. The study contrasts the precision of work sampling and time-and-motion techniques using data actually collected using the time-and-motion approach. That data set was used to generate a simulated set of work-sampling data points. Trained observers followed residents during their 24-hour day and recorded the start and end time of each activity performed by the resident. The activities were coded and then grouped into ten major categories. Work-sampling data were derived from the raw time-and-motion data for hourly, half-hourly, and quarter-hourly observations.

The study showed that the actual time spent on different tasks as assessed by the time-and-motion analysis differed from the percent of time projected by work-sampling. The work-sampling results differed by 20 percent or more of the estimated value for eight of the ten activities. As expected, the standard deviation decreases as work-sampling observations become more frequent. The findings

indicate that the work-sampling approach, as commonly employed, may not provide an acceptably precise approximation of the result that would be obtained by time-and-motion observations.

Oddone E, Guarisco S, Simel D. Comparison of housestaff's estimates of their workday activities with results of a random work-sampling study. Acad Med. 1993 Nov;68(11):859-61.

Accurately quantifying residents' work activities is acquiring increasing importance as resources become constrained and programs become more accountable for medical education. The authors compared a traditional method of time analysis based on residents' estimates of how they spent their workdays with the results of a formal time-analysis study based on random work sampling. All residents (18 interns and 18 residents) rotating on a general medicine service at Duke University Medical Center between December 1991 and March 1992 participated in the study. Twenty-six of the residents first provided estimates of how they spent their workdays, and then all 36 wore random reminder beepers and recorded what they were doing (activity) and with whom (contact) at each beep.

The results showed that residents overestimated the amounts of time spent in patient evaluation (e.g., the mean estimated proportion of time spent performing histories and physical examinations was 29%, whereas the mean actual proportion was 17%) and in educational activities (e.g., the mean estimated proportion of reading time was 8.4%, whereas the mean actual proportion was 2.7%). The residents underestimated the amount of supervision by attending physicians: the mean estimated proportion was 7.7%, whereas the mean actual proportion was 16.9%. The house staff's estimates of workday times differed from the observed times measured by random work sampling. These inaccuracies were manifest in several important areas, such as patient evaluation, educational activities, and attending physicians' supervision. These results suggest that program directors who seek to describe house staff's work activities or wish to determine the effects of administrative interventions should use random work sampling as the measure.

Parenti C, Lurie N. Are things different in the light of day? A time study of internal medicine house staff days. Am J Med. 1993 Jun;94(6):654-8.

To determine how internal medicine house staff spend their days and compare activities during the day with those previously observed during night call. University-affiliated Veterans Affairs Medical Center. Two internal medicine house staff teams (one PGY-1 [postgraduate year] and one PGY-2 or PGY-3) observed during 5 short call admitting days. Time in each activity recorded by trained observers, computed, summed, and compared with that of similar activities of house staff on night call.

House staff admitted an average of two patients each day. They spent, on average, 25 minutes per patient performing new patient histories and physical examinations, 29 minutes charting new patient information, and were interrupted after an average of 12 minutes during the new patient evaluation compared with 20, 19, and 7 minutes at night ($p > 0.05$). The average house officer spent 44 minutes in nonphysician duties and 11 minutes answering pages during the day. On average, house staff spent 3 minutes each day talking in person with patients' families. A significant amount of time each day was spent performing nonphysician duties. Little time was spent evaluating each patient or in person with patients' families and similar amounts of time were spent in charting and in patient evaluation. House staff appeared to spend more time with new patients during the day than they did at night, although this finding was not statistically significant. As noted during night call, evaluations were frequently interrupted. Future studies should examine why house staff choose to distribute their time in the manner described in this and similar studies.

Tanz RR, Charrow J. Black clouds. Work load, sleep, and resident reputation. Am J Dis Child. 1993 May;147(5):579-84.

Although it is assumed that residents in a specific training program will have comparable experiences, residents commonly perceive that some have consistently more difficult times on call. Such residents in the program are said to have "black clouds." They authors sought to determine if these perceptions were related to differences in real work load. They collected data about the on-call experiences of first-year pediatric residents (PL-1s) for 358 days (1355 on-call experiences) during the 1984-1985 academic year. Every PL-1 (n = 19) reported the following data the morning after each night on call: hours of sleep, number of admissions, total number of patients, number of deaths, number of transfers to the pediatric intensive care unit, number of delivery room trips, and a subjective assessment of work load, using a three-point scale. The reputation of each house officer was determined by asking all residents in the program (PL-1s, PL-2s, and PL-3s) to rate each other three times during the year regarding how hard they worked on call.

There were significant differences among PL-1s in how difficult they perceived their workload to be and in how much they slept ($P < .001$ using analysis of variance). However, actual work load (as measured by the number of either admissions or patients) did not vary significantly among the residents. There was a strong negative association between self-perception of workload and hours of sleep ($r = -.75$; 95% confidence interval, -0.73 to -0.76). **Sleep was the major predictor of perceived work load (multiple $R^2 = .563$ using multiple linear regression analysis). The absence of an association between perceived and actual workload is attributed to large differences in the residents' working styles. This is evidenced by a wide range of correlations among PL-1s between the number of admissions and hours of sleep (range of r values, $-.66$ to $-.16$). A reputation for difficult on-call experiences was strongly associated with few hours of sleep ($r = -.77$; 95% confidence interval, -0.49 to -0.91), but not with actual workload measured by the number of admissions, patients, deaths, or other variables. Sleep was the major predictor of reputation (multiple $R^2 = .567$ using multiple linear regression analysis).**

The authors concluded that some residents did have a black cloud; they slept less, perceived that they worked harder than average, and had a reputation for having difficult on-call experiences. Residents with a black cloud function differently from their colleagues; for example, some may be inefficient, while others may create extra work for themselves. Residency program directors must recognize these functional differences to effectively evaluate and counsel house officers.

Hayward RS, Rockwood K, Sheehan GJ, Bass EB. A phenomenology of scut. Ann Intern Med. 1991 Sep 1;115(5):372-6.

The objective was to identify, describe, and quantify the night-call duties that residents in internal medicine call "scutwork" and to compare faculty and residents' perceptions of scutwork. This was designed as a prospective, cross-sectional study in a general internal medicine training program at a university-affiliated tertiary care hospital. Forty-eight residents who spent 3 months or more on an internal medicine teaching unit during the previous year and 41 faculty members who spent 2 months or more on one of these units participated. Post-call surveys and night-call diaries were used to analyze residents' activities, to derive a definition of scutwork, and to estimate its prevalence. Residents and faculty then completed a detailed questionnaire that included ratings of the educational value, "scut content," and residents' responsibility for 20 specific tasks.

Eighty-three percent of residents found scutwork and education to be mutually exclusive for the 20 tasks, although 20% indicated that scutwork was an appropriate task for residents. Residents' ratings of tasks as scut varied according to the context of the task. For example, obtaining routine consent from someone else's patient was considered scutwork by 98% of residents, whereas obtaining such consent from the residents' own patient was rated as scutwork by only 52% (P less

than 0.01). Similarly, performing intravenous cannulation at the request of ward staff was rated as scut by 94% of residents, whereas performing cannulation at another resident's request was rated as scut by 56% (P less than 0.01). Night-time admission of a patient for an elective procedure was rated as scut by 75% of residents, whereas admission of such a patient after discussion with a faculty member was labeled scut by only 44% (P less than 0.01). Faculty ratings of such admissions did not show the same variation (24% for both). Faculty were more likely than residents to assess tasks as educational (50% compared with 26%, P less than 0.01) but were less likely to consider tasks as scutwork (47% compared with 62%, P = 0.12) or as work that should be done by nonresidents (35% compared with 46%, P greater than 0.2). The results suggest that the characteristics of scutwork can be identified, that the perception of scut varies between faculty and residents, and that the context of a task often determines whether residents perceive it as scut.

Strunk CL, Bailey BJ, Scott BA, Cummings CW, Lucente FE, Beatty CW, Neel HB, Pillsbury HC 3rd, Rice DH, Bryan MD, et al. Resident work hours and working environment in otolaryngology. Analysis of daily activity and resident perception. JAMA. 1991 Sep 11;266(10):1371-4

See summary on page 46.

Nerenz D, Rosman H, Newcomb C, Bolton MB, Heudebert G, Simmer T, Goldstein S. The on-call experience of interns in internal medicine. Arch Intern Med. 1990 Nov;150(11):2294-7.

As part of an effort to examine the structure and content of their residency program in internal medicine, the authors assessed interns' activities on call to identify problems with workload scheduling, supervision, or learning. Eleven interns were observed continuously during a 34-hour on-call period. Interns averaged 5.6 hours at the bedside, with 57 minutes of that time under direct supervision of a resident or attending physician. Nearly half of new patient examinations continued after midnight despite a special night admission team that evaluated all patients admitted after 11 pm.

The interns averaged 21 beeps per 30 hours. They slept an average of 2.5 hours with two interruptions. They read about their patients an average of 4 minutes during the 34-hour period. Most supervision was away from the bedside (82/139 minutes). Bedside supervision occurred predominantly during rounds (45/57 minutes). Attending physicians averaged only 12 minutes of bedside interaction with the intern. Many of these findings were unanticipated. Structural defects in the training program were defined and are being addressed. Other training programs should consider similar analyses before making fundamental changes.

Brock DM, Scott CS, Pendergrass TW, MacDonald SC. Sampling clinicians' activities using electronic pagers. Eval Health Prof. 1990 Sep;13(3):315-42.

Pager-based activity sampling (PAS) is described as a cost-effective and unobtrusive method for sampling residents' activities in clinical settings. A sample program evaluation is presented using residents in an urban children's hospital resident-training program. The purposes of the program evaluation were: (a) to establish a behavioral baseline that would help clinical faculty understand how residents were using their time, and (b) to determine whether alterations in the way residents were assigned within the hospital resulted in desired changes to time spent. The primary rationale for changing resident-assignment policies were: (a) to decrease the time residents were spending in transit between various locations within the hospital, and (b) to increase the time spent by residents in educational activities and in direct contact with patients and their families. **This PAS application demonstrates that the technique can produce statistically supportable conclusions, at minimal cost, without unduly disrupting either the residents or their patients. PAS is compared with other time-sampling methods, its limitations are discussed, and suggestions for future applications are provided.**

Dolan KL, Rosner F, Spiegel K. Survey of nonphysician tasks performed by medicine residents at a municipal hospital. J Natl Med Assoc. 1990 Sep;82(9):629-33.

In June 1988, the New York State Hospital Review and Planning Council approved major revisions in the state hospital code (Part 405). Among the most controversial of these changes were the recommendations of the Bell Commission concerning limitations on resident work hours, new emergency service requirements, and enhancements in ancillary staffing. The ancillary staffing mandated by the new code regulations for teaching hospitals include the provision at all times of intravenous services, phlebotomy services, messenger services, transport services, nurses aides, housekeeping services, and other ancillary support in a manner sufficient to meet patient care needs and to prevent adverse impact on the delivery of medical and nursing care. The intent of the new health code requirements is to reduce or eliminate many of the nonphysician tasks performed by residents so as to effectively reduce their workload. **The authors conducted a survey of Medicine residents at Queens Hospital Center to assess the amount of time they presently devote to nonphysician tasks, their perceptions of the need for ancillary staff to relieve them of the burden of these nonphysician tasks, and their evaluation of the effectiveness of a recently instituted intravenous therapy team.**

Warner BW, Hamilton FN, Brunck BS, Bower RH, Bell RH Jr. Study of surgical resident working hours and time utilization. J Surg Res. 1990 Jun;48(6):606-10.

See summary on page 48.

Lurie N, Rank B, Parenti C, Woolley T, Snoke W. How do house officers spend their nights? A time study of internal medicine house staff on call. N Engl J Med. 1989 Jun 22;320(25):1673-7.

Recommendations to limit the working hours of house staff are forcing directors of training programs to reevaluate how house officers spend their time. They studied how 35 house officers in internal medicine spent their on-call time in three teaching hospitals: an urban county hospital, a university hospital, and a regional Veterans Administration medical center. Trained observers accompanied each member of different on-call teams for five nights and quantified how their time was spent. Teams consisting of residents and interns admitted three new patients per night at the Veterans Administration hospital, six at the university hospital, and eight at the county hospital. Each house officer received 16 to 25 calls per night. Up to 12 percent of their time was spent doing procedures (such as inserting intravenous catheters or drawing blood specimens) most of which could have been done by nonphysicians.

From 87 to 175 minutes of on-call time was spent in direct patient evaluation, and the mean time spent on each new-patient evaluation ranged from 17 to 31 minutes. The mean time before the evaluation was interrupted ranged from 7 to 11 minutes. In contrast, 66 to 197 minutes per night was spent documenting new-patient evaluations in the hospital record. The average sleep time ranged from 122 to 273 minutes; however, the mean time before sleep was interrupted ranged from 40 to 86 minutes. The authors concluded that while on call, house officers spend relatively little time in direct patient contact, but they spend considerable time charting. They are frequently interrupted while working and trying to sleep. These data may be useful in finding administrative ways to improve patient care and the experience of the house staff while on call and in evaluating the effect of reforms.

Hsiao WC, Yntema DB, Braun P, Dunn D, Spencer C. Measurement and analysis of intraservice work. JAMA. 1988 Oct 28;260(16):2361-70

The work that physicians perform represents a major resource input to medical services and procedures.

In this article we describe the concepts of work and its dimensions, as well as the methods developed to measure them. We also describe the design and results of a national probability survey of physicians in 18 specialties. We present the results--estimated values of work and its dimensions--for selected services. Our findings indicate that physicians can give reliable and valid ratings of work and that we can model this work as a function of four dimensions: time, mental effort and judgment, technical skill and physical effort, and stress. Analyzing the complex functional relationship between work and these four dimensions shows that all four dimensions are important and statistically significant in predicting work. Time is a more important dimension in predicting work for medical specialties than for surgical specialties, with the estimated regression coefficients between .3 and .5 and .2 and .3, respectively. In contrast, technical skill is a more important dimension in predicting work in surgical specialties than for medical specialties, with the estimated regression coefficients between .3 and .5 and .2 and .3, respectively. Finally, we found that an exponential equation of the four dimensions precisely describes total work.

Wallace EZ. Service vs education in internal medicine residency. Need for a resolution. Arch Intern Med. 1988 Jun;148(6):1296.

Decreased availability of internal medicine residents for inpatient care may result from efforts to contain rising health costs and to decrease funding for graduate medical education. The movement toward increased ambulatory training, reduced work hours for residents, and the declining interest in internal medicine careers will further decrease resident numbers. Hospitals have relied on trainees for an extraordinary range of hospital services, resulting in long duty weeks, assumption of large amounts of ancillary responsibilities, excessive patient loads, and increased house staff stress. Residents must be relieved of time-consuming, nonmedical chores and internal medicine training must be redefined to provide experiences which are important to gain competence. Hospitals must find other resources for providing patient care functions not educationally valid for residents, to allow that training to refocus on the appropriate development of the internist of the future.

VIII. New Models of Care and Education under Duty Hour Restrictions

Auger KA, Sieplinga KR, Simmons JM, Gonzalez del Rey JA. Failure to Thrive: Pediatric Residents Weigh In on Feasibility Trial of the Proposed 2008 Institute of Medicine Work Hour Restrictions. JGME Dec 2009; 1(2):181-4.

See summary on page 133.

Mautone SG. Toward a New Paradigm in Graduate Medical Education in the United States: Elimination of the 24-Hour Call. JGME Dec 2009; 1(2):188-94.

See summary on page 134.

Tessing S, Amendt A, Jennings J, Thomson J, Auger KA, Gonzalez del Rey JA. One Possible Future for Resident Hours: Interns' Perspective on a One-Month Trial of the Institute of Medicine Recommended Duty Hour Limits. JGME Dec 2009; 1(2):185-7.

See summary on page 134.

Papaspyros SC, Javangula KC, O'Regan DJ. Surgical training in the 48-h week: a novel simulation and educational tool. From amateur golfer to professional pilot. Eur J Cardiothorac Surg. 2009 Sep;36(3):511-5.

See summary on page 173.

Ferran NA, Metcalfe AJ, O'Doherty D. Standardised proformas improve patient handover: Audit of trauma handover practice. Patient Saf Surg. 2008 Sep 25;2:24.

The implementation of the European Working Time Directive has meant the introduction of shift patterns of working for junior doctors. Patient handover between shifts has become a necessary part of practice in order to reduce the risk of medical errors. Data handed over between shifts are used to prioritize clinical jobs outstanding, and to create theatre lists. We present a closed-loop audit of handover practice to assess whether standardized proformas improve clinical data transfer between shifts during handover in our Orthopaedic Unit. We collected data handed over between shifts for a period of one week at our department. The data were in the form of hand written data on plain paper used to assist verbal handover. Data were analyzed and a standardized handover sheet was trialed. After feedback from juniors the sheet was revised and implemented. A re-audit, of handover data, was then undertaken using the revised standardized proforma during a period of 1 week.

Forty-eight patients were handed over in week 1 while 55 patients were handed over during re-audit. The standardized proformas encouraged use of pre-printed patient labels which contained legible patient identifiers, use of labels increased from 72.9% to 93.4%. Handover of outstanding jobs increased from 31.25% to 100%. Overall data handed over increased from 72.6% to 93.2%. Handover of relevant blood results showed little improvement from 18.8% to 20.7% This audit highlights the issue of data transfer between shifts. Standardised proformas encourage filling of relevant fields and increases the data transferred between shifts thereby reducing the potential for clinical error cause by shift patterns.

Feinland JB, Sankey HZ. The obstetrics team: midwives teaching residents and medical students on the labor and delivery unit. J Midwifery Womens Health. 2008 Jul-Aug;53(4):376-80.

In response to the new standards for resident work hours issued in 2003, Baystate Medical Center in Springfield, MA developed a program for midwifery involvement in resident and medical education. The Obstetrics Team consists of a midwife teaching first-year residents in obstetrics/gynecology and emergency medicine and third-year medical students on the labor and delivery unit. This program has successfully addressed the need for resident and medical education as well as service provision created by reduced resident work hours and provides a useful model for other institutions.

AC, Zandifar H, Guyer M, Kellman RM. Day float: an alternative to the night float coverage system for residency programs. Laryngoscope. 2008 Jul;118(7): 1257-9.

The Accreditation Council for Graduate Medical Education (ACGME) has mandated an 80-hour work week that has resulted in changes to many residency programs. In otolaryngology, most programs have switched to either home call or night float systems. Our department covers all of the maxillofacial trauma and backup airway calls, which has made it difficult to employ a home call system. Instead of a night float coverage system, our program implemented a day float coverage system that allows the residents to participate in a 24-hour call period. After call and sign-out, the residents go home; however, their clinical duties are covered by the day float resident. A brief review of the literature pertaining to call coverage systems followed by a description of our day float system. Residents who have participated in either night float, day float, or both systems were then surveyed regarding their experiences or perceptions of both systems. A nine-question survey was handed out to our otolaryngology residents and their responses were recorded.

The averaged responses strongly favored the day float over the night float coverage system regardless of the level of training and the systems in which the residents have participated. **The day float coverage system is favored by residents in our program. It allows for a more attending-like 24-hour period of call, continuity of care, attendance at educational activities, and more time with family. In addition, it eliminates a prolonged period devoid of clinical activities.**

Park J, Tymitz K, Engel AM, Welling RE. Computerized rounding in a community hospital surgery residency program. J Surg Educ. 2007 Nov-Dec;64(6):357-60.

With the institution of the 80-hour work week, residency programs have worked to institute programs that decrease the time that residents spend in the hospital while maintaining patient safety. This study was intended to assess the amount of time saved using computerized patient information in the form of a personal data assistant (PDA). A community hospital surgical residency program with 22 residents initially collected data daily for 4 weeks without PDA use. Data included preround time, check-out time, total number of patients, number of medical/surgical patients, and number of intensive care unit patients. The definition of prerounding time was started when residents first began collecting information on their patients in the morning until 6:00 am. Check-out time started at 5:00 pm and lasted until the discussion of patient care with the night team had finished. Residents were then given PDAs allowing immediate up-to-date access to patient information, which most importantly included current vital signs, laboratory data, radiological dictations, medication lists, and fluid intake and output. After a 4-week acquaintance period with the PDA had passed, data were again collected from the residents daily for 4 weeks. Daily averages for each week and an overall total average were calculated. Daily averages were also calculated for each PGY level. Paired t-tests compared the pre-PDA and post-PDA total averages.

No significant difference was found between the total number of patients pre-PDA and post-PDA (7.6 and 7.6, respectively, $p = 0.98$), the average number of medical/surgical patients (4.7 and 7.1, respectively, $p = 0.16$), or the average number of intensive care unit patients (2.6 and 0.4,

respectively, $p = 0.06$). Also, no significant difference was found between pre-PDA and post-PDA with average check-out time (24.5 minutes and 21.9 minutes, respectively, $p = 0.06$). However, a significant decrease in rounding time occurred with pre-PDA round time at 50.5 minutes and post-PDA round time at 40.7 minutes ($p = 0.02$). Results of this study support the hypothesis that the prerounding time dramatically decreases with the PDA compared to without. Not only does this decrease in time help to keep residents under the 80-hour work week rule, but also it helps to eliminate much of the confusion that can cause patient safety issues.

Arora VM, Georgitis E, Woodruff JN, Humphrey HJ, Meltzer D. Improving sleep hygiene of medical interns: can the sleep, alertness, and fatigue education in residency program help? Arch Intern Med. 2007 Sep 10;167(16):1738-44.

Because of concerns regarding sleep deprivation, the Accreditation Council for Graduate Medical Education limits duty hours and endorses education regarding sleep loss for residents. The authors assessed the effectiveness of a 60- to 90-minute lecture, the Sleep, Alertness, and Fatigue Education in Residency (SAFER) program, on sleep loss and recovery sleep in residents adhering to Accreditation Council for Graduate Medical Education duty hours. From July 1, 2003, through June 24, 2005, interns from the inpatient medicine service at the University of Chicago were asked to wear wristwatch activity monitors. In March 2005, interns received the SAFER program intervention. The authors used fixed-effects linear regression to estimate within-subject mean sleep per call day (on-call, pre-call, post-call, and second-day post-call sleep). These estimates were compared with recommended minimum levels of preventive (7 hours of pre-call) and recovery (16 hours during the 2 days after call) sleep in healthy populations using 2-tailed t tests.

These analyses were repeated to test the effect of the SAFER program. Fifty-eight of 81 interns (72%) participated for 147 intern-months (63%). Interns on call slept an average of 2.84 hours (95% confidence interval, 2.75-2.93 hours). Interns obtained less than recommended amounts of recovery sleep (14.06 hours [95% confidence interval, 13.84-14.28 hours]; $P < .001$). Intern preventive sleep was also less than recommended (6.47 hours [95% confidence interval, 6.39-6.56 hours]; $P < .001$). Interns attempted to compensate for their acute sleep loss; for each hour of on-call sleep loss, they received 18 minutes (95% confidence interval, 7-30 minutes) more recovery sleep ($P = .003$). The SAFER program had no significant beneficial effect on intern sleep. The current duty-hour regulations of the Accreditation Council for Graduate Medical Education, residents continue to be sleep deprived. The SAFER program has no impact on resident pre-call or post-call sleep.

Schneider JR, Coyle JJ, Ryan ER, Bell RH Jr, DaRosa DA. Implementation and evaluation of a new surgical residency model. J Am Coll Surg. 2007 Sep;205(3):393-404.

The Accreditation Council for Graduate Medical Education (ACGME) duty-hour requirements prompted program directors to rethink the organizational structure of their residency programs. Many surgical educators have expressed concerns that duty-hour restrictions would negatively affect quality of resident education. This article summarizes evaluation research results collected to study the impact of our reengineered residency program designed to preserve important educational activities while meeting duty-hour accreditation requirements. The traditional residency structure was redesigned to include a mixture of apprenticeship, small team, and night-float models.

Impact evaluation data were collected using operative case logs, standardized test scores, quality assurance data, resident perception surveys, a faculty survey, and process evaluation measures. PGY1s and PGY2s enjoyed a substantial increase in operative cases. Operative cases increased overall and no resident has failed to meet ACGME volume or distribution requirements. American Board of Surgery In-Training Examination performance improved for PGY1s and PGY2s. Patient

outcomes measures, including monthly mortality and number of and charges for admissions, showed no changes. Anonymously completed rotation evaluation forms showed stable or improved resident perceptions of case load, continuity, operating room teaching, appropriate level of faculty involvement and supervision, encouragement to attend conferences, and general assessment of the learning environment. A quality-of-life survey completed by residents before and after implementation of the new program structure showed substantial improvements. Faculty surveys showed perceived increases in work hours and job dissatisfaction. New physician assistant and nurse positions directly attributed to duty-hour restrictions amounted to about 0.2 full-time equivalents per resident. The study concluded that duty-hour restrictions produce new challenges and might require additional resources but need not cause a deterioration of surgical residents' educational experience.

Lundberg S, Wali S, Thomas P, Cope D. Attaining resident duty hours compliance: the acute care nurse practitioners program at Olive View-UCLA Medical Center. Acad Med. 2006 Dec;81(12):1021-5.

The institution of resident duty hours limits by the Accreditation Council for Graduate Medical Education (ACGME) has made it difficult for some programs to cover inpatient teaching services. The medical literature is replete with editorials criticizing the hour limits and the resulting problems but is nearly silent on the topic of constructive solutions to compliance. In this article, the authors describe a new program, initiated in 2003 at the Olive View-UCLA Medical Center, of using acute care nurse practitioners to allow for compliance with the "24 + 6" continuous duty hours limit, as well as the 80-hour workweek limit.

Each post-call team is assigned a nurse practitioner for the day, allowing residents to sign out by 2 pm while ensuring quality care for patients. Nurse practitioners participate in evaluation of residents and, in turn, are evaluated by them. Using this system, the authors report 99% compliance with ACGME work-hour restrictions, with average work hours for inpatient ward residents decreasing from 84 to 76 hours per week. Physician satisfaction with the new system is high; anonymous evaluation by residents and faculty returned average scores of 8.8 out of 9 possible points. The authors report that using nurse practitioners on post-call days provides excellent, continuous patient care without impinging on scheduling and without sacrificing responsibility, continuity, or education for the residents. This system has several potential advantages over previously described work-hour solutions. Addition of a nurse practitioner to the post-call team is an effective solution to the problem of compliance with resident duty hour limitations.

Wallach SL, Alam K, Diaz N, Shine D. How do internal medicine residency programs evaluate their resident float experiences? South Med J. 2006 Sep;99(9):913.

We surveyed the nation's internal medicine residency training program directors to determine the range and frequency of existing methods by which float experiences are evaluated. The authors sent questionnaires to the program directors of all 396 internal medicine residency training program sites in the country. Information requested included program characteristics, months devoted to float experiences in each year of training, and the location and purpose of the rotation. Program directors were also asked to choose among descriptors characterizing the evaluative process.

There were 139 responding programs (39%), 134 with data that could be aggregated. Responding programs were similar to all programs nationally in the distributions of size and university sponsorship. **Overall, 76% of programs employed a night float for any period of time, and 71% currently had one, on average for 6.7 years. Mean months of float experience during residency was 2.4 months, significantly longer in programs that were not university based. Float experiences were evaluated in**

89% of those programs who employed them, with ten different methods reported. University-based programs were significantly less likely to use chart review as a method of evaluation, but no other differences in methodology were significant. Float rotations are common among internal medicine residency training programs. Evaluative methods vary, but one or more are applied in the vast majority of programs.

Asad M, Shah AK, Ehrlich F. Electronic submission of resident work hours: a convenient way of exchange of information. Am Surg. 2006 Aug;72(8):735-8.

The purpose of this protocol is to assess how residents can document their work hours in a convenient and objective way; to find an efficient, secure, quick, and reproducible way of communication between house staff and residency administrators regarding work hours data; and to fulfill the requirements of the Accreditation Council for Graduate Medical Education and other monitoring bodies regarding work hours documentation. This electronic work hour submission protocol is based on the Microsoft Excel system. The data is submitted via e-mail to the residency coordinators. The work hour sheet recognizes the time spent by the residents in various categories such as patient care, off hours, off days, vacations, outpatient clinic time, on-site rest time, and education time. Calculations are done automatically in the work sheet and results are shown graphically. **The authors found electronic submission of work hours as a more convenient, secure, objective, efficient, and reproducible way of communication than the paper submission forms.** Each resident can now easily be tracked for the time he/she spends in various categories. The data will be used to assess how more efficiently residents can spend their time. It also fulfills the documentation requirements of different monitoring bodies.

Mahmoud A, Andrus CH, Matolo NM, Ward CC. Directed postgraduate study result in quantitative improvement in American Board of Surgery In-Training Exam scores. Am J Surg. 2006 Jun;191(6):812-6.

The collective study habits of 1 group of residents involved in educationally distinct periods of time in a community-based general surgery residency program were evaluated. American Board of Surgery In-Training Exam (ABSITE) score results of 31 residents were calculated during 3 distinctive educational time periods: resident independent, self-directed study; resident-directed study with weekly systematic textbook reviews; and faculty-directed study with additional formal basic science and clinical lectures. Aggregate higher scores were observed when ABSITE results for the directed study period were compared with those observed during the independent study period in mid-level resident years (postgraduate year [PGY] 2 to 4). With limited faculty resources, community-based surgery residency programs have more challenges in opportunities for resident acquisition of cognitive knowledge and subsequent quantitative improvement in ABSITE scores. This study demonstrated a successful methodology particularly in the face of mandated limitation of weekly resident work hours and diminishing allocated education resources.

Day TE, Napoli JT, Kuo PC. Scheduling the resident 80-hour work week: an operations research algorithm. Curr Surg. 2006 Mar-Apr;63(2):136-41; discussion 141-2.

The resident 80-hour work week requires that programs now schedule duty hours. Typically, scheduling is performed in an empirical "trial-and-error" fashion. However, this is a classic "scheduling" problem from the field of operations research (OR). It is similar to scheduling issues that airlines must face with pilots and planes routing through various airports at various times. The authors hypothesized that an OR approach using iterative computer algorithms could provide a rational scheduling solution. Institution-specific constraints of the residency problem were formulated. A total of 56 residents are rotating through 4 hospitals. Additional constraints were dictated by the Residency Review Committee (RRC) rules or the

specific surgical service. For example, at Hospital 1, during the weekday hours between 6 am and 6 pm, there will be a PGY4 or PGY5 and a PGY2 or PGY3 on-duty to cover Service "A." **A series of equations and logic statements was generated to satisfy all constraints and requirements. These were restated in the Optimization Programming Language used by the ILOG software suite for solving mixed integer programming problems. An integer programming solution was generated to this resource-constrained assignment problem. A total of 30,900 variables and 12,443 constraints were required. A total of man-hours of programming were used; computer run-time was 25.9 hours. A weekly schedule was generated for each resident that satisfied the RRC regulations while fulfilling all stated surgical service requirements. Each required between 64 and 80 weekly resident duty hours.** The authors conclude that OR is a viable approach to schedule resident work hours. This technique is sufficiently robust to accommodate changes in resident numbers, service requirements, and service and hospital rotations.

Kendrick AS, Ciraulo DL, Radeker TS, Lewis PL, Richart CM, Maxwell RA, Barker DE, Smith PW. Trauma nurse specialists' performance of advanced skills positively impacts surgical residency time constraints. Am Surg. 2006 Mar;72(3):224-7.

The Accreditation Council for Graduate Medical Education imposed 80-hour work week constraints on residency programs in July 2003. Certain programs were granted an additional 10 per cent for specific educational purposes, bringing restrictions to 88 hours per week. The increased demand for residents to leave the hospital has placed teaching institutions in exhaustive situations to provide comprehensive patient care. In response to the work hour constraints among residents and emergency room staff, a unique group of registered nurses, trauma nurse specialists (TNSs), were credentialed with advanced practice skill sets. Governed by practice guidelines and overseen by a medical director, TNSs perform invasive procedures that are normally the responsibility of the surgical resident. The purpose of this study was to evaluate work hours saved for surgery residents using credentialed nurses (TNSs). Procedure logs were maintained by the TNSs over a 6-month period, and surgical house staff (postgraduate year 1-3) over a 4-month period. A total of 423 procedures were recorded, reflecting time taken for attempted/completed procedures and complications. Resident procedures numbered 98; TNS procedures numbered 325. TNSs spent an average of 42 hours per month (10.6 hours per week) completing advanced procedures with no statistical difference in time or complications compared with surgical residents. By using the TNSs, work hours for surgery residents were saved while maintaining a safe and reliable work atmosphere for patients.

Roey S. Medical education and the ACGME duty hour requirements: assessing the effect of a day float system on educational activities. Teach Learn Med. 2006 Winter;18(1):28-34.

In July 2003, the Accreditation Council for Graduate Medical Education (ACGME) instituted new resident work hour mandates, which are being shown to improve resident well-being and patient safety. However, there are limited data on the impact these new mandates may have on educational activities. To assess the impact on educational activities of a day float system created to meet ACGME work hour mandates. The inpatient ward coverage was changed by adding a day float team responsible for new patient admissions in the morning, with the on-call teams starting later and being responsible for new patient admissions thereafter. I surveyed the residents to assess the impact of this new system on educational activities-resident autonomy, attending teaching, conference attendance, resident teaching, self-directed learning, and ability to complete patient care responsibilities.

There was no adverse effect of the day float system on educational activities. House staff reported increased autonomy, enhanced teaching from attending physicians, and improved ability to complete patient care responsibilities. Additionally, house staff demonstrated improved compliance with the ACGME mandates. The implementation of a novel day float system for the inpatient medicine

ward service improved compliance with ACGME work duty requirements and did not adversely impact educational activities of the residency training program.

Afessa B, Kennedy CC, Klarich KW, Aksamit TR, Kolars JC, Hubmayr RD. Introduction of a 14-hour work shift model for housestaff in the medical ICU. Chest. 2005 Dec;128(6):3910-5.

To describe the outcomes of switching residents from a traditional model of "long-call" every 4 days to a 14-h work-shift model in a medical ICU (MICU) over a 5-week pilot period. DESIGN: Retrospective comparison of a 5-week pilot period for a 14-h work-shift model vs. a 4-month period for the traditional model. The study assessed 626 patients admitted to the MICU and 34 internal medicine residents taking care of them. **Severity-adjusted patient outcomes, resident performance on end-of-rotation examinations, and scheduled duty hours during the 5-week 14-h work-shift pilot period compared to a 16-week traditional nonpilot work period. There were no statistically significant differences in patients' adjusted mortality rates, hospital lengths of stay, or resident performance on end-of-rotation knowledge assessment examinations between the pilot and nonpilot periods. During the pilot period, each resident was scheduled to work for an average of 61.3 h weekly, and each fellow for 65.3 h weekly. In comparison, each resident and fellow was scheduled to work for an average of 73.3 h weekly during the nonpilot period. The 14-h work shift is a feasible option for resident rotation in the MICU. Although the power of the authors' study to detect significant differences in mortality, length of stay, and educational outcomes was low, there was no evidence of compromised patient care or resident education associated with the 14-h shift model over the course of this 5-week pilot study.**

Schenarts P, Bowen J, Bard M, Sagraves S, Toschlog E, Goettler C, Cromwell S, Rotondo M. The effect of a rotating night-float coverage scheme on preventable and potentially preventable morbidity at a level 1 trauma center. Am J Surg. 2005 Jul;190(1):147-52.

The effect of resident work-hour restriction on patient outcome remains controversial. Demographic data, mechanism of injury, length of hospital stay length of intensive care unit (ICU) stay, ventilator days, mortality, and complication data were prospectively collected for 11 months before and 11 months after institution of a rotating night-float system. Seven attending surgeons reviewed all complications and categorized each as preventable, potentially preventable, or nonpreventable. **Both study periods were comparable with respect to demographic data, mean Injury Severity Score, mechanism of injury, and admissions. Limitation of resident work hours had no effect on length of hospital or ICU stay, ventilator days, or mortality. Work-hour restrictions did not increase or decrease the total number of complications nor did it alter the distribution of those determined to be preventable or potentially preventable. Resident work-hour restrictions were not associated with significant improvement or deterioration in patient outcome.**

Lefrak S, Miller S, Schirmer B, Sanfey H. The night float system: ensuring educational benefit. Am J Surg. 2005 Jun;189(6):639-42.

The authors assessed whether taking a block of night call would provide an opportunity for residents to improve clinical decision-making without detracting from operative experience. The educational benefit of the Night Float model was evaluated weekly by anonymous questionnaires that assessed resident conference attendance, operative experience, attending teaching interactions, and consultations for the previous seven days.

Preliminary results demonstrated that a higher percentage of Night Float residents reported less exposure to each educational opportunity than their colleagues. These data prompted several

remedial interventions that resulted in significant improvement. Compliance with the 80-hour workweek was equal for both groups. The Night Float model has the advantage of fulfilling ACGME requirements, but it also has the potential to limit educational experience. The authors concluded that continued monitoring and faculty intervention are critical.

Rogers F, Shackford S, Daniel S, Crookes B, Sartorelli K, Charash W, Igeneri P. Workload redistribution: a new approach to the 80-hour workweek. J Trauma. 2005 May;58(5):911-4.

The authors assessed the effect of the duty hour limits on busy trauma services. Beginning in July 2003, the authors Level I trauma service began a policy of direct admission of isolated neurosurgical or orthopedic injuries to the specific subspecialty service after complete evaluation by the trauma service in the emergency department for associated injuries. Complications, missed injuries, delayed diagnoses, and admission rates were compared in two 6-month periods: PRE, before the policy change; and POST, after the new policy had been instituted. Resident work hours were likewise compared over the two time periods.

Selected single-system injury admission to subspecialty services resulted in a 15% reduction in admissions to the trauma service. There were no significant differences in the overall complication rate, delayed diagnoses, or missed diagnoses between the PRE and POST time periods. Overall, there was a 9.7% reduction in resident work hours ($p = 0.45$; analysis of variance) between the PRE and POST periods, which allowed them, on average, to meet the Accreditation Council for Graduate Medical Education 80-hour workweek mandate. Direct admission of patients with isolated injuries to subspecialty services is safe and decreases the workload of residents on busy trauma services.

Van Eaton EG, Horvath KD, Lober WB, Rossini AJ, Pellegrini CA. A randomized, controlled trial evaluating the impact of a computerized rounding and sign-out system on continuity of care and resident work hours. J Am Coll Surg. 2005 Apr;200(4):538-45.

Adoption of limits on resident work hours prompted the authors to develop a centralized, Web-based computerized rounding and sign-out system (UWCores) that securely stores sign-out information; automatically downloads patient data (vital signs, laboratories); and prints them to rounding, sign-out, and progress note templates. The study tested the hypothesis that this tool would positively impact continuity of care and resident workflow by improving team communication involving patient handovers and streamlining inefficiencies, such as hand-copying patient data during work before rounds ("prerounds"). Fourteen inpatient resident teams (6 general surgery, 8 internal medicine) at two teaching hospitals participated in a 5-month, prospective, randomized, crossover study. Data collected included number of patients missed on resident rounds, subjective continuity of care quality and workflow efficiency with and without UWCores, and daily self-reported prerounding and rounding times and tasks. **UWCores halved the number of patients missed on resident rounds (2.5 versus 5 patients/team/month, $p = 0.0001$); residents spent 40% more of their prerounds time seeing patients ($p = 0.36$); residents reported better sign-out quality (69.6% agree or strongly agree); and improved continuity of care (66.1% agree or strongly agree). UWCores halved the portion of prerounding time spent hand-copying basic data ($p < 0.0001$); it shortened team rounds by 1.5 minutes/patient ($p = 0.0006$); and residents reported finishing their work sooner using UWCores (82.1% agree or strongly agree).**

This system enhances patient care by decreasing patients missed on resident rounds and improving resident-reported quality of sign-out and continuity of care. It decreases by up to 3 hours per week

(range 1.5 to 3) the time used by residents to complete rounds; it diverts prerounding time from recopying data to more productive tasks; and it facilitates meeting the 80-hour work week requirement by helping residents finish their work sooner.

Goldstein MJ, Samstein B, Ude A, Widmann WD, Hardy MA. Work Hours Assessment and Monitoring Initiative (WHAMI) under resident direction: A strategy for working within limitations. Curr Surg. 2005 Jan-Feb;62(1):132-7.

A review of surgical residents' duty-hours prompted a Work Hours Assessment and Monitoring Initiative (WHAMI) that preemptively limits residents from violating "duty-hours rules.": An ongoing review of work hours data for the Department of Surgery were reviewed over eight-months at New York Presbyterian Hospital-Columbia Campus was performed by a work-hours monitoring team, which supervises residents' hours for the initial five days of each week. As residents approach work-hours limits for the week, they are dismissed from duty for appropriate time periods in the remaining two days of the week. The work-hours data entry compliance for 52 residents was increased from 93% to 99% after creation of the WHAMI. Before the new system, a mean of 9.5 residents per month (19%) worked an average of 7.3 +/- 6.4 hours over the 80-hour limit. Averaged monthly compliance with the 80-hour work limit was increased to 98% with introduction of the WHAMI. A review of on-call duty hours revealed a mean of 7 (14%) residents per month who worked an average of 2.4 hours beyond 24-hour call limitations including "sign-out" time imposed by the ACGME. New monitoring procedures have improved compliance to 100% with 24-hour call limitations imposed by the ACGME. Compliance with the more stringent New York State (NYS) guidelines has approached 94% with noncompliant residents extending on-call hours by an average of 1.5 hours over the 24-hour limitations, most on "off General Surgery" rotations or out-of-state rotations. Review of mandatory rest periods contributed to an increase in mean "time off" between work periods, thereby increasing compliance with ACGME guidelines and NYS regulations from 75% to 88%, and 90% to 98%, respectively. Residents reporting less than ten hours rest reported increased "time off" from 6.2 +/- 2.0 to 7.9 +/- 1.3 hours ($p < 0.001$). **Internal review of surgical resident's duty-hours at a large university hospital revealed that despite strict scheduling and the requirement of mandatory duty-hours entry, achieving the goals of meeting the duty-hours requirements and of ongoing data entry required the creation of a resident enforced, real-time Work Hours Assessment and Monitoring Initiative.**

Fletcher KE, Saint S, Mangrulkar RS. Balancing continuity of care with residents' limited work hours: defining the implications. Acad Med. 2005 Jan;80(1):39-43.

The impact of the new resident work-hours rules on all aspects of patient care and education must be considered. While physician fatigue has taken center stage as the primary motivation behind this movement, the effect of these rules on the continuity of care for hospitalized patients needs to be critically analyzed from the perspectives of patients, physicians, and the health care system. The authors describe a conceptual framework that places continuity at the center and then considers the benefits and drawbacks of preserving continuity from the perspectives of the major stakeholders. They describe the categories of outcomes related to residents' fatigue and sleep deprivation that have been studied. **Only a few studies have addressed patient outcomes, while most address resident outcomes. The authors discuss some of the possible solutions, including night float and the British system of shift work, and suggest that these solutions have different effects on each group of stakeholders, including both intended and unintended benefits and harms. Finally, the research agenda that arises from this framework is described. It includes taking into account multiple perspectives, identifying important outcomes, and considering unintended consequences. Using this framework, medical educators may better evaluate previous studies and consider remaining questions.**

Mathur M, Rampersad A, Howard K, Goldman GM. Physician assistants as physician extenders in the pediatric intensive care unit setting-A 5-year experience. *Pediatr Crit Care Med.* 2005 Jan; 6(1):14-9.

The authors sought to describe the scope of practice and complementary role of physician assistants as physician extenders in the pediatric intensive care unit. Descriptive report of a 5-yr experience using a physician assistant-resident staffing model in comparison to the traditional resident-only coverage, in the six-bed pediatric intensive care unit at a tertiary care center subject to longstanding New York Hospital Code 405 restrictions on resident work hours. Interventions included orientation, training, credentialing, and evaluation of physician assistants. Physician assistants were oriented for a period of six months to one yr to develop skill competencies, observe and learn pediatric intensive care unit practices and procedures, and complete credentialing to perform traditionally physician, nursing, and respiratory therapist functions. Physician assistants were then assigned to an independent but supervised patient care role similar to that of a resident physician. The impact of the physician assistant program was assessed by the attending physicians, and resident opinions were surveyed. **Physician assistants play a complementary role as physician extenders in the pediatric intensive care unit, enabling compliance with New York state and Accreditation Council for Graduate Medical Education resident work hour regulations. Physician assistants perform similar tasks and activities as the pediatric intensive care unit residents and integrate well with them in enhancing bedside patient care. Over time, physician assistants provide additional direction to the residents by virtue of their familiarity with unit-specific policies and procedures and repetitive pediatric intensive care unit practice patterns. The physician assistant serves as a key member of the pediatric intensive care unit transport team. Limitations observed include high job turnover rates among the physician assistants and confusion between their role as shift workers or professional employees.**

Dwight P, MacArthur C, Friedman JN, Parkin PC. Evaluation of a staff-only hospitalist system in a tertiary care, academic children's hospital. *Pediatrics.* 2004 Dec;114(6):1545-9.

The staff/house staff hospitalist system has been evaluated in two pediatric centers in the United States. In Canada, fewer residents and duty hour restrictions led to the development of a staff-only hospitalist system. The objective of this study was to compare the staff-only pediatric hospitalist system and the staff/house staff hospitalist system with respect to traditional outcome measures. DESIGN: This cohort study (staff-only hospitalist system versus staff/house staff system) used electronic health records data (July 1, 1996, to June 30, 1997) for all admissions (n = 3807) to the general pediatric inpatient unit of an urban, tertiary care, pediatric, teaching hospital in Toronto, Canada. Outcome measures included length of hospital stay, subspecialty consultations, readmission to the hospital, and death during the hospital stay.

The median length of hospital stay was reduced by 14% for patients admitted to the staff-only hospitalist system, compared with the staff/house staff hospitalist system (2.5 and 2.9 days, respectively). This difference remained statistically significant after adjustment for age, gender, and comorbidity. There were no significant differences between the two models of care with respect to subspecialty consultation, hospital readmission, or mortality rates. A stratified analysis showed similar findings for the 10 most frequent diagnostic groups. **The staff-only hospitalist system was associated with a significant reduction in the hospital length of stay, without evidence of adverse effects on mortality or readmission rates, compared with the staff/hospitalist system. In the context of recent restrictions on resident duty hours in the United States, these findings may be of interest to pediatric teaching hospitals considering the development of a similar staff-only hospitalist model.**

Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, Lilly CM, Stone PH, Lockley SW, Bates DW, Czeisler CA. Effect of reducing interns' work hours on serious medical errors in intensive care units. N Engl J Med. 2004 Oct 28;351(18):1838-48.

See summary on page 77.

Lockley SW, Cronin JW, Evans EE, Cade BE, Lee CJ, Landrigan CP, Rothschild JM, Katz JT, Lilly CM, Stone PH, Aeschbach D, Czeisler CA. Effect of reducing interns' weekly work hours on sleep and attentional failures. N Engl J Med. 2004 Oct 28;351(18):1829-37.

See summary on page 77.

Goldstein MJ, Kim E, Widmann WD, Hardy MA. A 360 degrees evaluation of a night-float system for general surgery: a response to mandated work-hours reduction. Curr Surg. 2004 Sep-Oct;61(5):445-51.

New York State Code 405 and societal/political pressure have led the RRC and ACGME to mandate strict limitations on resident work hours. In an attempt to meet these limitations, the authors have switched from the previous Q3 call schedule to a specialized night float (NF) system, the continuity-care system (CCS). The purpose of this CCS is to maximize resident duty time spent on direct patient care, operative experience, and outpatient clinics, while reducing duty hours spent on performing routine tasks and call coverage. The implementation of the CCS is the fundamental step in the restructuring of the residency program. In addition to a change in the call system, the authors added physician assistants to aid in performing some service tasks. The authors performed a 360 degrees evaluation of this work in progress.

In May 2002, the standard Q3 call system was abolished on the general surgery services at the New York Presbyterian Hospital, Columbia campus. Two dedicated teams were created to provide day and night coverage, a day continuity-care team (DCT) and a night continuity-care team (NCT). This system creates a schedule with less than 80 duty hours per week, on average, with one 24-hour period off a week, one complete weekend off per month, and no more than 24 hours of consecutive duty time. After one year of use, the system was evaluated by a 360 degrees method in which residents, residents' spouses, nurses, and faculty were surveyed using a Likert-type scale. Statistical significance was calculated using the Student t-test. Patient satisfaction was measured both by internal review of a patient complaint database as well as by the Press Ganey patient satisfaction surveys.

Twenty-one residents, 10 residents' spouses, 11 general surgery faculty, and 16 nurses were surveyed. Statistically significant findings included reduced resident fatigue noted by all groups (residents, $p = 0.01$; resident spouses, $p = 0.05$; faculty, $p < 0.0001$; nurses, $p < 0.0001$). Further, residents reported more time for sleep at home ($p = 0.0005$) and more time for independent reading ($p = 0.01$). Residents' spouses reported increased availability for family events ($p = 0.01$). Nurses reported increased availability of residents ($p = 0.0002$), shorter times to physician identification of patient problems ($p = 0.0086$), improved resident-nursing communications ($p = 0.0096$), and increased ease of nursing duties ($p < 0.0001$). Faculty were the only responders who felt that continuity of patient care suffered with the new system ($p = 0.02$). The Press Ganey review showed improvement in the quality of care rendered as perceived by patients. **The institution of a specialized NF or CCS for in-house coverage of general surgical services in a large metropolitan university hospital has had initial success in meeting the mandated changes in resident work hours. The CCS reduced resident fatigue, improved quality of resident life, and improved patient care as judged by patients and nurse.**

Cockerham WT, Cofer JB, Lewis PL, Scroggins CM, Burns RP. Resident work hours: can we meet the ACGME requirements? Am Surg. 2004 Aug;70(8):687-90.

The Accreditation Council for Graduate Medical Education (ACGME) requires all programs to limit resident work hours to 80 hours per week with some programs allotted an extra 10 per cent for specific educational purposes. The purpose of this study was to evaluate data reflecting changes in resident schedules made in 2002-2003 to be compliant with ACGME requirements without compromising patient care or resident education. Surgery residents originally completed a work-hour survey in May 2002. The survey contained 14 daily time sheets. Residents were asked to document how their time was spent between 14 different categories delineating in-house and out-of-house hours. Changes were made to resident schedules in order to become compliant with the new regulations. After making changes in the schedule, two more surveys were completed and evaluated, once in May 2003 and again in November 2003. Final analyses compared results from May 2002 to November 2003. Surveys were distributed to 30 residents in May 2002. Twenty-two residents completed the survey, with 16 surveys eligible for analysis following exclusion of abnormal rotations (i.e., research and vacation). **Eighty-eight per cent of junior residents (PGY 1, 2, and 3), 50 per cent of senior residents (PGY 4-5), and 33 per cent of chief residents (PGY 6) worked more than 88 hours per week. In November 2003, surveys were sent to 32 residents. Twenty-four residents who were on a normal call schedule completed the survey. Fourteen per cent of junior residents, 33 per cent of senior residents, and 0 per cent of chief residents worked more than 88 hours per week. By making the changes described, the authors noted they substantially reduced the number of resident work-hours while maintaining the academic and patient care missions.**

Kuo AK, Ma CT, Kamei RK. Evening continuity clinic: preserving primary care education in the face of duty hour limitations? *Ambul Pediatr.* 2004 Jul-Aug;4(4):332-5.

Residency programs with post-call afternoon continuity clinics violate the new Accreditation Council for Graduate Medical Education (ACGME) limitations on resident duty hours. The authors evaluated house staff experience with a pilot intervention that replaced post-call continuity clinics with evening continuity clinics. The authors began this pilot program at one continuity clinic site for pediatric residents. Instead of post-call clinics, residents had evening continuity clinic added to a regular clinic day when they were neither post-call nor on call. At 5 and 11 months, the authors surveyed house staff satisfaction and experience with the evening clinics, particularly in comparison to post-call clinics. Nineteen of 23 pediatric residents participated in the pilot program. Twenty-two and 17 residents completed the 5- and 11-month follow-up surveys, respectively. **A significantly greater proportion of residents rated their overall satisfaction with evening clinic as good/outstanding (16/18, 89%) compared with post-call clinic (2/19, 11%) at the five-month survey ($P < .01$). Resident preference for evening clinic over post-call clinic persisted but was not statistically significant at 11 months ($P = .05$), and overall satisfaction with evening clinic was unchanged from the 5- and 11-month surveys ($P = .64$). All areas of patient care, medical education, and clinic infrastructure were better or equal in evening clinic in comparison to post-call clinic except for continuity of preceptors and access to medical services. House staff had greater satisfaction and a better clinic experience with evening clinic versus post-call clinic.** Evening continuity clinic is a viable solution to meeting the ACGME work hour limitations while preserving house staff primary care education.

Kamei RK, Chen HC, Loeser H. Residency is not a race: our ten-year experience with a flexible schedule residency training option. *Acad Med.* 2004 May;79(5):447-52.

To evaluate the Flexible Option (FO), a residency training schedule offered by the University of California, San Francisco, Pediatric Residency Program. In 2002, structured telephone interviews were conducted with residents who participated in the FO between 1992 and 2002. Twenty-four of the 284 pediatrics residents during this time participated in the FO. Descriptive interview data were analyzed. A Web-based questionnaire was sent to 72 regularly scheduled (RS) residents at the end of 2001-02. FO and

RS residents' specialty board performances were compared. Twenty-one FO residents participated in the telephone interviews. The majority reported that the FO was critical to their success as residents. Most requested the FO for personal and family reasons; over 40% would otherwise have requested leaves from the residency. **The most common perceived disadvantages were delay in graduation and financial concerns. Forty-two RS residents completed the online questionnaire. Seventeen percent considered the FO an important factor in program selection; 43% had considered participating in the FO. Seventy-nine percent felt that the FO had a positive effect on the general morale of the program. RS residents perceived that the FO increased workload (43%) and created scheduling problems (52%). However, 88% of RS residents encouraged the program to continue offering the FO.** Specialty board scores were similar across FO and RS residents. Participants perceived that the FO's advantages outweighed the disadvantages. There were no concerning academic disadvantages identified in FO participants. Wide-spread support was found throughout the residency program to sustain the FO. More residency programs should consider creating and offering flexible scheduling options.

Wong JG, Holmboe ES, Huot SJ. Teaching and learning in an 80-hour work week: a novel day-float rotation for medical residents. Gen Intern Med. 2004 May;19(5 Pt 2):519-23.

The 80-hour workweek limit for residents provides an opportunity for residency directors to creatively innovate their programs. The authors' novel day-float rotation augmented both the educational structure within the inpatient team setting and the ability for house staff to complete their work within the mandated limits. **Descriptive evaluation of the rotation was performed through an end-of-rotation questionnaire. The average length of the ward residents' work week was quantified before and after the rotation's implementation. Educational portfolios and mentored peer-teaching opportunities enriched the rotation. As measured by the authors' evaluation, this new rotation enhanced learning and patient care while reducing work hours for inpatient ward residents.**

Victorino GP, Organ CH Jr. Physician assistant influence on surgery residents. Arch Surg. 2003 Sep;138(9):971-5; discussion 975-6.

The authors hypothesized that physician assistants (PAs) will decrease surgery resident work hours and improve resident work outlook. The authors surveyed surgical residents in a county hospital in a university-based surgical residency program. Surgery residents who switched (or "rotated") to the county hospital were polled monthly for 6 months after using PAs as team members on the surgical services. Outcome measures included resident work hours and work outlook.

Surgery resident hours were significantly decreased by the fourth, fifth, and sixth months after PAs joined the surgical services. Despite what these data on resident hours suggest, 6 (60%) of 10 residents believed that the PAs had no influence on the amount of time the residents spend in the hospital. Six (60%) of 10 residents thought the PAs decreased stress levels and 6 (60%) of 10 residents thought the PAs helped to improve morale. The authors found that physician assistants can have a positive influence on graduate surgical education programs. Physician assistants can help decrease surgery resident work hours and improve resident work outlook.

Mendoza KA, Mendoza B, Britt LD. A template for change and response to work hour restrictions. Am J Surg. 2003 Aug;186(2):89-96.

Surgical program directors are seeking how to best meet the work hour restrictions recently mandated by the American College of Graduate Medical Education. Implementation of an 80-hour work week forces major change to graduate medical education, especially surgical education. Creative restructuring of surgical training is necessary to ensure compliance. Developing an innovative solution to meet these requirements must consider programmatic needs, requiring commitment to a change process. **The Department of Surgery at Eastern Virginia Medical School experienced a five-month strategic**

planning process that generated the Mendoza plan. This plan uses an every third night call model and a night float model to meet site-specific needs. The specifics of the Mendoza plan protect the cornerstone of surgical education, which is continuity of patient care and resident education. The Mendoza plan, and the process leading to its development, may provide insightful information for other surgical residency programs planning to meet work hour guidelines.

Cavallo A, Ris MD, Succop P. The night float paradigm to decrease sleep deprivation: good solution or a new problem? *Ergonomics*. 2003 Jun 10;46(7):653-63.

In the late 1980s physician residency training programs developed the night float rotation, characterized by a sequence of 5 - 15 days of night work without any daytime duties, thereby involving an abrupt reversal of the wake – sleep schedule. The authors examined the effect of the night float rotation on sleep, mood and performance of pediatric residents. Residents completed sleep diaries daily, and tests of mood (Profile of Mood States) and attention (Conner's Continuous Performance Test) three times a week during the two-week night float rotation, and during equivalent blocks of time of their daytime rotations.

Results show that, despite having ample opportunity to sleep during the day, while on night float rotation residents slept less than during the nights of their normal daytime rotations, 6.3 h +/- 2.5 h and 7.2 h +/- 1.7 h, respectively, $p < 0.0001$. **Also, during night float compared to daytime rotations residents had increased fatigue-inertia scores, 8.7 +/- 4.1 and 4.8 +/- 2.4, respectively, $p < 0.0001$, and decreased vigor-activity scores 10.7 +/- 5.4 and 14.8 +/- 5.3, respectively, $p = 0.02$. The scores for attention were not significantly different between night float and daytime rotations. The correlation coefficients of fatigue with measures of attention were not statistically significant for daytime rotations. However, for night float fatigue correlated with omission errors, $r = 0.51$, $p = 0.001$ and with attentiveness $r = - 0.36$, $p = 0.03$.** Training programs that adopt the night float rotation must be aware of potential deleterious effects of the night float rotation as they may lead to serious consequences on residents' performance and patients' safety.

Darosa DA, Bell RH Jr, Dunnington GL. Residency program models, implications, and evaluation: results of a think tank consortium on resident work hours. *Surgery*. 2003 Jan;133(1):13-23.

The authors sought to develop practical schemes of resident rotations that program directors could adopt to their local environment to meet the 80-hour workweek while at the same time maintaining or hopefully enhancing resident education. Four models emerged from a think tank at Northwestern University Hospital: the Stretch Model, the Night Float Model, the Apprentice Model and the Mastery or Case-Based Model. Current practice is assumed to be hospital-based teams of residents who work with multiple attendings on a service and who take night call on a regular schedule, typically every third night.

In the *Stretch Model*, residents take call every fourth night (or less frequently) and leave early the next morning after call (although up to six hours are allowed for transition of care). This reduces the number of work hours in the week. The stretch model is probably the easiest way to get to an 80-hour week, but it has no real educational advantages other than shortening the work week and presumably giving residents more time to read. The *Night Float Model* consists of a traditional resident team system, except that a percentage of the program's total residents are designated to work a permanent night shift, usually for a month at a time (in most programs, residents will be on night float two to three months per year). Several teams would work the day shift, that includes a one hour overlap with the night team allowing for a robust "sign-out." Teams working during the day would leave in the evening and take no in-house night call. There is again an overlap hour in the evening for "sign-out." The "night float" team would work a night shift six days per week, although larger programs may be able to have a five nights per week schedule.

The *Apprentice Model* involves one resident working exclusively with one or two faculty members over one to three months. Residents work side-by-side with their assigned mentors in the operating room and

outpatient office, and take home call when their mentor is on call. Residents are involved only in the care of their mentors' patients. Faculty members would need to be selected carefully based on dedication to education and an appropriate practice profile. This model lends itself particularly well to certain subspecialty areas like colorectal surgery or breast surgery but can be used for general surgery rotations as well. Because apprentices take no regular in house night call, it is usually possible to construct a work week that is less than 80 hours long, even if the resident has to come in at night once or twice a week. In the *Mastery (Case-Based) Model*, patient cases are assigned to residents based on the residents' learning needs irrespective of attending or team assignments. Proficiency, knowledge and skills associated with diseases and operations are measured by personal progress, not by time. Proficiency is verified through formal assessment, and then residents are allowed to move on to other areas, and are not required to scrub on operations they have mastered unless they feel the need to refresh their knowledge. Participating residents would meet each week to receive their final patient/attending assignments for the coming week. Residents are responsible for making arrangements to review the cases with the appropriate attending. Residents round on their own patients in the morning and go to the clinic or operating room depending on their assignments for that week. They do not necessarily take regular night call, but could take call from home. Either in-house or home call can work with the model. Residents would follow all of their assigned/operated patients, irrespective of attending or service. There would be an outpatient clinic block, which would probably have to be attending-based, since it would be difficult for residents to follow-up on their patients in multiple ambulatory offices. Learning expectations are made clear at the start and are mastery-based, but broken down by years for planning purposes. The authors also discussed the advantages and disadvantages of each model.

Hassett JM, Nawotniak R, Cummiskey D, Berger R, Posner A, Seibel R, Hoover E. Maintaining outcomes in a surgical residency while complying with resident working hour regulations. *Surgery*. 2002 Oct;132(4):635-9; discussion 639-41.

Regulatory requirements for resident working hours were designed to improve patient care. Compliance challenges a training program to meet procedural and clinical requirements. This is a retrospective study of a 5-year experience in addressing the challenges and studying the impact of compliance on resident caseload and board performance. **The surgical program at SUNY Buffalo adopted strict start/stop working hours for clinical contact. Program leadership modified the program to establish procedural and performance criteria. Procedures were prioritized and assignments were changed to maximize clinical and procedural experience while reducing redundancy of experience. Procedural activity was monitored frequently. Compliance with working hour regulations was monitored and behavior modified where necessary. A web based computer program was developed to improve measurement of compliance and provide feedback. Outcome measures included both the number of procedures as reported by the ACGME and performance on the American Board of Surgery, Qualifying Examination.**

As a result, working hour compliance was greater than 95%. First time pass rate on the Qualifying examination was 90% (45/50). There is no significant difference in the procedural activity. The authors concluded that complying with working hour regulations improves the quality of a resident's life and can be achieved while maintaining procedural experience and guaranteeing academic development.

Cavallo A, Jaskiewicz J, Ris MD. Impact of night-float rotation on sleep, mood, and alertness: the resident's perception. *Chronobiol Int*. 2002 Sep;19(5):893-902.

Night-float rotations were designed to alleviate the workload of residents on night call and thereby improve patient safety. However, the impact of the night float on residents is yet to be surveyed. The authors assessed the impact of the night-float rotation on pediatric residents using an anonymous questionnaire that covered topics, based on recall, about sleep, mood, alertness, adjustment, and others.

The study was conducted in a major tertiary pediatric teaching hospital in the United States. Participants were pediatric residents who had completed one or two night-float rotations. Fifty-two of 60 eligible residents (87%) responded. **Sleep duration during the night-float rotation was shorter than during day-shift work in 24 residents (46%), longer in 20 (38%), and unchanged in eight (15%). A higher proportion of residents took longer to fall asleep, had more difficulty falling asleep, had more sleep interruptions, and felt less rested upon awakening. Twenty-four residents (46%) felt that their bodies never adjusted to the night shift. Also, 22 residents (43%) felt moody or depressed in contrast to seven (14%) who felt depressed during the daytime rotation ($p = 0.0001$). Twenty-one residents (41%) felt they were slower in their thinking during the night float than daytime rotations. The results suggest that disturbances of sleep and mood and decreased alertness, typical of night shift, are present in the night-float rotation.** Residency programs should monitor closely the impact of the night-float rotation on resident well being and patient safety. The impact of night-shift work should be considered in the design of night-float schedules, and teaching should be provided for residents to learn coping strategies for night-shift work.

Gauger PG, Davis JW, Orr PJ. A novel Web-based graduate medical education management system including ACGME compliance algorithms. Acad Med. 2002 Sep;77(9):928.

The authors note that administration of graduate medical education programs has become more difficult as compliance with ACGME work guidelines has assumed increased importance. These guidelines have caused many changes in the resident work environment, including the emergence of complicated cross-cover arrangements. Many participating residents (each with his or her own individual scheduling requirements) usually generate these schedules. Accordingly, schedules are often not submitted in a timely fashion and they may not be in compliance with the ACGME guidelines for maximum on-call assignments and mandatory days off. The objective was the establishment of a Web-based system that guides residents in creating on-call schedules that follow ACGME guidelines while still allowing maximum flexibility -- thus allowing each resident to maintain an internal locus of control.

The authors tested a versatile and scalable system with password-protected user (resident) and administrator interfaces was created. An entire academic year is included, and past months and years are automatically archived. The residents log on within the first 15 days of the preceding month and choose their positions in a schedule template. They then make adjustments while receiving immediate summary feedback on compliance with ACGME guidelines. The schedule is electronically submitted to the educational administrator for final approval. If a cross-cover system is required, the program automatically generates an optimal schedule using both of the approved participating service schedules. The residents then have an additional five-day period to make adjustments in the cross-cover schedule while still receiving compliance feedback. The administrator again provides final approval electronically. The communication interface automatically pages or e-mails the residents when schedules are updated or approved. Since the information exists in a relational database, simple reporting tools are included to extract the information necessary to generate records for institutional GME management. The authors noted that implementation of this program has been met with great enthusiasm from the institutional stakeholders. **Specifically, residents have embraced the ability to directly control their schedules and have gained appreciation for the regulatory matrix in which they function. Institutional administrators have praised the improvement in compliance and the ease of documentation. The authors anticipate that the system will also meet with approval from reviewing regulatory bodies, as it generates and stores accurate information about the resident work environment.** This program is robust and versatile enough to be modified for any GME training program in the country.

Kostreva M, McNelis E, Clemens E. Using a circadian rhythms model to evaluate shift schedules. Ergonomics. 2002 Sep 15;45(11):739-63.

As long as the need for shift work exists, so will the demand for an optimal scheduling strategy that balances the needs of both industry and the shift worker. One aim is for schedules that require workers to be on duty during the times that they are most naturally alert and awake. Czeisler et al. (1982) developed a set of circadian rhythm based guidelines intended to aid in designing such shift work schedules. This paper takes research one step further by testing such empirical criteria in a mathematical setting. The two-oscillator model of free-run human circadian rhythms developed by Kronauer et al. (1982) was modified to represent the circadian rhythms of a shift worker on a pre-selected shift work schedule. **Numerical simulations were used to compare the circadian rhythms produced from a variety of shift work schedules to the free-run rhythms. Shift schedules that resulted in circadian rhythms closest to the free-run rhythms were identified as preferred schedules. The numerical results supported Czeisler's findings (1982), indicating the best shift schedules adopt a slow, forward-shifting rotation pattern, rotate shifts after two-week periods and allow an average of two days off per week.**

Reader DW, Spigos DG, Bennett WF, Mueller CF, Vaswani KK. The graveyard shift: experience with a night float system. Emerg Radiol. 2002 Jul;9(2):82-7.

The aim of this study is to describe the effects of a new night float system on the circadian rhythm and clinical judgment of the residents. In addition, the study looks at the residents' opinions of how to optimize the night float system in the future. All 20 of the radiology residents completed a questionnaire about the night float system after completing their night float coverage. The results of the questionnaire were then compiled and tabulated. It took the residents an average of 2.0 days to become acclimated to the night float and an average of 2.3 days to return to a normal daily routine after completing the night float. No residents perceived impairment in their clinical judgment while on the night float. **Nine of the 20 residents (45%) stated that their clinical judgment was improved on the night float compared to that of a 24-hour call. Eighteen of 20 residents (90%) preferred the night float system to a 24-hour call system. On average, residents believe that the optimal number of hours for a night float shift is 10.5 hours and the optimal numbers of days to do the night float consecutively is 6.8 days. In conclusion, a night float system can be a preferable means of evening coverage as it has a minimal effect on the circadian rhythm by allowing residents to become acclimated to working the night shift over the course of several days. The night float system also demonstrates no appreciable adverse effects on clinical judgment and may allow better clinical judgment than a 24-hour call system.**

McDonald FS, Ramakrishna G, Schultz HJ. A real-time computer model to assess resident work-hours scenarios. Acad Med. 2002 Jul;77(7):752.

The authors sought to accurately model residents' work hours and assess options to forthrightly meet Residency Review Committee-Internal Medicine (RRC-IM) requirements. The requirements limiting residents' work hours are clearly defined by the Accreditation Council for Graduate Medical Education (ACGME) and the RRC-IM: "When averaged over any four-week rotation or assignment, residents must not spend more than 80 hours per week in patient care duties." (1) The call for the profession to realistically address work-hours violations is of paramount importance. (2) Unfortunately, work hours are hard to calculate.

The authors developed an electronic model of residents' work-hours scenarios, using Microsoft Excel 97. This model allows the input of multiple parameters, i.e., call frequency, call position, days off, short-call, weeks per rotation, outpatient weeks, clinic day of the week, additional time due to clinic) and start and stop times for post-call, non-call, short-call, and weekend days. For each resident on a rotation, the model graphically demonstrates call schedules, plots clinic days, and portrays all possible and preferred days off. They tested the model for accuracy in several scenarios. For example, the model predicted average work hours of 85.1 hours per week for fourth-night-call rotations. This was compared with logs of actual work

hours of 84.6 hours per week. **Model accuracy for this scenario was 99.4% (95% CI 96.2%-100%). The model prospectively predicted work hours of 89.9 hours/week in the cardiac intensive care unit (CCU). Subsequent surveys found mean CCU work hours of 88.1 hours per week. Model accuracy for this scenario was 98% (95% CI 93.2-100%).** The authors then used the model to test proposed scenarios for complying with RRC-IM limits. **The flexibility of the model allowed demonstration of the full range of work-hours scenarios in every rotation of this 36-month program.**

Demonstrations of status-quo work-hours scenarios were presented to faculty as well as real-time demonstrations of the feasibility, or unfeasibility, of their proposed solutions. The model clearly demonstrated that non-call (i.e., short-call) admissions without concomitant decreases in overnight call frequency resulted in substantial increases in total work hours. Attempts to "get the resident out" an hour or two earlier each day had negligible effects on total hours and were unrealistic paper solutions. For fourth-night-call rotations, the addition of a "golden weekend" (i.e., a fifth day off per month) was found to significantly reduce work hours. The electronic model allowed the development of creative schedules for previously third-night-call rotations that limit resident work hours without decreasing continuity of care by scheduling overnight call every sixth night alternating with sixth-night-short-call rotations. The authors noted that their electronic model is sufficiently robust to accurately estimate work hours on multiple and varied rotations. This model clearly demonstrates that it is very difficult to meet the RRC-IM work-hours limitations under standard fourth-night-call schedules with only four days off per month. The authors commented they are successfully using the model to test proposed alternative scenarios, to overcome faculty misconceptions about resident work-hours "solutions," and to make changes to the call schedules that both are realistic for residents to accomplish and truly diminish total resident work hours toward the requirements of the RRC-IM.

Fassler S, Dobkin ED, Horowitz S, Morejon O, Reilly P, Civetta J. Lemonade from lemons: a program response to RRC-determined probation. Current Issues in Surgery 2000 July 1;57(4):373-376.

To assess resident satisfaction as a result of changes made to an integrated surgical residency in response to probation. The University of Connecticut Integrated General Surgery Residency, which consists of 5 hospitals, 18 rotations, and has a complement of 44 residents, was placed on probation by the Residency Review Committee (RRC) in Surgery in November 1998. Among the deficiencies cited by the RRC were inadequate evaluation of the program, rotations, residents, and the faculty by the residents, along with inadequate documentation issues. Lack of organized educational conferences, lack of faculty involvement, excessive service responsibilities and work hours, and hospital environmental issues were also cited. It was also apparent that morale of the residents and faculty had significantly eroded. Rather than trying patchwork "fixes" of deficiencies, the authors noted that programs should use this opportunity to reengineer themselves to educating and developing future surgeons. Task forces, including joint faculty and resident participation, were set up to develop solutions, based on the answer to the question: "Do we want a residency or not?" This focus was especially helpful to create hospital administration and faculty support. A survey was created to assess the changes made in the program. The survey included 65 questions pertaining to the learning environment, hospital and departmental support, and balance between clinical and educational responsibilities and overall working environment. **Each resident was asked to fill out three identical surveys, one just before the RRC report, and the other two at 6-month intervals after the probation announcement. A 4-point grading scale was used. The results were reflective of resident perceptions of improvement and increased satisfaction. These data demonstrated that the changes implemented as a result of the RRC findings had a positive effect on the residency program, and they corresponded to the areas where changes were implemented.** This

survey also gave the researchers a method to evaluate ongoing changes in the residency. Probation can be a potent stimulus for improvement of a surgical residency.

Smith-Coggins R, Rosekind MR, Buccino KR, Dinges DF, Moser RP. Rotating shift work schedules: can we enhance physician adaptation to night shifts? Acad Emerg Med. 1997 Oct;4(10):951-61.

The authors sought to evaluate the effectiveness of a broad, literature-based night shift work intervention for enhancement of emergency physicians' (EPs') adaptation to night rotations. A prospective, double-blind, active placebo-controlled study was conducted on six attending physicians in a university hospital ED. Three data sets were collected under the following conditions: baseline, after active placebo intervention, and after experimental intervention. In each condition, data were collected when the physicians worked both night and day shifts. Measurements included ambulatory polysomnographic recordings of the main sleep periods, objective performance tests administered several times during the subjects' shifts, and daily subjective ratings of the subjects' sleep, moods, and intervention use.

Subjects slept an average of 5 hr 42 min across all conditions. After night shifts, the subjects slept significantly less than they did after day shifts (5 hr 13 min vs. 6 hr 20min; $p < 0.05$). The physicians' vigilance reaction times and times for intubation of a mannequin were significantly slower during night shifts than they were during day shifts ($p = 0.007$ and $p < 0.04$, respectively), but performances on ECG analysis did not significantly differ between night and day shifts. Mood ratings were significantly more negative during night shifts than they were during day shifts (more sluggish $p < 0.04$, less motivated $p < 0.03$, and less clear thinking $p < 0.04$). The strategies in the experimental intervention were used 85% of the time according to logbook entries. The experimental and active placebo interventions did not significantly improve the physician's performance, or mood on the night shift, although the subjects slept more after both interventions. **Although the experimental intervention was successfully implemented, it failed to significantly improve attending physicians' sleep, performance, or mood on night shifts. A decrease in speed of intubation, vigilance reaction times, and subjective alertness was evident each time the physicians rotated through the night shift. These findings plus the limited sleep across all conditions and shifts suggest that circadian-mediated disruptions of waking neurobehavioral functions and sleep deprivation are problems in EPs.**

Roughton VJ, Severs MP. The junior doctor handover: current practices and future expectations. J R Coll Physicians Lond. 1996 May-Jun;30(3):213-4.

Restructuring junior doctors' patterns of work has led to several changes, including the increasing implementation of shift and partial-shift rotas. These changes heighten the necessity for good communication between the doctors responsible at different times for the patients. The authors surveyed all junior doctors in two district general hospitals; the results showed that existing handover systems are frequently not as good as doctors would wish. **They found the lack of advice and guidance on the structure of handover has impeded good practice, and a standard of professional practice needs to be set. Opportunities exist within the NHS to utilize information systems to obtain the necessary information and to improve the format of the handover.**

Schulman M, Lucchese KR, Sullivan AC. Transition from housestaff to non-physicians as neonatal intensive care providers: cost, impact on revenue, and quality of care. Am J Perinatol. 1995 Nov;12(6):442-6.

Non-physician providers (NPP) increasingly fill roles traditionally performed by residents. Downsizing of a pediatric residency program prompted phased replacement of residents in a 26-bed neonatal intensive

care unit (NICU). Subsidized education for neonatal nurse-practitioners, recruitment of physician assistants, and NPP leadership took place over 18 months, at which time all resident functions were assumed by NPP. Cost to establish the program, impact on hospital revenue under New York's prospective reimbursement system, and quality of care were evaluated. **The net startup cost for the NPP program was \$441,000 (\$722,000 for education, salaries, staff replacement, and recruitment, partially offset by a New York State workforce demonstration project grant). Ongoing costs of the program are \$1.2 million/yr (including salaries, off-hours medical backup, recruitment, administrative overhead, and loss of indirect and direct medical education reimbursement, partially offset by recaptured resident salaries and ancillary expense reductions). Access to care was maintained. Quality of care was assessed during the last 6 months of resident and the first 6 months of full NPP staffing, revealing similar weight-specific survival, and improvement in documentation and compliance with immunization and blood utilization guidelines during the NPP period. NPP are expensive in comparison to residents.** Revenue is minimally adversely affected, but access to NICU services and quality of care was preserved and in some cases enhanced with NPP. In the context of graduate medical education reform, staffing problems will be encountered increasingly in inpatient subspecialty settings.

Buff DD, Shabti R. The night float system of resident on call: what do the nurses think? 13: J Gen Intern Med. 1995 Jul;10(7):400-2.

In 1989, the internal medicine residency training program at St. John's Episcopal Hospital changed from a standard one-in-four on-call system to a night float system of resident on call. Using a confidential questionnaire that assessed the opinions of medical nurses, the nurses were asked which system they preferred, and how the change to a night float system of resident on call affected medical resident performance. A significant majority of the nurses preferred night float over a standard system of resident on call. **Most nurses responded that because night float allows residents to get more rest, residents make fewer mistakes and are easier to work with. Residents on night float were not considered to be more knowledgeable. The responders indicated that night float did not create confusion about which resident to call for a patient problem.**

Dowling S, Barrett S, West R. With nurse practitioners, who needs house officers? BMJ. 1995 Jul 29;311(7000):309-13.

The boundaries between the work of doctors and that of nurses are changing, with nurses taking over important parts of junior hospital doctors' clinical work. In 1993 an exploratory study was carried out to identify the professional, educational, and management issues that such developments raise. Interviews were carried out with a range of stakeholders in three innovative posts in which nurses were doing much of the clinical work of house officers. **A complex picture of perceived benefits and problems for patients, junior doctors, and nurses emerged. These seemed to be associated with (a) the extent to which the contribution of professional nursing was valued in the new role and (b) the amount of clinical discretion which the post holder was allowed, this depending on the type of preparatory education provided and the management of the post.** The study points to the need for strategic issues--such as the development of appropriate education and the professional recognition of these new clinical roles--to be addressed at a national and regional level.

Green BA, Johnson T. Replacing residents with midlevel practitioners: a New York City-area analysis. Health Aff (Millwood). 1995 Summer;14(2):192-8.

Reducing the number of residency positions in U.S. teaching hospitals poses special problems for New York City-area hospitals, which rely heavily on residents to deliver patient care services. This study

analyzes the costs of replacing residents with midlevel practitioners under proposals considered in 1994 by Congress to limit the number of first-year training positions and alter the configuration of primary care physicians and specialists produced. **The study found that, depending on the replacement strategy used, the proposals could require New York City-area hospitals to hire thousands of midlevel practitioners and other staff, costing a minimum of \$242 million annually, to cover patient care services.**

Riportella-Muller R, Libby D, Kindig D. The substitution of physician assistants and nurse practitioners for physician residents in teaching hospitals. Health Aff (Millwood). 1995 Summer;14(2):181-91.

This study documents features of clinical departments in teaching hospitals that are using physician assistants (PAs) and nurse practitioners (NPs) to perform some tasks previously done by medical or surgical residents. **More than 60 percent of teaching hospital medical directors surveyed reported experience with substitution in their hospitals. The experience overall appears to be positive; one-third of the departments are planning to increase the number of PAs and NPs they use.** The results imply that some of the services lost in house-staff reductions called for in many physician workforce reform proposals could be provided by alternative health professionals.

Rosenberg M, McNulty D. Beyond night float? The impact of call structure on internal medicine residents. J Gen Intern Med. 1995 Feb;10(2):95-8.

Limitation of resident working hours has been a critical issue for training programs in recent years. At Providence Medical Center, residents and faculty collaborated in developing goals, implementation strategies, and an evaluation process for a new ward float system. The goals of the float system were to reduce fatigue, facilitate education, maintain continuity of care, and minimize the negative impact of training on residents' personal lives. **Evaluation revealed: 1) 74% of the residents preferred Providence Medical Center float system (PMCF) to either night float (NF) (13%) or standard every-fourth-night call (EFNC) (13%); and 2) PMCF was perceived to ensure quality patient care to a greater degree than was NF, to better facilitate resident education than was NF, and to have a less negative impact on personal lives than was EFNC.**

Carzoli RP, Martinez-Cruz M, Cuevas LL, Murphy S, Chiu T. Comparison of neonatal nurse practitioners, physician assistants, and residents in the neonatal intensive care unit. Arch Pediatr Adolesc Med. 1994 Dec;148(12):1271-6.

The authors sought to compare patient care delivery by neonatal nurse practitioners and physician assistants with that of pediatric residents in the intensive care setting. The survey design was a retrospective chart review after developing specific performance criteria, namely, patient management, outcome, and charges. They assessed the charts for 244 consecutive admissions to a neonatal intensive care unit in Jacksonville, Florida, were reviewed. Patients were cared for by one of two teams, one staffed by residents and the other by neonatal nurse practitioners and physician assistants. Similar patients were cared for by the two teams, as determined by patient background characteristics and diagnostic variables. Performance of the two teams was assessed by comparison of patient management, outcome, and charges. Management variables included data on length of critical care and hospital stay, ventilator and oxygen use, total parenteral nutritional use, number of transfusions, and the performance of various procedures. Outcome variables included the incidence of air leaks, bronchopulmonary dysplasia, intraventricular hemorrhage, patent ductus arteriosus, necrotizing enterocolitis, retinopathy of prematurity, and number of infants who died. Charge variables included hospital and physician charges.

The findings demonstrated no significant differences in management, outcome, or charge variables between patients cared for by the two teams. The authors concluded that neonatal nurse practitioners and physician assistants are an effective alternative to residents for patient care in the neonatal intensive care unit.

Krakow B, Hauswald M, Tandberg D, Sklar D. Floating nights: a 5-year experience with an innovative ED schedule. Am J Emerg Med. 1994 Sep;12(5):517-20.

An academic emergency group was surveyed to determine if scheduling night shifts in blocks ("floats") improved attitudes and functioning. Seven physicians worked most of their nights as floats. Another four chose only isolated nights. Float physicians were surveyed for isolated and block nights. **Faculty in the float group had poorer attitudes compared with the non-float group when both worked isolated nights (P = .0053). Working night floats eliminated these differences. Float physicians had more difficulty with sleep regardless of their schedule. They took longer to recover from an isolated night shift, drank more coffee, and used more post-call sedatives than their colleagues (P = .0108). The ideal night float was two to four weeks with shifts less than ten hours, but careful attention to sleep hygiene remained essential. Physicians have different adaptability to night work. For some, concentrating night shifts is a useful strategy for improving shift work. This would require shorter shifts and larger groups than are now commonplace.**

Holzman MD, Elkins CC, Neuzil DF, Williams LF Jr. Expanding the physician care team: its effect on patient care, resident function. J Surg Res. 1994 Jun;56(6):636-40.

Recent attempts to improve surgical resident working conditions have taken many forms. We evaluated a system in which a well-trained physician extender had been hired to assist residents taking call on a busy cardiothoracic teaching service. The physician extender ("night nurse," NN) helped with perioperative care using well-defined protocols. The NN, who was in-house Sunday-Friday, 7 pm-7 am, rounded with the residents at the beginning of the evening. Concerns were discussed and care plans formulated. Thereafter, all pages (except codes and extreme emergencies) were directed to the NN, freeing the residents to complete work-ups, patient assessments, or study. The NN assessed patients and initiated care plans including orders that followed either care protocols or plans previously arranged with the resident. For unanticipated concerns, the resident was notified for input and/or patient assessment. For 30 consecutive nights, the patient load and acuity were evaluated. Residents and NN kept diaries of all pages received. The residents also documented time slept and times awakened. Residents received 10 times fewer calls when the NN was available (21.8 +/- 10.5 vs 2.9 +/- 2.4) and slept an average of 2.5 hr more (135 +/- 106.1 vs 286.2 +/- 68.2 min). Care was maintained as judged by morbidity and mortality statistics. Such a system has allowed us to avoid cross coverage, thereby maintaining resident continuity of care and involvement in meaningful care plans, while providing increased time for patient evaluation, self-education, and increased uninterrupted sleep.

Yu JN. Night shift call systems in family practice residencies. Fam Med. 1994 Mar;26(3):163-7.

The number of hours worked by residents has come under scrutiny recently. One approach to decreasing the number of consecutive hours worked is the night shift call or night float system. A survey was sent to the directors/administrators of all family practice residency programs. The survey inquired about their experience with the night shift call system (NSCS). Residencies with an NSCS were asked the reasons for its implementation, how it was implemented, its structure, and its effect on resident well-being, medical education, and patient care.

Of the 295 programs responding, 15% had an NSCS in place, and 12% were considering its implementation. Resident satisfaction, alertness, personal life, quality of care, education, cross coverage, call frequency, reading, and studying improved in 50% or more of residencies. Conference attendance was unchanged. The authors concluded that NSCSs are one way of reducing resident work hours without lengthening a residency. It can improve patient care, resident well-being, and postgraduate education

Mann FA, Danz PL. The night stalker effect: quality improvements with a dedicated night-call rotation. Invest Radiol. 1993 Jan;28(1):92-6.

The authors assessed whether a non-sleep-deprived, second-year diagnostic radiology resident assigned to an after-hours "night stalker" emergency radiology (ER) rotation in an urban university hospital has a measurable impact on the number and clinical significance of "missed" radiologic findings. After-hours Emergency Department (ED) radiographs interpreted by radiology residents between January and December 1991 were reviewed daily by ER faculty. Faculty-modified final interpretations were recorded on a worksheet and given to the attending ED physician (EDP). The EDP reviewed and, if indicated, modified clinical dispositions, and categorized missed diagnoses as requiring recall into the following categories: 1 = immediately, 2 = in 24 to 48 hours, 3 = no recall necessary, or 4 = recognized during patient visit by clinicians. Morbidity attributable to "misses" was graded A to C (A, definite; B, possible; C, none). All cases requiring patient recall were evaluated monthly with follow-up information and classified as false-positive, false-negative, or indeterminate. The relative performance of control (traditional "call") and night stalker groups were compared.

Of 26,421 on-call examinations in 1991, there were 489 (1.1%) misses, of which 202 (1.4%) were from the June-to-December study group. The control group residents averaged 2.75 hours of sleep per call night. On night stalker days, on-call residents and the night stalker averaged 5.75 and 7.25 hours of sleep daily, respectively. The fractions (and number) of recall assignments of discordant cases for the control and night stalker groups, respectively, were: 1) immediate 48% (23) and 26% (32); 2) within 48 hours 31% (15) and 26% (31); 3) no recall 79% (38) and 36% (43); and, 4) abnormality not missed by EDPs 10% (5) and 12% (15). Morbidity for the control and night stalker groups, respectively, were: 1) 4% and 0%; 2) 31% and 30%; and 3) 65% and 70%. The amount of rework between July and December 1991 spent by the EDPs to re-evaluate cases because of discordant opinions was more than 68 hours, with no significant difference noted between the study groups. Errors were false-negative, 84.9% (415); false-positive, 7% (34); and indeterminate, 8.2% (40). Radiology faculty errors contributed 5.8% (13) of patient recalls (false-positive, 11; false-negative, 2). Finally, 58/78 questionnaire respondents believed that service quality had improved. No one believed that the standard of service had been lowered. A dedicated night-shift ER coverage of a busy urban ED improves quality, appropriateness, and timeliness of patient care.

Seelig CB. Changes in residents' attitudes in response to residency program modifications: a prospective study. South Med J. 1992 Oct;85(10):972-5.

Interventions to modify stress during residency training have rarely been formally analyzed for effectiveness. Using a 33-item, closed-ended questionnaire based on factors previously reported to cause residency stress, the authors studied how program modifications affected the attitudes of residents in a university-affiliated community internal medicine residency training program. **Training program modifications, targeting specific questions, were prospectively introduced, and questionnaire responses were compared from year to year and by resident year of training. Between 1988 and 1989, the noon conferences and ward rotations were modified. Between 1989 and 1990, a "night float" was introduced. Residents' responses varied little by year of training, but the mean responses to seven of the fourteen "targeted" questions showed significant changes over time.** In particular, the

introduction of a night float resulted in markedly improved attitudes regarding time demands. This study demonstrates that residents' attitudes can be objectively measured, and that residents accurately perceive and respond to program modifications. Efforts should be made to standardize, validate, and develop attitudinal scales from such questionnaires to aid in the assessment of the numerous changes in residency programs currently being considered or implemented nationwide.

Vassallo DJ, Chana J, Clark CL, Smith RE, Wood RF. Introduction of a partial shift system for house officers in a teaching hospital. *BMJ*. 1992 Oct 24;305(6860):1005-8.

The authors introduced a partial shift system to reduce the hours of work of pre-registration house surgeons to an average of 64 a week to comply with the New Deal for junior doctors; (2) to test linking the partial shift concept to an existing structure of "on call" firms. They conducted a formal assessment after three months of a pilot partial shift system for eight house surgeons on three firms instituted on 1 November 1991, followed by questionnaire and interview evaluation at three and six months of a revised system implemented on 1 February 1992.

Subjects were 24 house surgeons attached to three surgical firms. In eight weeks each house surgeon worked one week (five shifts) of night duty, one week of "cover" (afternoon and evening) duty, and six weeks of normal daytime hours. Each weekday a house surgeon from the firm on call worked an extended daytime on call shift until 10 pm. **Weekend duties were split between two house surgeons from the firm on call. A computer generated graphical display of the rota was used to facilitate leave planning. Average working hours were reduced to below 64 per week, including prospective cover, without detriment to patient care and educational standards. Within the shift system individual house surgeons could be on call with their own firm by day and at weekends. Opinions were equally divided among junior staff as to their preference for either on call or partial shift systems.** The authors concluded that the principles of this partial shift system are generally applicable and the model can readily be adopted by district general hospitals.

Knickman JR, Lipkin M Jr, Finkler SA, Thompson WG, Kiel J. The potential for using non-physicians to compensate for the reduced availability of residents. *Acad Med*. 1992 Jul;67(7):429-38.

Both the number of residents and the amount of time existing residents have in which to carry out their activities may soon be decreasing. To consider the potential for alternative ways of staffing teaching hospitals, it is necessary to know how residents spend their time. The authors sought to learn this by conducting a time-motion study of eight internal medicine residents at two urban hospitals in New York City in 1988. The residents' activities were observed and coded by premedical students, and the authors independently classified the possible activities into (1) those that had to be done by a physician, (2) those that were educational only, and (3) those that could be done by a non-physician. A total of 1,726 activities of 67 kinds were coded, averaging 7.75 minutes each.

The authors analyze and project their data using two models--the traditional model of care in which the physician is the primary medical manager of the patient, and an alternative model in which a midlevel practitioner, such as a nurse practitioner, would perform the day-to-day monitoring of patients. For example, the data indicate that in the traditional model, almost half of a resident's time is spent in activities that must be done by a physician, meaning that another kind of physician would be needed to do those activities if the resident were unavailable; but in the midlevel practitioner model, only around 20% of the activities would require a physician. The authors give detailed breakdowns of their data, estimate the kinds and numbers of non-physician health care professionals necessary to substitute for residents in appropriate activities, and review possible difficulties in implementing such substitutions.

Schwartz RJ, Dubrow TJ, Rosso RF, Williams RA, Butler JA, Wilson SE. Guidelines for surgical residents' working hours. Intent vs. reality. Arch Surg. 1992 Jul;127(7):778-82; discussion 782-3.

To comply with voluntary California medical school guidelines, this general surgery residency program reduced in-house call to 1 in 4 nights, and scheduled a 72-hour workweek. The authors assessed the effectiveness of these changes by prospectively surveying the actual working hours of surgical house staff through completion of a daily schedule for 1 month. **Actual in-hospital hours averaged 98 per week, significantly exceeding the scheduled hours, and were greater for interns (100 hours) and junior residents (97 hours) than for chief residents (95 hours). Twenty hours (22%) of non-conference waking hours were spent on so-called scut work. Significant reduction of intern work hours could be accomplished by expansion of ancillary care, allowing more time for direct patient care.** The effect on senior house staff hours would be less dramatic but might be sufficient to bring hours into compliance with proposed limits.

Lieu TA, Forrest CB, Blum NJ, Cornfeld D, Polin RA. Effects of a night-float system on resident activities and parent satisfaction. Am J Dis Child. 1992 Mar;146(3):307-10.

Night-float systems have recently been proposed as a way to reduce resident stress resulting from irregular sleep patterns. The authors prospectively evaluated the effects of a night-float system in which designated residents relieved on-call senior residents and interns of routine admissions of patients in medically stable condition during the late-night period (11 PM to 7 AM). **Senior residents (3.7 vs. 2.4 hours) and interns (3.7 vs. 3.2 hours) reported sleeping more under the night-float system than under the traditional system. The night-float system did not affect residents' overall ratings of call nights. Educators who reviewed medical records agreed with residents' decisions about patients' appropriateness for admission using the night-float system in 95 (81%) of 117 cases. When educators disagreed with residents, the most common reasons were the patient's potential educational value or medical instability.** The night-float system did not affect interns' ratings of the educational value of late-night admissions or parents' ratings of satisfaction with medical care. The authors concluded that the night-float system can increase resident sleep with little cost to parent satisfaction, but standards for selective use may be needed to avoid compromising patient care and resident education.

Trontell MC, Carson JL, Taragin MI, Duff A. The impact of the night float system on internal medicine residency programs. J Gen Intern Med. 1991 Sep-Oct;6(5):445-9.

The authors studied the design, method of implementation, perceived benefits, and problems associated with a night float system. A self-administered questionnaire was completed by program directors, which included both structured and open-ended questions. The answers reflect resident and student opinions as well as those of the program directors, since program directors regularly obtain feedback from these groups. The setting encompassed the 442 accredited internal medicine residency programs listed in the 1988-89 Directory of Graduate Medical Education Programs.

Of the 442 programs, 79% responded, and 30% had experience with a night float system. The most frequent methods for initiating a night float system included: decreasing elective time (42.3%), hiring more residents (26.9%), creating a non-teaching service (12.5%), and reallocating resident time (9.6%). Positive effects cited include decreased fatigue, improved resident morale, improved recruiting, and better attitude toward internal medicine training. The quality of medical care was considered the same or better by most programs using it. The most commonly cited problems were decreased continuity of care, inadequate teaching of the night float team, and miscommunication. The authors concluded that residency programs using a night float system usually observe a positive

effect on resident morale, recruitment, and working hours and no detrimental effect on the quality of patient care. Miscommunication and inadequate learning experience for the night float team are important potential problems. This survey suggests that the night float represents one solution to reducing resident working hours.

Seltzer V, Foster HW Jr, Gordon M. Resident scheduling: night float programs. *Obstet Gynecol.* 1991 Jun;77(6):940-3.

Obstetrics and gynecology residency programs have traditionally involved long hours in the hospital. In recent years, in an attempt to determine whether work hours could be reduced while at least maintaining resident education and patient care, many program directors have instituted night float systems. In New York State, these systems must adhere to rigid hospital code requirements (limiting total hours worked and with specific mandates regarding time away from the hospital); in other areas, these requirements are not as limiting. At the request of the Council on Resident Education in Obstetrics and Gynecology, residency program directors and residents in the United States and Canada were sent a survey regarding whether they had a night float program, how it was structured, and what changes it was perceived to have caused. **Responses were received from 193 program directors (65%) and 302 residents. Major differences were noted in the structure of the programs within New York State compared with those outside the state. In New York, 63% of the programs had residents in all 4 years participating in the night float; this was true for only 10% of the programs outside New York.** In New York State, the programs were required to adhere to state hospital code requirements limiting hours on duty and mandating the specifics of time off, whereas the programs outside New York did not necessarily adhere to these restrictive requirements. Twelve characteristics were evaluated regarding changes that were perceived to have occurred as a result of the night float program.

Carey JC, Fishburne JI. A method to limit working hours and reduce sleep deprivation in an obstetrics and gynecology residency program. *Obstetrics and Gynecology* 1989 Oct;74(4):668-672.

The authors adopted a system in which a team of residents works at night and all other residents work during the day. **This system allowed the researchers to limit resident work time to 75 hours a week. Residents never work more than 24 hours in a 36-hour period, and usually no more than 13 hours in a 24-hour period. All residents have one day off each week and at least one weekend in three off. They did not have to obtain additional residents or ancillary personnel, and residents have the same exposure to operative cases as they did under the old system. The system can work with as few as 12 residents.** Sleep deprivation is reduced, resident morale is improved, and resident learning, as reflected by in-training examinations, appears to be enhanced.

IX. Responding to the IOM Duty Hour Recommendations

Auger KA, Sieplinga KR, Simmons JM, Gonzalez del Rey JA. Failure to Thrive: Pediatric Residents Weigh In on Feasibility Trial of the Proposed 2008 Institute of Medicine Work Hour Restrictions. JGME Dec 2009; 1(2):181-4.

In December 2008 the Institute of Medicine (IOM) released a report recommending limits on resident hours that are considerably more restrictive than the current Accreditation Council for Graduate Medical Education duty hour standards. In March 2009, a large pediatric residency program implemented a 1-month trial of a schedule and team structure fully congruent with the IOM recommendations to study the implications of such a schedule. The study compared the interns' experience in the trialed intervention schedule to interns working a traditional schedule with every fourth night call.

The residents on the intervention schedule averaged 7.8 hours of sleep per 24-hour period compared to 7.6 hours for interns in a traditional schedule. Participation in bedside rounds and formal didactic conferences was decreased in the intervention schedule. Several factors contributed to increased perceived work intensity for interns in the intervention schedule. Redistribution of work during busy shifts altered the role of senior residents and attending physicians which may have a negative effect on senior residents' ability to develop skills as supervisors and educators. The trial implementation suggests it is *possible* to implement the proposed duty hour limits in a pediatric residency, but it would require a significant increase in the resident workforce (at least 25% and possibly 50%) to care for the same number of patients. Furthermore, the education model would need to undergo significant changes. Further trials of the IOM recommendations are needed prior to widespread implementation in order to learn what works best and causes the least harm, disruption, and unnecessary cost to the system.

Carek PJ, Gravel Jr JW, Kozakowski S, Pugno PA, Fetter G, Palmer EJ. Impact of Proposed Institute of Medicine Duty Hours: Family Medicine Residency Directors' Perspective. JGME Dec 2009; 1(2):195-200.

The authors sought to examine the opinions of family medicine residency program directors concerning the potential impact of the Institute of Medicine (IOM) resident duty hour recommendations on patient care and resident education. A survey was mailed to 455 family medicine residency program directors. Data were summarized and analyzed using Epi Info statistical software. Significance was set at the $P < .01$ level.

A total of 265 surveys were completed (60.9% response rate). A majority of family medicine residency program directors disagreed or strongly disagreed that the recent IOM duty hour recommendations will, in general, result in improved patient safety and resident education. Further, a majority of respondents disagreed or strongly disagreed that the proposed IOM rules would result in residents becoming more compassionate, more effective family physicians. A majority of family medicine residency program directors believe that the proposed IOM duty hour recommendations would have a primarily detrimental effect on both patient care and resident education.

Cedfeldt AS, English C, El Youssef R, Gilhooly J, Girard DE. Institute of Medicine Committee Report on Resident Duty Hours: A View From a Trench. JGME Dec 2009; 1(2):178-80.

In late 2008, the Institute of Medicine (IOM) published a report recommending more restrictive limits on resident work hours to promote patient safety. Reaction from the graduate medical education community

has focused on concerns about a lack of evidence supporting the IOM's recommendations. We highlight 3 concerns with the report: 1) a disproportionate attention to resident fatigue when changes in other areas may have a larger impact on patient safety. Data supporting a causal link between resident fatigue and medical errors that harm patients are not robust. **Two areas where data support a stronger impact on patient safety include resident supervision and transitions of care; 2) a "one size fits all" model when specialty-specific recommendations may be more appropriate. For example, 16 hours on task is not at all similar for residents in different specialties (ie, surgery and primary care); and 3) the absence of a process to evaluate the impact of current or potential duty hour requirements on outcomes. Because these potential impacts have not been sufficiently researched, it is premature to support additional changes at this time.**

To move forward in a comprehensive manner, we recommend the following: 1) support more research to evaluate the effects of duty hours in conjunction with other interrelated factors on patient safety, 2) encourage individual Accreditation Council for Graduate Medical Education (ACGME) Review committees to develop specialty specific duty hour limitations, and 3) develop partnerships between the IOM, ACGME, and the institutions directly involved with medical education to study how to maximize patient safety while maintaining quality educational outcomes.

Mautone SG. Toward a New Paradigm in Graduate Medical Education in the United States: Elimination of the 24-Hour Call. JGME Dec 2009; 1(2):188-94.

Sleep deprivation negatively affects resident performance, education, and safety. Concerns over these effects have prompted efforts to reduce resident hours. This article describes the design and implementation of a scheduling system with no continuous 24-hour calls. Aims included meeting Accreditation Council for Graduate Medical Education work hour requirements without increasing resident complement, maximizing continuity of learning and patient care, maintaining patient care quality, and acceptance by residents, faculty, and administration.

Various coverage options were formulated and discussed. The final schedule was the product of consensus. After re-engineering the master rotation schedule, service-specific conversion of on-call schedules was initiated in July 2003 and completed in July 2004. Annual in-training and certifying examination performance, length of stay, patient mortalities, resident motor vehicle accidents/near misses, and resident satisfaction with the new scheduling system were tracked.

Continuous 24-hour call has been eliminated from the program since July 2004, with the longest assigned shift being 14 hours. Residents have at least 1 free weekend per month, a 10-hour break between consecutive assigned duty hours, and a mandatory 4-hour "nap" break if assigned a night shift immediately following a day shift. Program-wide, duty hours average 66 hours per week for first-year residents, 63 hours per week for second-year residents, and 60 hours per week for third-year residents. Self-reported motor vehicle accidents and/or near misses of accidents significantly decreased ($P < .001$) and resident satisfaction increased ($P = .42$). The change was accomplished at no additional cost to the institution and with no adverse patient care or educational outcomes. Pediatric residency training with restriction to 14 consecutive duty hours is effective and well accepted by stakeholders. Five years later, the re-engineered schedule has become the new "normal" for our program.

Sloan S, Krishnamurthy M, Lyon DT, Mitri G, Chyshkevych I, Livert D. Work Hour Regulations: Do We Need Further Changes Now? A Survey of Internal Medicine Faculty and Residents. . JGME Dec 2009; 1(2):201-7.

In 2003, the Accreditation Council for Graduate Medical Education standardized and regulated work

hours for physicians in training in the United States. In December 2008, the Institute of Medicine (IOM) recommended further reductions in duty hours to ensure safer conditions for patients and residents and fellows. Significantly, the IOM committee acknowledged that there are barriers to implementing its recommendations. In the wake of the IOM proposals, we chose to survey a reference closer to home: residency program directors, faculty, and residents. Our survey allowed them the opportunity to express their opinions regarding the IOM proposals.

The majority of the faculty oppose the proposed IOM changes, arguing that there is no definite evidence to support the hypothesis that fewer work hours mean better outcomes in patient safety and education. First-year residents and residents who moonlight were more likely to experience stress and to support decreased work hours. The thoughts and opinions of faculty and residents collected through this survey, in combination with evidence-based studies from trial implementation of these standards, will contribute real answers to the challenging questions on resident work hours.

Tessing S, Amendt A, Jennings J, Thomson J, Auger KA, Gonzalez del Rey JA. One Possible Future for Resident Hours: Interns' Perspective on a One-Month Trial of the Institute of Medicine Recommended Duty Hour Limits. JGME Dec 2009; 1(2):185-7.

In December 2008, the Institute of Medicine (IOM) released the report of a consensus committee recommending added limits on resident duty hours. The study assessed perceptions of interns participating in a 1-month trial implementation of the IOM-recommended duty hour limits in one large pediatric residency program during March 2009 were aggregated.

Interns experienced benefits from the shift-based schedule, including reduced hours and more nights at home. These were accompanied by shortcomings of the new schedule, most prominently increased intensity during the hours worked, weaknesses in sign-outs and handing off of tasks, and inability to know and “own” all patients on the interns' team. The experiment also changed the role and the level of engagement expected from attending physicians. The trial implementation of the IOM-recommended limits highlighted that to adapt to additional reduction in hours, residency education needs a significant culture change, including better sign-outs, improved organization of bedside and didactic education, and attention to the added work intensity of a team-based model with daily admissions. Ultimately this may require an adjustment in residents' workload and different expectations and models of support from attending physicians.

Nuckols TK, Bhattacharya J, Wolman DM, Ulmer C, Escarce JJ. Cost implications of reduced work hours and workloads for resident physicians. N Engl J Med. 2009 May 21;360(21):2202-15.

See summary on page 80.

X. New York State Regulations - Impact on Resident Work Hours

Poulose BK, Ray WA, Arbogast PG, Needleman J, Buerhaus PI, Griffin MR, Abumrad NN, Beauchamp RD, Holzman MD. Resident work hour limits and patient safety. Ann Surg. 2005 Jun;241(6):847-56; discussion 856-60.

This study evaluates the effect of resident physician work hour limits on surgical patient safety. Resident work hour limits have been enforced in New York State since 1998 and nationwide from 2003. A primary assumption of these limits is that these changes will improve patient safety. The authors examined effects of this policy in New York on standardized surgical Patient Safety Indicators (PSIs). An interrupted time series analysis was performed using 1995 to 2001 Nationwide Inpatient Sample data. The intervention studied was resident work hour limit enforcement in New York teaching hospitals. PSIs included rates of accidental puncture or laceration (APL), postoperative pulmonary embolus or deep venous thrombosis (PEDVT), foreign body left during procedure (FB), iatrogenic pneumothorax (PTX), and postoperative wound dehiscence (WD). PSI trends were compared pre- versus post-intervention in New York teaching hospitals and in 2 control groups: New York non-teaching hospitals and California teaching hospitals. A mean of 2.6 million New York discharges per year were analyzed with cumulative events of 33,756 (APL), 36,970 (PEDVT), 1,447 (FB), 10,727 (PTX), and 2,520 (WD).

Increased rates over time (expressed per 1000 discharges each quarter) were observed in both APL (0.15, 95% confidence interval, 0.09-0.20, P<0.05) and PEDVT (0.43, 95% confidence interval, 0.03-0.83, P<0.05) after policy enforcement in New York teaching hospitals. No changes were observed in either control group for these events or New York teaching hospital rates of FB, PTX, or WD. Resident work hour limits in New York teaching hospitals were not associated with improvements in surgical patient safety measures, with worsening trends observed in APL and PEDVT corresponding with enforcement.

Samuels RC, Chi GW, Rauch DA, Palfrey JS, Shelov SP. Lessons from pediatrics residency program directors' experiences with work hour limitations in New York State. Acad Med. 2005 May;80(5):467-72.

To evaluate the impact of residency work hour limitations on pediatrics residency programs in New York State, and to learn lessons that can be used nationally with the implementation of the Accreditation Council of Graduate Medical Education's similar rules, a three-page questionnaire was mailed to all pediatrics residency program directors in New York. The questionnaire assessed methods used to accommodate the work hour limitations and perceptions of the limitations' effects. Twenty-one program directors responded (68%).

Only large programs used night floats and night teams to meet work hour requirements. Programs of all sizes and in all settings used cross coverage and sent residents home immediately post call. About half of the programs hired additional nonresident staff, usually nurse practitioners, physician assistants, and/or attendings. The most frequently reported effects were decreases in the amount of time residents spent in inpatient settings, patient continuity in inpatient settings, flexibility of residents' scheduling, and increased logistical work needed to maintain continuity clinic. A summary of advice to other program directors was "be creative" and "be flexible." New York's pediatrics residency programs used a variety of mechanisms to meet work hour restrictions. Smaller programs had fewer methods available to them to meet such restrictions. Although the logistical work needed to maintain continuity clinic increased greatly, continuity and outpatient settings themselves were not greatly affected by work hour limitations. Inpatient settings were more affected and experienced much more in the way of change.

Zuckerman JD, Kubiak EN, Immerman I, Dicesare P. The early effects of code 405 work rules on attitudes of orthopaedic residents and attending surgeons. J Bone Joint Surg Am. 2005 Apr;87(4):903-8.

See summary on page 31.

Goldstein MJ, Samstein B, Ude A, Widmann WD, Hardy MA. Work Hours Assessment and Monitoring Initiative (WHAMI) under resident direction: A strategy for working within limitations. Curr Surg. 2005 Jan-Feb;62(1):132-7.

See summary on page 114.

Mathur M, Rampersad A, Howard K, Goldman GM. Physician assistants as physician extenders in the pediatric intensive care unit setting-A 5-year experience. Pediatr Crit Care Med. 2005 Jan;6(1):14-9.

See summary on page 115.

Kort KC, Pavone LA, Jensen E, Haque E, Newman N, Kittur D. Resident perceptions of the impact of work-hour restrictions on health care delivery and surgical education: time for transformational change. Surgery. 2004 Oct;136(4):861-71.

See summary on page 38.

Goldstein MJ, Kim E, Widmann WD, Hardy MA. A 360 degrees evaluation of a night-float system for general surgery: a response to mandated work-hours reduction. Curr Surg. 2004 Sep-Oct;61(5):445-51.

See summary on page 116.

Howard DL, Silber JH, Jobes DR. Do regulations limiting residents' work hours affect patient mortality? J Gen Intern Med. 2004 Jan;19(1):1-7.

See summary on page 78.

Whang EE, Mello MM, Ashley SW, Zinner MJ. Implementing resident work hour limitations: lessons from the New York State experience. Ann Surg. 2003 Apr;237(4):449-55.

The authors sought to determine the impact of work hour limitations imposed by the 405 (Bell) Regulations as perceived by general surgery residents in New York State. New Accreditation Council for Graduate Medical Education (ACGME) requirements on resident duty hours are scheduled to undergo nationwide implementation in July 2003. State regulations stipulating similar resident work hour limitations have already been enacted in New York. A statewide survey of residents enrolled in general surgery residencies in New York was administered.

Most respondents reported general compliance with 405 Regulations in their residency programs, a finding corroborated by reported work hours and call schedules. Whereas a majority of residents reported improved quality of life as a result of the work hour limitations, a substantial portion

reported negative impacts on surgical training and quality and continuity of patient care. Negative perceptions of the impact of duty hour restrictions were more prevalent among senior residents and residents at academic medical centers than among junior residents and residents at community hospitals. The authors concluded that implementation of resident work hour limitations in general surgery residencies may have negative consequences for patient care and resident education. As surgical residency programs develop strategies for complying with ACGME requirements, these negative consequences must be addressed.

Whetsell JF. Changing the law, changing the culture: rethinking the "sleepy resident" problem. *Ann Health Law.* 2003;12(1):23-73.

The author examined the Bell Regulations, which limit New York's hospital residents' work hours and require increased supervision from senior doctors, in light of the currently pending federal bill that seeks to do the same. The article argues that the federal government should draw lessons from the New York experience before proceeding with similar guidelines. **The article notes that many roadblocks have prevented successful implementation of the New York policy, including a long-standing tradition of "hazing" first-year residents with long, unsupervised hours; medical community resistance to the notion of residents' sleep deprivation and dislike of government interference; and a general fear within the medical community of increased medical malpractice liability and other indicia of "blame culture."** The Article concludes that the most effective approach to patient safety related to residency sleep deprivation should work within hospital culture, not against it. The proposed alternative approach would encourage patient safety strategies that value teamwork and cross-discipline collaboration, and consequently result in greater satisfaction for residents, hospitals, and patients.

Johnson T. Limitations on residents' working hours at New York teaching hospitals: a status report. *Acad Med.* 2003 Jan;78(1):3-8.

See summary on page 81.

Holzman IR, Barnett SH. The Bell Commission: ethical implications for the training of physicians. *Mt Sinai Journal of Medicine* 2000 Mar;67(2):136-139.

In 1989, the New York State Legislature enacted New York State Code 405 in response to the death of a patient in a New York City hospital. Code 405 was the culmination of a report (the Bell Commission Report) that implicated the training of residents as part of the problem leading to that tragic death. This paper explores the consequences of the regulatory changes in physician training. The sleep deprivation of house officers was considered a major issue requiring correction. There is little evidence to support the claim that sleep deprivation is a serious cause of medical misadventures. **The changes in house officers' working hours and responsibilities have profound implications. Changes in the time allotted to teaching, the ability to learn from patients admitted after a shift is over, and the increasing loss of continuity, all may have a negative impact on physician training. It is not clear that trainees are being realistically prepared for the actual practice of medicine - physicians often work extended hours. The most serious concern that has been raised is the loss of professionalism by physicians. Residents are now viewing themselves as hourly workers, and the State has intervened in an area of training formerly left to the profession to manage.** The authors noted that programs are now training doctors in New York State who will be comfortable working in an hourly wage setting, but not in the traditional practice of medicine as it has been in the United States during this century. They are concerned that this may sever the bond between doctor and patient - a bond that has been the bedrock of the community's conception of a physician.

Schulman M, Lucchese KR, Sullivan AC. Transition from housestaff to nonphysicians as neonatal intensive care providers: cost, impact on revenue, and quality of care. *Am J Perinatol.* 1995 Nov;12(6):442-6.

See summary on page 125.

Green BA, Johnson T. Replacing residents with midlevel practitioners: a New York City-area analysis. *Health Aff (Millwood).* 1995 Summer;14(2):192-8.

See summary on page 126.

Conigliaro J, Frishman WH, Lazar EJ, Croen L. Internal medicine housestaff and attending physician perceptions of the impact of the New York State Section 405 regulations on working conditions and supervision of residents in two training programs. *Journal of General Internal Medicine* 1993 Sep;8(9):502-7

The study sought to assess the attitudes of internal medicine residents and their attending physicians regarding the impact of the reduction in on-call working hours and increased supervision mandated in New York by a revision of the State Health Code (Section 405). The authors surveyed senior medical residents and attendings two years after the adoption of the mandated changes. The settings were two independent medicine training programs of the Albert Einstein College of Medicine in the Bronx, New York.

Participants were 53% of third- and fourth-year residents (n = 79) and 60% of voluntary and full-time attendings (n = 266) responded. factor analysis of 13 variables that appeared on both versions of the survey identified two interpretable factors. A multivariate analysis of variance compared responses to each factor by group and by campus, and Bonferroni post-hoc comparisons analyzed the items within factors. Chi-square analyses compared responses of residents and attendings to the open-ended questions. **Significant differences between the resident and attendings groups were found for all fixed-response items (minimum p < 0.05 for all analyses), but both groups agreed that the regulations had a positive impact on resident attitudes regarding the demands on their time. Both groups were also uncertain whether the new regulations had a beneficial effect on the choice of internal medicine as a career, the quality of resident supervision, and residents' intellectual interest in challenging medical problems. Whereas residents agreed that the regulations diminished their fatigue, had no impact on their ability to observe the full impact of interventions on patients, and resulted in better patient care, attendings were uncertain or disagreed. While attendings agreed that the regulations had caused a shift-work mentality among residents, residents were uncertain.**

The findings showed that residents had more positive attitudes about the impact of the mandated changes in working conditions for residents than did attending physicians in the same institutions. The major benefits seen by residents were less fatigue and more spare time. There was no consensus about whether these changes had a positive impact on internal medicine practice and clinical supervision. There was some concern that a shift-work mentality is developing among residents and that continuity of patient care has suffered. Thus, despite some substantial benefits, Section 405 may not be achieving its goals of improving resident supervision and the quality of patient care by house officers.

Yedidia MJ, Lipkin M Jr, Schwartz MD, Hirschhorn C. Doctors as workers: work-hour regulations and interns' perceptions of responsibility, quality of care, and training. Journal of General Internal Medicine 1993 Aug;8(8):429-435.

The objective was to study residents' perceptions of their responsibility for patients, the quality of patient care, and their learning experiences in light of new work-hour regulations. The survey design was an inductive analysis of in-depth, semi structured, recorded interviews with a cohort of interns in internal medicine in the last month of their first postgraduate year. Questions were grounded in an examination of issues related to going off duty and delegating tasks to colleagues. Transcripts were independently analyzed by an interdisciplinary team.

The setting was the New York University/Bellevue Hospital Center's residency program in internal medicine (in New York City), and a cohort of 21 of a possible 24 interns in medicine on rotation at Bellevue Hospital Center. **The interviews of the residents revealed: 1) intense concern harbored by interns for their patients with resulting difficulty in maintaining realistic boundaries between work and personal lives; 2) an open-ended workday and competing considerations confronting interns when deciding to leave the hospital--including concerns about leaving patients at critical junctures in their care, confidence in the colleague to whom they were signing out, regard for the workload of this colleague, and uneasiness about the educational consequences; 3) deterrents to acknowledging and acting on one's limits in performing medical work; and 4) a recurrent conflict between delegating responsibility and retaining control over patient care.**

The authors concluded that the values traditionally learned in training emphasize autonomy and individual accountability. They may conflict with the shared decision making and collective responsibility among peers necessitated by work-hour limitations and associated changes in program structure.

Knickman JR, Lipkin M Jr, Finkler SA, Thompson WG, Kiel J. The potential for using non-physicians to compensate for the reduced availability of residents. Acad Med. 1992 Jul;67(7):429-38.

See summary on page 130.

Kelly A, Marks F, Westhoff C, Rosen M. The effect of the New York State restrictions on resident work hours. Obstetrics and Gynecology 1991 Sep;78(3 Pt 1):468-473.

New York State has recently restricted the hours that residents may work to an average of 80 hours per week. The authors noted they have complied with these regulations through the addition of nonresident personnel, including attending physicians, a physician assistant, and nurse midwives. This study was designed to assess the effect of these changes on the residents. A questionnaire covering the effects of the new system was distributed to both attending and resident staff. Surgical case load and Council on Resident Education in Obstetrics and Gynecology (CREOG) scores since the change were compared with those of previous years. A marked improvement in resident life-style was noted. Although residents commented that they had increased time for reading, this was not reflected in an improvement in the CREOG scores. **The quality of patient care was not felt to be improved, and the continuity of care was considered to be adversely affected. Resident surgical case load was unchanged. The assignment of emergency room coverage to attending physicians and gynecologic floor coverage to a physician assistant was seen as having a detrimental effect on resident experience. The authors concluded that the new restrictions on resident work hours in New York have improved resident quality of life. However, there does not appear to be an improvement in patient care, which was the original intent of the statute.** Concerns are discussed about the effect of this decrease in hours worked on resident experience and education. Further research is needed to assess the long-term effects of reduced resident work hours on both patient care and resident education.

Seltzer V, Foster HW Jr, Gordon M. Resident scheduling: night float programs. Obstet Gynecol. 1991 Jun;77(6):940-3.

See summary on page 131.

Foster HW Jr, Seltzer VL. Accommodating to restrictions on residents' working hours. Acad Med. 1991 Feb;66(2):94-7.

See summary on page 47.

Pallarito K. Experts still deliberating effectiveness of N.Y. rules limiting residents' hours. Modern Healthcare 1990 Nov 19;20(46):41.

A New York state law limiting the schedules of interns and residents has resulted in 15 citations so far, a degree of compliance one hospital spokesman said is higher than anticipated. It's less discernible whether the curbs are having their intended effect of keeping house staff rested and supervised, and whether other states will take New York's lead.

Dolan KL, Rosner F, Spiegel K. Survey of nonphysician tasks performed by medicine residents at a municipal hospital. J Natl Med Assoc. 1990 Sep;82(9):629-33.

See summary on page 105.

Thorpe KE. House staff supervision and working hours. Implications of regulatory change in New York State. JAMA. 1990 Jun 20;263(23):3177-81.

See summary on page 82.

XI. Impact of Work Hours on Health and Cognitive Functioning

IsHak WW, Lederer S, Mandili C, Nikravesh R, Seligman L, Vasa M, Ogunyemi D, Bernstein CA. Burnout During Residency Training: A Literature Review. JGME Dec 2009; 1(2):236-242.

Burnout is a state of mental and physical exhaustion related to work or care giving activities. Burnout during residency training has gained significant attention secondary to concerns regarding job performance and patient care. This article reviews the relevant literature on burnout in order to provide information to educators about its prevalence, features, impact, and potential interventions. Studies were identified through a Medline and PsychInfo search from 1974 to 2009. Fifty-one studies were identified. Definition and description of burnout and measurement methods are presented followed by a thorough review of the studies.

Examination of the burnout literature reveals that it is prevalent in medical students (28%–45%), residents (27%–75%, depending on specialty), as well as practicing physicians. Psychological distress and physical symptoms can impact work performance and patient safety. Distress during medical school can lead to burnout, which in turn can result in negative consequences as a working physician. Burnout also poses significant challenges during early training years in residency. Time demands, lack of control, work planning, work organization, inherently difficult job situations, and interpersonal relationships, are considered factors contributing to residents' burnout. Potential interventions include workplace-driven and individual-driven measures. Workplace interventions include education about burnout, workload modifications, increasing the diversity of work duties, stress management training, mentoring, emotional intelligence training, and wellness workshops. Individual-driven behavioral, social, and physical activities include promoting interpersonal professional relations, meditation, counseling, and exercise. Educators need to develop an active awareness of burnout and ought to consider incorporating relevant instruction and interventions during the process of training resident physicians.

Reimann M, Manz R, Prieur S, Reichmann H, Ziemssen T. Education research: cognitive performance is preserved in sleep-deprived neurology residents. Neurology. 2009 Nov 24;73(21):e99-e103.

To test the hypotheses that sleep deprivation in neurology residents is associated with performance deficits and that vigilance and cognitive performance is more compromised after overnight on-call duty compared to nightshift. Thirty-eight neurology residents of a university teaching hospital participated in a prospective single-blind comparison study. Residents were recruited according to their working schedule and divided into 3 groups: 24 hours overnight on-call duty, night shift, and regular day shift (controls). All participants underwent serial measurements of sleepiness and cognitive performance in the morning directly after or before their shift. Pupillary sleepiness test and Paced Auditory Serial Addition Test were applied. Perceived sleepiness was assessed by a questionnaire.

Sleepiness was increased in residents after night shift and overnight call compared to controls while the type of night duty was not associated with the extent of sleepiness. Sleep-deprived residents did not show any performance deficits on the Paced Auditory Serial Addition Test. Cognitive performance was not associated with sleepiness measures. Night shift and overnight call duty have a similar impact on alertness in neurology residents. Sleep-deprived neurology residents may be able to overcome sleep loss-related performance difficulties for short periods.

Gohar A, Adams A, Gertner E, Sackett-Lundeen L, Heitz R, Engle R, Haus E, Bijwadia J. Working memory capacity is decreased in sleep-deprived internal medicine residents. J Clin Sleep Med. 2009 Jun 15;5(3):191-7.

Concerns about medical errors due to sleep deprivation during residency training led the Accreditation Council for Graduate Medical Education to mandate reductions in work schedules. Although call rotations with extended shifts continue, effects on resident sleep-wake times and working memory capacity (WMC) have not been investigated. The objective of this study was to measure effects of call rotations on sleep-wake times and WMC in internal medicine residents. During 2 months of an internal medicine training program adhering to ACGME work-hour restrictions (between April 2006 and June 2007), residents completed daily WMC tests, wore actigraphy watches, and logged their sleep hours. This observational study was conducted during a call month requiring 30-hour call rotations every fourth night, whereas the noncall month, which allowed sleep/wake cycle freedom, was used as the control. Main outcomes were sleep hours per night and WMC testing.

Thirty-nine residents completing the study had less sleep per night during their call month (6.4 vs 7.3 h per night noncall, $p < 0.001$) and sleep per night varied from 3.7 to 10.1 hours. Call rotation caused greater self-assessed sleepiness and reduced WMC recall scores (-2.6/test, $p < 0.05$), and more math errors occurred when on call (+1.07/test, $p < 0.04$). Full recovery of WMC did not occur until the fourth day after call. On-call rotation on the first month had a confounding detrimental effect on WMC. A month of call rotations reduced overall sleep per night; sleep hours per night were variable, and WMC was adversely affected. Decreased WMC could explain impaired judgment during sleep deprivation, although clinical error rates were not evaluated.

Stucky ER, Dresselhaus TR, Dollarhide A, Shively M, Maynard G, Jain S, Wolfson T, Weinger MB, Rutledge T. Intern to attending: assessing stress among physicians. Acad Med. 2009 Feb;84(2):251-7.

Organizations have raised concerns regarding stress in the medical work environment and effects on health care worker performance. This study's objective was to assess workplace stress among interns, residents, and attending physicians using Ecological Momentary Assessment technology, the gold-standard method for real-time measurement of psychological characteristics. The authors deployed handheld computers with customized software to 185 physicians on the medicine and pediatric wards of four major teaching hospitals. The physicians contemporaneously recorded multiple dimensions of physician work (e.g., type of call day), emotional stress (e.g., worry, stress, fatigue), and perceived workload (e.g., patient volume). The authors performed descriptive statistics and t test and linear regression analyses.

Participants completed 5,673 prompts during an 18-month period from 2004 to 2005. Parameters associated with higher emotional stress in linear regression models included male gender ($t = -2.5$, $P = .01$), total patient load ($t = 4.2$, $P < .001$), and sleep quality ($t = -2.8$, $P = .006$). Stress levels reported by attendings ($t = -3.3$, $P = .001$) were lower than levels reported by residents ($t = -2.6$, $P = .009$), and emotional stress levels of attendings and residents were both lower compared with interns. **On inpatient wards, after recent resident duty hours changes, physician trainees continue to show wide-ranging evidence of workplace stress and poor sleep quality. This is among the first studies of medical workplace stress in real time. These results can help residency programs target education in stress and sleep and readdress workload distribution by training level. Further research is needed to clarify behavioral factors underlying variability in housestaff stress responses.**

Czeisler CA. Medical and genetic differences in the adverse impact of sleep loss on performance: ethical considerations for the medical profession. *Trans Am Clin Climatol Assoc.* 2009;120:249-85.

The Institute of Medicine recently concluded that on average medical residents make more serious medical errors and have more motor vehicle crashes when they are deprived of sleep. In the interest of public safety, society has required limitations on work hours in many other safety sensitive occupations, including transportation and nuclear power generation. Those who argue in favor of traditional extended duration resident work hours often suggest that there are inter-individual differences in response to acute sleep loss or chronic sleep deprivation, implying that physicians may be more resistant than the average person to the detrimental effects of sleep deprivation on performance, although there is no evidence that physicians are particularly resistant to such effects. Indeed, recent investigations have identified genetic polymorphisms that may convey a relative resistance to the effects of prolonged wakefulness on a subset of the healthy population, although there is no evidence that physicians are over-represented in this cohort. Conversely, there are also genetic polymorphisms, sleep disorders and other inter-individual differences that appear to convey an increased vulnerability to the performance-impairing effects of 24 hours of wakefulness.

Given the magnitude of inter-individual differences in the effect of sleep loss on cognitive performance, and the sizeable proportion of the population affected by sleep disorders, hospitals face a number of ethical dilemmas. How should the work hours of physicians be limited to protect patient safety optimally? For example, some have argued that, in contrast to other professions, work schedules that repeatedly induce acute and chronic sleep loss are uniquely essential to the training of physicians. If evidence were to prove this premise to be correct, how should such training be ethically accomplished in the quartile of physicians and surgeons who are most vulnerable to the effects of sleep loss on performance without unacceptably compromising patient safety? Moreover, once it is possible to identify reliably those most vulnerable to the adverse effects of sleep loss on performance, will academic medical centers have an obligation to evaluate the proficiency of both residents and staff physicians under conditions of acute and chronic sleep deprivation? Should work-hour policy limits be modified to ensure that they are not hazardous for the patients of the most vulnerable quartile of physicians, or should the limits be personalized to enable the most resistant quartile to work longer hours? Given that the prevalence of sleep disorders has increased in our society overall, and increases markedly with age, how should fitness for extended duration work hours be monitored over a physician's career? In the spirit of the dictum to do no harm, advances in understanding the medical and genetic basis of inter-individual differences in the performance vulnerability to sleep loss should be incorporated into the development of work-hour policy limits for both physicians and surgeons.

Hanlon JG, Hayter MA, Bould MD, Joo HS, Naik VN. Perceived sleepiness in Canadian anesthesia residents: a national survey. *Can J Anaesth.* 2009 Jan;56(1):27-34.

To compare the self-perceived sleepiness of Canadian anesthesia residents providing modified on-call duties (12-16 h) vs. traditional on-call duties (24 h). A 25-item online survey was distributed to all Canadian anesthesia residents who, at that time, were on anesthesia rotations. The survey assessed resident demographics, perceived work patterns, and sleepiness, as well as their opinions on resident work hour reform. Self-perceived sleepiness was quantified using the validated Epworth sleepiness scale (ESS).

Three hundred eight of 400 (77%) eligible Canadian anesthesia residents completed the survey. **Forty-three percent of residents who worked traditional on-call (duration 24.1 +/- 0.5 h) shifts and 48% of residents who worked modified on-call (duration 15.5 +/- 1.8 h) shifts met ESS criteria for excessive daytime sleepiness. Overall mean ESS scores did not differ significantly between the traditional (9.1 +/- 4.9) and the modified call groups (9.5 +/- 4.8). Residents with an on-call frequency of $\geq 1:4$ days or those who slept ≤ 2 h while on call perceived themselves as significantly more sleepy ($P = 0.045$ and $P = 0.008$, respectively). Six percent of residents admitted to taking "something other**

than caffeine" to stay awake on call. Many anesthesia residents do exhibit excessive daytime sleepiness, with a similar incidence for those working within either modified or traditional call systems. Our study suggests that sleepiness may be reduced by scheduling on-call duties no more frequently than one in every five nights and by ensuring that residents sleep more than 2 h while on call.

Taoda K, Nakamura K, Kitahara T, Nishiyama K. Sleeping and working hours of residents at a national university hospital in Japan. *Ind Health.* 2008 Dec;46(6):594-600.

This study aimed to examine the status of time spent working and sleeping by resident doctors before the introduction of the New Training System for Residents in Japan. A time-budget survey was conducted over a 4-wk period on 102 residents at the Shiga University of Medical Science Hospital, and the response rate among residents was 76% of a total of 2,722 person-days. The average number of hours spent sleeping was the lowest and spent in the hospital including commuting time was the highest in residents of the surgery department, at 4.4 h and 18.9 h, respectively.

Forty percent of residents reported dozing off at work, with the incidence rate being highest in residents of the surgery department (0.7 times/person-day). Dozing appeared to occur in response to the lack of sleep and fatigue, since the same residents slept longer on nights before days they reported not dozing off than on nights before days when they did doze off. Strong correlations were observed between the number of sleeping and working hours and between working hours and the number of patients in a resident's care. In order to maintain high standards of training and to get sufficient sleep it is therefore necessary for residents to manage their work and the number of patients in their care.

Friesen LD, Vidyarthi AR, Baron RB, Katz PP. Factors associated with intern fatigue. *J Gen Intern Med.* 2008 Dec;23(12):1981-6.

Prior data suggest that fatigue adversely affects patient safety and resident well-being. ACGME duty hour limitations were intended, in part, to reduce resident fatigue, but the factors that affect intern fatigue are unknown. To identify factors associated with intern fatigue following implementation of duty hour limitations. Cross-sectional confidential survey of validated questions related to fatigue, sleep, and stress, as well as author-developed teamwork questions. Interns in cognitive specialties at the University of California, San Francisco. Measurements included univariate statistics characterized the distribution of responses. Pearson correlations elucidated bivariate relationships between fatigue and other variables. Multivariate linear regression models identified factors independently associated with fatigue, sleep, and stress.

Of 111 eligible interns, 66 responded (59%). **In a regression analysis including gender, hours worked in the previous week, sleep quality, perceived stress, and teamwork, only poorer quality of sleep and greater perceived stress were significantly associated with fatigue ($p < 0.001$ and $p = 0.02$, respectively). To identify factors that may affect sleep, specifically duty hours and stress, a secondary model was constructed. Only greater perceived stress was significantly associated with diminished sleep quality ($p = 0.04$), and only poorer teamwork was significantly associated with perceived stress ($p < 0.001$). Working >80 h was not significantly associated with perceived stress, quality of sleep, or fatigue.** Simply decreasing the number of duty hours may be insufficient to reduce intern fatigue. Residency programs may need to incorporate programmatic changes to reduce stress, improve sleep quality, and foster teamwork in order to decrease intern fatigue and its deleterious consequences.

Arora VM, Georgitis E, Siddique J, Vekhter B, Woodruff JN, Humphrey HJ, Meltzer. Association of workload of on-call medical interns with on-call sleep duration, shift duration, and participation in educational activities. JAMA. 2008 Sep 10;300(10):1146-53.

See summary on page 93.

Collins J, Hinshaw JL, Fine E, Albanese MA. Diagnostic radiology resident compliance with recommended health guidelines effect of resident work environment. Acad Radiol. 2008 Aug;15(8):1046-57.

The study sought to determine diagnostic radiology resident compliance with recommended health guidelines for physical activity, body weight, diet, related health indicators, and the effects of the resident work environment on compliance. A request was electronically mailed to members of the Association of Program Directors in Radiology and the Association of Program Coordinators in Radiology in May 2007 and again in June 2007, asking members to forward to their radiology residents an invitation to complete an online health survey. Frequency counts and Fisher's exact test, respectively, were used to summarize results and to determine statistically significant relationships between survey variables. A total of 811 radiology residents completed the survey, representing 18% of 4,412 diagnostic radiology residents. Five hundred forty-five (67.2%) of 811 were male and 264 (32.6%) female. Two hundred ten (25.9%) were first-year, 239 (29.5%) second-year, 201 (24.8%) third-year, and 161 (19.9%) fourth-year residents. Three hundred two (37.2%) engaged in recommended guidelines for physical activity and ≤ 465 (57.3%) complied with each of multiple federal dietary guidelines (excluding alcohol intake). Up to 329 (40.6%) residents did not know whether they were in compliance with various dietary guidelines. A total of 426 (52.5%) residents reported working ≥ 60 hours/week, which significantly correlated with less physical activity ($P = .013$). A substantial number of residents are out of compliance with federal guidelines for physical activity and diet and are not knowledgeable about their personal dietary intake. Long work hours are related to a lack of physical activity. Radiology programs may be able to influence resident health practices by modifying work hours and the working environment, encouraging healthy dietary intake and physical activity, and instituting campaigns to inform residents and faculty about health guidelines and available wellness programs.

Landrigan CP, Fahrenkopf AM, Lewin D, Sharek PJ, Barger LK, Eisner M, Edwards S, Chiang VW, Wiedermann BL, Sectish TC. Effects of the Accreditation Council for Graduate Medical Education duty hour limits on sleep, work hours, and safety. Pediatrics. 2008 Aug;122(2):250-8.

See summary on page 51.

Woodrow SI, Park J, Murray BJ, Wang C, Bernstein M, Reznick RK, Hamstra SJ. Differences in the perceived impact of sleep deprivation among surgical and non-surgical residents. Med Educ. 2008 May;42(5):459-67.

Resident work hour restrictions have been mandated in the USA largely out of concern that sleep deprivation compromises doctor performance and patient care. However, individuals' ability to recognize the effects of sleep deprivation has not been studied in medical education. The authors examined the perceived impact of sleep deprivation among different groups of postgraduate medical trainees. The study used a survey addressing work hours, sleepiness and daily functioning was mailed to all residents in the internal medicine, surgery and psychiatry programs at the University of Toronto who were working at 6 different teaching hospitals. The mailing included the Epworth Sleepiness Scale (ESS), measuring acute sleepiness, and a new Sleep Deprivation Impact (SDI) scale, consisting of 12 items designed to measure the perceived impact of sleep deprivation on an individual's own performance.

Overall, 62.5% of surgery (95/152) and 59.5% of non-surgery residents (194/326) completed the survey. Surgery residents reported working longer hours per week (83.0 versus 62.5 hours; $P < 0.01$), and scored higher on the ESS (12.8 versus 9.2; $P < 0.01$) compared with other residents. **Surgery residents scored significantly lower than others on the SDI scale (45.2 versus 51.5, $P < 0.01$), indicating less perceived impact of sleep deprivation on performance.** The results are consistent with the presence of an underlying culture within surgery in which individuals may be less willing to accept a natural limitation of individual performance. Whether these findings represent an actual resilience to sleep deprivation among surgery residents or a misperception within this group remains to be determined.

Rose M, Manser T, Ware JC. Effects of call on sleep and mood in internal medicine residents. Behav Sleep Med. 2008;6(2):75-88.

Residents on call experience decreased total sleep time (TST) and increased dysphoria. This study monitored changes in mood and sleepiness for 3 post-call days. Fifty-two internal medicine residents participated in the study. The residents wore actigraphs for the 4 to 9 days of the study. Each morning resident completed mood scales, a sleepiness scale, and estimated their prior night TST. The residents were on a 1-in-4 schedule. Call decreased subjective- and actigraphy-derived TST to less than 4 hr. During the 3 days post call, mood measures improved. Tension, depression, and anxiety stabilized on the first post-call day following the first night of off-call sleep during which the residents obtained about 7 hr of sleep. Vigor, fatigue, and confusion stabilized on the second post-call day. **The Epworth Sleepiness Scale dropped to less than 11 after 1 post-call night and continued to decrease up to 3 post-call days. The effects of call linger past the first recovery night.** For these residents, recovery sleep appeared inadequate, and the negative effects of call persisted across succeeding off-call days. Thus, for these residents on a 1-in-4 schedule, call affects their mood for much of the time when off call and potentially their personal and professional interactions during this period as well.

Minion D, Plymale M, Donnelly M, Endean E. The effect of prior night call status on the American Board of Surgery in-training examination scores: eight years of data from a single institution. J Surg Educ. 2007 Nov-Dec;64(6):416-9.

Despite recent attention to resident duty hours, little data evaluate the effect of being on-call the night before taking an in-training examination on examination performance. The few previous studies evaluated single-year test scores, from heterogeneous cohorts, with inconsistent findings. The purpose of this study was to determine the effect of being on-call the night before taking the American Board of Surgery In-Training Examination (ABSITE) on resident scores at a single institution over a duration of several years. Overall percentile rank, standard scores, and prior night call status were recorded for all residents (categorical and preliminary) taking the ABSITE at our institution from 1999 to 2006. A 2-way ANOVA was performed to determine whether (1) the standard scores varied significantly between residents not on-call and those who were on-call, 2) performance varied significantly by PGY level, and 3) there was a significant interaction between call status and PGY level. Percentile rank of residents on-call the night before the examination were compared with those off-call using the Mann-Whitney U-test. For residents with scores from multiple years, standard scores from years on-call were compared with years off-call using the Wilcoxon signed rank test.

A total of 282 ABSITE results were recorded with 69 (24%) residents taking in-house call the night before the examination. **A 2-way analysis of variance indicated that although standard score performance varied significantly by PGY level ($p < 0.001$), no significant differences were found in scores at any PGY level attributable to being on-call ($p = 0.70$). This analysis was also performed on only categorical general surgery residents' scores. Again, no significant differences were attributable to being on-call. Similarly, a Mann-Whitney U-test indicated no statistical difference in percentile scores based on call status ($p = 0.43$). Matched resident scores from year to year did not**

differ significantly based on call status ($p = 0.21$). Based on several analytic models, being on-call the night before the ABSITE does not significantly affect resident performance.

Lockley SW, Barger LK, Ayas NT, Rothschild JM, Czeisler CA, Landrigan CP; Harvard Work Hours, Health and Safety Group. Effects of health care provider work hours and sleep deprivation on safety and performance. Jt Comm J Qual Patient Saf. 2007 Nov;33(11 Suppl):7-18.

There has been increasing interest in the impact of resident-physician and nurse work hours on patient safety. The evidence demonstrates that work schedules have a profound effect on providers' sleep and performance, as well as on their safety and that of their patients. Nurses working shifts greater than 12.5 hours are at significantly increased risk of experiencing decreased vigilance on the job, suffering an occupational injury, or making a medical error.

Physicians-in-training working traditional > 24-hour on-call shifts are at greatly increased risk of experiencing an occupational sharps injury or a motor vehicle crash on the drive home from work and of making a serious or even fatal medical error. As compared to when working 16-hours shifts, on-call residents have twice as many attentional failures when working overnight and commit 36% more serious medical errors. They also report making 300% more fatigue-related medical errors that lead to a patient's death. The weight of evidence strongly suggests that extended-duration work shifts significantly increase fatigue and impair performance and safety. From the standpoint of both providers and patients, the hours routinely worked by health care providers in the United States are unsafe. To reduce the unacceptably high rate of preventable fatigue-related medical error and injuries among health care workers, the United States must establish and enforce safe work-hour limits.

Arora VM, Georgitis E, Woodruff JN, Humphrey HJ, Meltzer D. Improving sleep hygiene of medical interns: can the sleep, alertness, and fatigue education in residency program help? Arch Intern Med. 2007 Sep 10;167(16):1738-44.

See summary on page 108.

Jones AM, Jones KB. The 88-hour family: effects of the 80-hour work week on marriage and childbirth in a surgical residency. Iowa Orthop J. 2007;27:128-33.

The restriction of the resident physician work week to 80 hours has had dramatic affects on resident education and life-style. While effects on mood, psychological distress, and burn-out have been studied, the resultant changes in tangible quality of life have received little attention. Birth rate was considered a measurable, relevant outcome. The resident marital and parental status by duty month was collected from a single orthopaedic surgical residency program for the four academic years preceding and following the implementation of the 80-hour work week. The number of births to residents during these periods were also tallied. **The relative prevalence of positive marital status changed very little between residents in the two time durations from 66 to 71 percent, but parental status increased from 27 to 43 percent. The number of births per married resident duty year also increased from 0.23 pre-restrictions to 0.32 post-restrictions.** While the individual decisions involved in generating these observed changes are complex and difficult to entirely decipher, it is thought that an increased perception of life-control within the work-hour restrictions may have prompted the dramatic changes in birth rate among resident families.

Golub JS, Weiss PS, Ramesh AK, Ossoff RH, Johns MM 3rd. Burnout in residents of otolaryngology-head and neck surgery: a national inquiry into the health of residency training. Acad Med. 2007 Jun;82(6):596-601.

To characterize resident burnout on a national scale with a large sample size and to identify associated modifiable factors to minimize burnout and improve the quality of residency education. A survey was mailed to all 1,364 U.S. residents of otolaryngology-head and neck surgery in September 2005. The main outcome measures were the Maslach Burnout Inventory-Human Services Study, demographic information, and potential burnout predictors, including stressors, satisfaction, self-efficacy, and support systems. The response rate was 50% (684/1,364).

Current second-year through fifth-year residents were included for further analysis (514). Burnout was extremely common among otolaryngology residents. High burnout was seen in 10% of residents (51), moderate burnout in 76% (391), and low burnout in 14% (72). The strongest associated demographic factor was work hours ($P < .001$). Hours worked was predictive of emotional exhaustion, with exhaustion scores rising by 0.19 for each hour worked ($P < .001$). Furthermore, there was an 8% (41 resident) reported violation rate of the Accreditation Council for Graduate Medical Education (ACGME) 80-hour-workweek limitation. Satisfaction with the balance between personal and professional life, relationship stability, and satisfaction with career choice were negatively associated with burnout (all $P < .001$). Burnout is widely prevalent among U.S. otolaryngology residents and is present at greater levels than those seen in chairs or faculty of the same specialty. Work hours predict emotional exhaustion, and adherence to the ACGME 80-hour workweek may help protect against burnout and its deleterious consequences in residents of all specialties.

Surani S, Subramanian S, Aguillar R, Ahmed M, Varon J. Sleepiness in medical residents: impact of mandated reduction in work hours. Sleep Med. 2007 Jan;8(1):90-3.

The study sought to assess sleepiness among Family Practice residents using subjective data, including the Epworth sleepiness scale (ESS), as well as objective assessment, the multiple sleep latency test (MSLT). Subjects were Family Practice residents at Texas A&M University, Corpus Christi. Sixteen residents, aged 21-40 yrs, were recruited and divided into two groups. The study group was comprised of residents who were on night-float rotation for at least three days and underwent MSLT post-call, and the control group was comprised of residents who were not on night-float and were not post-call. Daytime sleepiness was evaluated using both the ESS and MSLT. Respondents also completed a questionnaire assessing their beliefs regarding effects of sleep loss. Sleep latencies <10 min were observed in 6 out of the 8 day shift-work interns, while only 1 out of 8 night-float residents had an average sleep latency <10 min ($p=0.0195$).

Following night-float, despite less sleep, residents had sleep latencies which were higher [14.2 (+/- 5.0) min] than those in the control group [8.4 (+/- 5.4) min, ($p=0.043$)]. Despite the difference in objective sleepiness, subjective sleepiness (Epworth scores) did not differ. Over 80% of interns reported having driven while sleepy. The study found that sleepiness continues to be a significant issue among medical residents despite recently mandated reductions in resident work hours. MSLT values in the pathologic range are seen in the majority of residents studied, but in those who were post-night call there seemed to be a paradoxical improvement.

Papp KK, Miller CM, Strohl KP. Graduate medical training, learning, relationships, and sleep loss. Sleep Med Rev. 2006 Oct;10(5):339-45.

An extensive literature exists regarding the potential effect of sleep loss on human performance and the recent regulatory changes that now limit the duty hours of resident-physicians. Recent studies and reviews emphasize the effects of sleepiness on medical errors of commission and to a lesser extent omission. This

review focuses on an emerging literature on the effects of sleep loss on personal, social and professional growth and development of residents. As with the early literature on sleep loss and resident performance, this literature is largely at an observational level, but there is sufficient evidence from other professions to indicate that sleep loss will affect post-graduate career and life skills. A multi-dimensional approach is needed to counter the adverse outcomes of sleep loss and fatigue and might consist of education on healthy sleep habits, family outreach, personal alertness strategies, and reversal of bias if sleepiness is personally disclosed. The multi-dimensional approach might include not only resident physicians, but also residency program directors and attending physicians at their institutions.

Ayas NT, Barger LK, Cade BE, Hashimoto DM, Rosner B, Cronin JW, Speizer FE, Czeisler CA. Extended work duration and the risk of self-reported percutaneous injuries in interns. JAMA. 2006 Sep 6;296(9):1055-62.

In their first year of postgraduate training, interns commonly work shifts that are longer than 24 hours. Extended-duration work shifts are associated with increased risks of automobile crash, particularly during a commute from work. Interns may be at risk for other occupation-related injuries. To assess the relationship between extended work duration and rates of percutaneous injuries in a diverse population of interns in the United States. National prospective cohort study of 2737 of the estimated 18,447 interns in US postgraduate residency programs from July 2002 through May 2003. Each month, comprehensive Web-based surveys that asked about work schedules and the occurrence of percutaneous injuries in the previous month were sent to all participants. Case-crossover within-subjects analyses were performed. Comparisons of rates of percutaneous injuries during day work (6:30 am to 5:30 pm) after working overnight (extended work) vs. day work that was not preceded by working overnight (nonextended work). The authors also compared injuries during the nighttime (11:30 pm to 7:30 am) vs. the daytime (7:30 am to 3:30 pm).

From a total of 17,003 monthly surveys, 498 percutaneous injuries were reported (0.029/intern-month). In 448 injuries, at least 1 contributing factor was reported. Lapse in concentration and fatigue were the 2 most commonly reported contributing factors (64% and 31% of injuries, respectively). Percutaneous injuries were more frequent during extended work compared with nonextended work (1.31/1000 opportunities vs. 0.76/1000 opportunities, respectively; odds ratio [OR], 1.61; 95% confidence interval [CI], 1.46-1.78). Extended work injuries occurred after a mean of 29.1 consecutive work hours; nonextended work injuries occurred after a mean of 6.1 consecutive work hours. Injuries were more frequent during the nighttime than during the daytime (1.48/1000 opportunities vs. 0.70/1000 opportunities, respectively; OR, 2.04; 95% CI, 1.98-2.11). Extended work duration and night work were associated with an increased risk of percutaneous injuries in this study population of physicians during their first year of clinical training.

Lockley SW, Landrigan CP, Barger LK, Czeisler CA; Harvard Work Hours Health and Safety Group. When policy meets physiology: the challenge of reducing resident work hours. Clin Orthop Relat Res. 2006 Aug;449:116-27.

Considerable controversy exists regarding optimal work hours for physicians and surgeons in training. In a series of studies, The authors assessed the effect of extended work hours on resident sleep and health as well as patient safety. In a validated nationwide survey, The authors found that residents who had worked 24 hours or longer were 2.3 times more likely to have a motor vehicle crash following that shift than when they worked < 24 hours, and that the monthly risk of a crash increased by 16.2% after each extended duration shift. **The authors found in a randomized trial that interns working a traditional on-call schedule slept 5.8 hours less per week, had twice as many attentional failures on duty overnight, and made 36% more serious medical errors and nearly six times more serious diagnostic errors than when working on a schedule that limited continuous duty to 16 hours.** While numerous

opinions have been published opposing reductions in extended work hours due to concerns regarding continuity of patient care, reduced educational opportunities, and traditionally-defined professionalism, there are remarkably few objective data in support of continuing to schedule medical trainees to work shifts > 24 hours. An evidence-based approach is needed to minimize the well-documented risk that current work hour practices confer on resident health and patient safety while optimizing education and continuity of care.

Martini S, Arfken CL, Balon R. Comparison of burnout among medical residents before and after the implementation of work hours limits. Acad Psychiatry. 2006 Jul-Aug;30(4):352-5.

The authors assessed whether implementation of work hour limits is associated with a lower prevalence of medical resident burnout. A survey was mailed to medical residents in different medical specialties at one university. Somewhat lower burnout prevalence was reported among residents after implementation of work hour limits compared with the rates prior to the implementation period. **The decrease in burnout prevalence occurred primarily among PGY-1 residents. Prevalence of burnout increased with hours worked. Implementing work hour limits appeared to reduce burnout prevalence.**

Kiernan M, Civetta J, Bartus C, Walsh S. 24 hours on-call and acute fatigue no longer worsen resident mood under the 80-hour work week regulations. Curr Surg. 2006 May-Jun;63(3):237-41.

Studies in on-call residents have shown that mood is worsened by fatigue as indicated by increased scores on measures of depression, anxiety, confusion, and anger using the Profile of Mood States (POMS). In prior sleep deprivation studies, mood has been shown to be more affected than either cognitive or motor performances. The purpose of this study was to examine the effect of the 80-hour work week regulations on resident mood in general and in a post-call period (PC). Institutional Review Board approval was obtained to survey the residents and publish the results. POMS is a 65-item adjective questionnaire that includes subscales for measuring tension-anxiety, anger-hostility, depression-dejection, vigor-activity, fatigue-inertia, and confusion-bewilderment, with the summation of the scales forming a total mood disturbance score. Surgical residents were tested at a 9 am didactic curriculum session (9 am has been shown to correlate with the nadir of performance). Residents were tested after nights off call (NOC) or after PC. Time asleep in the preceding 24 hours and other demographic data were also collected. Acute fatigue (AF) was defined as <4 hours sleep. The two-sample t-test and linear regression were used to assess differences between groups.

A total of 123 standardized POMS mood questionnaires were administered on 4 occasions to 51 surgical residents, 35 men and 16 women at levels PGY-1 through PGY-5. **Overall, 33 tests (27%) were taken after PC and 90 (73%) were taken after NOC. Acute fatigue residents had a mean sleep time of 2.2 (+/-1.5) hours, whereas rested (R) residents had a mean sleep time of 6.7 (+/-2.2) hours (whether PC or NOC). No statistical differences in mean values of vigor, anger, depression, concentration, fatigue, tension, or total score were observed between PC and NOC or between AF and R residents. There was no significant relationship between acute sleep deprivation and total mood disturbance, whether PC or NOC. In linear relationships, NOC total score and hours slept had $r^2 = 0.01$ ($p = 0.44$), whereas PC total score and hours slept had $r^2 = 0.07$ ($p = 0.14$).** Although POMS was given 4 times, only 27% were PC, which reflects our 1 in 4 night in-house coverage. In contrast to earlier studies, resident mood, as measured by POMS, is no longer related to PC/NOC or acute fatigue. Previous studies have shown that loss of sleep was associated with declining mood. The lack of such a relationship in this study may be related to the new regulations. It has been assumed that people can adapt to chronic sleep loss but have a harder time coping with the effects of acute sleep deprivation. If, however, the new regulations have relieved chronic sleep deprivation, then a well-rested resident can periodically cope with the effects of acute sleep deprivation. Perhaps by eliminating chronic sleep debt, work hour restrictions seem to have removed the negative impact of PC seen in the prior era. Further studies should increase the

number of residents studied, have numerous repeat NOC and PC pairs in same subjects, and compare different services with different workloads, junior and senior residents, and in-house and at-home call schedules.

Smith AM, Morris P, Rowell KO, Clarke S, Jones TH, Channer KS. Junior doctors and the full shift rota--psychological and hormonal changes: a comparative cross-sectional study. Clin Med. 2006 Mar-Apr;6(2):174-7.

The authors studied the hormonal and psychological effect of the full shift rota on junior doctors after implementation of the European Working Time Directive, using a comparative, cross-sectional study design of male doctors in South Yorkshire. Cortisol and testosterone levels were measured and subjects completed the general health questionnaire (GHQ-12) and the androgen deficiency in the aging male screening questionnaire (ADAM), after a week of holiday (baseline), a week of nights, and a normal working week. **The results showed that cortisol levels decreased from 480.6 +/- 33.1 nmol/l at baseline (after a week of holiday), to 355.7 +/- 29.1 nmol/l post normal working week (p = 0.003); to 396.7 +/- 32.5 nmol/l post nights (p = 0.03). GHQ-12 scores increased from 0.5 +/- 0.3 at baseline, to 1.8 +/- 0.5 post normal working week (p = 0.02) and to 2.3 +/- 0.5 post nights (p = 0.005).** These results suggest that there are still appreciable physiological consequences with new work patterns.

Rosen IM, Gimotty PA, Shea JA, Bellini LM. Evolution of sleep quantity, sleep deprivation, mood disturbances, empathy, and burnout among interns. Acad Med. 2006 Jan;81(1):82-5.

To explore the relationships between sleep deprivation and the evolution of mood disturbances, empathy, and burnout among a cohort of interns. In 2002-03, 47 interns in the internal medicine resident program at the University of Pennsylvania School of Medicine completed the following instruments at baseline and at year end: sleep quantities, Epworth Sleepiness Scale, the Beck Depression Inventory-Short Form, the Interpersonal Reactivity Index, and the Maslach Burnout Inventory-Human Services Survey. The prevalence of acute and chronic sleep deprivation, subjective sleepiness, burnout, empathy, and depression at the beginning of the year were compared to prevalence at the end of internship. Associations between sleep deprivation and mood, empathy, or burnout were explored. **The prevalence of chronic sleep deprivation, depression, burnout, and empathy increased from baseline to year end. Specifically, the prevalence of "high" scores changed for chronic sleep deprivation (9% to 43%, p = .0001). The prevalence of moderate depression increased from 4.3% to 29.8% (p = .0002). Only 4.3% reported a high level of burnout initially compared with 55.3% at year end (p < .0001). Scores that were originally more favorable than general population norms (p < .001) approached norms at the end of the year for empathic concern (p = .15). There was an association between becoming chronically sleep deprived and becoming depressed (OR = 7, p = .014).** Given the association between chronic sleep deprivation and mood disturbances during internship, outcome assessment is warranted to see if duty-hour reform will translate into more hours slept or fewer hours worked, coincident with improved mood.

Saxena AD, George CF. Sleep and motor performance in on-call internal medicine residents. Sleep. 2005 Nov 1;28(11):1386-91.

To compare vigilance and performance among internal medicine residents doing in-house call versus residents not doing in-house call. Prospective study of resident cohorts with repeated testing. University Teaching Hospital. Internal medicine residents doing in-house call and residents not doing in-house call (pathology, endocrinology) (controls). Subjective sleepiness scores (daily Stanford Sleepiness Scale and Epworth Sleepiness Scale at start and end of the test period), actigraphy, and daily sleep logs as well as regular psychomotor vigilance testing using a Palm version (Walter Reed Army Institute of Research) of the Psychomotor Vigilance Test (PVT). Subjects were enrolled for a period of 28 to 32 days, which

included 4 to 6 on-call nights for the internal medicine residents. Controls took call from home. Participants were compensated for their time.

Twenty residents were evaluated, 13 internal medicine and 7 controls. **Overall median reaction time was slower in the internal medicine residents (264.7 +/- 102.9 vs 239.2 +/- 26.1 milliseconds; P < .001). Internal medicine residents showed no difference in reaction time postcall versus other periods (269.9 +/- 131.2 vs 263.6 +/- 95.6; P = .65). Actigraphic sleep time was shorter during on-call than noncall nights and in internal medicine residents as compared with controls (287.48 +/- 143.8 vs 453.49 +/- 178.5 and 476.08 +/- 71.9 minutes; P < .001). Internal medicine residents had significantly greater major and minor reaction-time lapses compared with controls (1.26 +/- 3.4 vs 0.53 +/- 1.1 & 2.4 +/- 7.4 vs 0.45 +/- 1.0; P < .001).** They reported increased sleepiness on postcall days compared with the start of their call (Stanford Sleepiness Scale: 3.26 +/- 1.2 vs 2.22 +/- 0.8; P < .001) but had scores similar to those of controls by their next call (2.22 +/- 0.8 vs 2.07 +/- 0.8; P = .13). Internal medicine residents have impaired reaction time and reduced vigilance compared with controls. Despite subjective improvements in sleepiness postcall, there was no change in their objective performance across the study period, suggesting no recovery. Internal medicine residents did not get extra sleep on postcall nights in an attempt to recover their lost sleep time. Implications for residents' well-being and patient care remain unclear.

Philibert I. Sleep loss and performance in residents and nonphysicians: A meta-analytic examination. *Sleep* 2005 Nov;28:1392-1402.

The article explored the effect of sleep loss on cognitive function, memory and vigilance in resident physicians and non-physicians, and on residents' clinical performance. It consisted of a meta-analysis of 60 studies on the effect of sleep deprivation, with a total sample of 959 physicians and 1,028 non-physicians and 5,295 individual effect indices. Outcome Measures included cognitive performance and performance on clinical tasks under acute and partial chronic sleep deprivation. Additional analyses stratified the data by physician/nonphysician, type of performance, and length and type of sleep loss, and assessed the combined effect of several of these factors.

Sleep loss of less than 30 hours reduced physicians' overall performance by nearly one standard deviation and clinical performance by more than 1.5 standard deviations. The effect of sleep deprivation was larger in non-physicians than in physicians (corrected d value -.995 vs. -.880), with these smaller effects likely resulting from "study factors," primarily variation in the hours without sleep prior and chronically reduced sleep in the "rested" controls in physician studies. The weekly hours and continuous wakefulness permitted under the current national limits for residents may not completely guard against the negative effect of sleep loss on cognitive and clinical performance. Research is needed to explore the effect of continuous duty periods and chronic partial sleep loss in residents, and to assess its clinical and educational consequences of sleep loss. The goal should be to combine scientifically based duty hour limits with broader efforts to enhance patient safety and resident learning.

Arnedt JT, Owens J, Crouch M, Stahl J, Carskadon MA. Neurobehavioral performance of residents after heavy night call vs. after alcohol ingestion. *JAMA*. 2005 Sep 7;294(9):1025-33.

The authors noted that concern exists about the effect of extended resident work hours; however, no study has evaluated training-related performance impairments against an accepted standard of functional impairment. To compare post-call performance during a heavy call rotation (every fourth or fifth night) to performance with a blood alcohol concentration of 0.04 to 0.05 g% (per 100 mL of blood) during a light call rotation, and to evaluate the association between self-assessed and actual performance.

A prospective 2-session within-subject study of 34 pediatric residents (18 women and 16 men; mean age, 28.7 years) in an academic medical center conducted between October 2001 and August 2003, who were

tested under 4 conditions: light call, light call with alcohol, heavy call, and heavy call with placebo. Residents attended a test session during the final week of a light call rotation (non-post-call) and during the final week of a heavy call rotation (post-call). At each session, they underwent a 60-minute test battery (light and heavy call conditions), ingested either alcohol (light call with alcohol condition) or placebo (heavy call with placebo condition), and repeated the test battery. Performance self-evaluations followed each test.

Outcome measures were sustained attention, vigilance, and simulated driving performance measures; and self-report sleepiness, performance, and effort measures. Participants achieved the target blood alcohol concentration. Compared with light call, heavy call reaction times were 7% slower (242.5 vs. 225.9 milliseconds, $P < .001$); commission errors were 40% higher (38.2% vs. 27.2%, $P < .001$); and lane variability (7.0 vs. 5.5 ft, $P < .001$) and speed variability (4.1 vs. 2.4 mph, $P < .001$) on the driving simulator were 27% and 71% greater, respectively. Speed variability was 29% greater in heavy call with placebo than light call with alcohol (4.2 vs. 3.2 mph, $P = .01$), and reaction time, lapses, omission errors, and off-roads were not different. Correlation between self-assessed and actual performance under heavy call was significant for commission errors ($r = -0.45$, $P = .01$), lane variability ($r = -0.76$, $P < .001$), and speed variability ($r = -0.71$, $P < .001$), but not for reaction time. Post-call performance impairment during a heavy call rotation is comparable with impairment associated with a 0.04 to 0.05 g% blood alcohol concentration during a light call rotation, as measured by sustained attention, vigilance, and simulated driving tasks. Residents' ability to judge this impairment may be limited and task-specific.

Cavallo A, Ris MD, Succop P, Jaskiewicz J. Melatonin treatment of pediatric residents for adaptation to night shift work. *Ambul Pediatr.* 2005 May-Jun;5(3):172-7.

Night float rotations are used in residency training programs to reduce residents' sleep deprivation. Night shift work, however, is accompanied by deleterious effects on sleep, mood, and attention. The authors sought to test whether melatonin reduces the deleterious effects of night shift work on sleep, mood, and attention in pediatric residents during night float rotation. Double-blind, randomized, placebo-controlled crossover. Participants took melatonin (3 mg) or a placebo before bedtime in the morning after night shift; completed a sleep diary and an adverse-effects questionnaire daily; and completed the Profile of Mood States and the Conners Continuous Performance Test 3 times in each study week to test mood and attention, respectively.

The setting was a university-affiliated, tertiary-care pediatric hospital, and the participants were healthy second-year pediatric residents working 2 night float rotations. Outcome measures were standardized measures of sleep, mood, and attention. Twenty-eight residents completed both treatments; 17 completed 1 treatment (10 placebo, 7 melatonin). **There was not a statistically significant difference in measures of sleep, mood, and 5 of 6 measures of attention during melatonin and placebo treatment. One measure of attention, the number of omission errors, was significantly lower on melatonin (3.0 +/- 9.6) than on placebo (4.5 +/- 17.5) ($z = -2.12$, $P = .03$). The isolated finding of improvement of 1 single measure of attention in a test situation during melatonin treatment was not sufficiently robust to demonstrate a beneficial effect of melatonin in the dose used. Other strategies need to be considered to help residents in adaptation to night shift work.**

Stoller EP, Papp KK, Aikens JE, Erokwu B, Strohl KP. Strategies Resident-Physicians Use to Manage Sleep Loss and Fatigue E-published in *Medical Education Online*, March 2005.

The author's purpose was to examine strategies or countermeasures resident-physicians used in dealing with the effects of sleep loss and fatigue during residency training. A total of 149 residents across five sites and six specialty areas were recruited for the study. Focus groups consisted of an average of seven

individuals in the same year of training and residency program, and included 60 interns and 89 senior residents. Trained moderators conducted focus groups using a semi-structured discussion guide. Transcripts were analyzed using the grounded theory tradition. **The range of strategies adopted was: Chemical, Dietary, Sleep Management, Behavioral, and Cognitive. Residents exhibited a trial-and-error approach to identifying management strategies. None mentioned searching the scientific literature or consulting local sleep medicine experts. Residents relied on putative countermeasures even when they were aware of their negative effects. The results document the need to educate resident physicians on self-care strategies during residency training.**

Barger LK, Cade BE, Ayas NT, Cronin JW, Rosner B, Speizer FE, Czeisler CA. Extended work shifts and the risk of motor vehicle crashes among interns. N Engl J Med. 2005 Jan 13; 352(2): 125-34.

Long work hours and work shifts of an extended duration (> or =24 hours) remain a hallmark of medical education in the United States. Yet their effect on health and safety has not been evaluated with the use of validated measures. The authors conducted a prospective nationwide, Web-based survey in which 2737 residents in their first postgraduate year (interns) completed 17,003 monthly reports that provided detailed information about work hours, work shifts of an extended duration, documented motor vehicle crashes, near-miss incidents, and incidents involving involuntary sleeping. **The odds ratios for reporting a motor vehicle crash and for reporting a near-miss incident after an extended work shift, as compared with a shift that was not of extended duration, were 2.3 (95 percent confidence interval, 1.6 to 3.3) and 5.9 (95 percent confidence interval, 5.4 to 6.3), respectively. In a prospective analysis, every extended work shift that was scheduled in a month increased the monthly risk of a motor vehicle crash by 9.1 percent (95 percent confidence interval, 3.4 to 14.7 percent) and increased the monthly risk of a crash during the commute from work by 16.2 percent (95 percent confidence interval, 7.8 to 24.7 percent). In months in which interns worked five or more extended shifts, the risk that they would fall asleep while driving or while stopped in traffic was significantly increased (odds ratios, 2.39 [95 percent confidence interval, 2.31 to 2.46] and 3.69 [95 percent confidence interval, 3.60 to 3.77], respectively).**

The authors concluded that extended-duration work shifts, which are currently sanctioned by the Accreditation Council for Graduate Medical Education, pose safety hazards for interns. These results have implications for medical residency programs, which routinely schedule physicians to work more than 24 consecutive hours.

Zohar D, Tzischinsky O, Epstein R, Lavie P. The effects of sleep loss on medical residents' emotional reactions to work events: a cognitive-energy model. Sleep. 2005 Jan 1;28(1):47-54.

This study investigated the relationship between sleep loss and emotional reactivity in medical residents. The authors hypothesized that this relationship is shaped by the effect of sleep loss on cognitive-energy resources required for coping with goal-disruptive events or for capitalizing on new opportunities offered by goal-enhancing events. The setting included 15 medical wards in 4 large hospitals in Israel, and the participants were 78 medical residents, 67% men, aged 26 to 39 years. Actigraphic sleep-wake cycles were measured for 5- to 7-day periods, surrounding nightshifts, every 6 months, covering the first 2 years of residency. During each study period, emotional reactivity was investigated using the experience-sampling methodology by which residents received 3 phone calls at random times during their working day for 3 consecutive days. These calls reminded them to fill out brief questionnaires concerning change of circumstances over the previous 15 minutes and to rate their emotional response to these circumstances using the Positive Affect and Negative Affect Scales. Fatigue at those times was measured by a subscale of the Profile of Mood States.

Multilevel regression analysis was used to determine the influence of sleep duration and sleep fragmentation on the emotional reactions to goal-disruptive and goal-enhancing daytime events. **The authors found that sleep loss intensified negative emotions and fatigue following daytime disruptive events, while positive emotion was mitigated following goal-enhancing events. Sleep loss also resulted in an overall elevated baseline for positive emotion. Sleep loss amplifies the negative emotive effects of disruptive events while reducing the positive effect of goal-enhancing events.** Methodologically, the study highlights the utility and advantages of event-level analysis as opposed to the current practice of random sampling of emotion states during waking hours, disregarding contextual factors associated with purposeful, goal-oriented behavior episodes.

Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, Lilly CM, Stone PH, Lockley SW, Bates DW, Czeisler CA. Effect of reducing interns' work hours on serious medical errors in intensive care units. N Engl J Med. 2004 Oct 28;351(18):1838-48.

See summary on page 77.

Papp KK, Stoller EP, Sage P, Aikens JE, Owens J, Avidan A, Phillips B, Rosen R, Strohl KP. The effects of sleep loss and fatigue on resident-physicians: a multi-institutional, mixed-method study. Acad Med. 2004 May;79(5):394-406.

The authors sought to identify and model the effects of sleep loss and fatigue on resident-physicians' professional lives and personal well-being. In 2001-02, 149 residents at five U.S. academic health centers and from six specialties (obstetrics-gynecology, emergency medicine, family medicine, internal medicine, pediatrics, surgery) were recruited for the study. Residents were all in good standing in their programs. In a mixed-methods design, focus groups consisted of an average of seven (range, three to 14) individuals in the same year of training and residency program, for a total of 60 interns and 89 senior residents. Trained moderators conducted focus groups using a standardized, semi-structured discussion guide. Participants also completed a 30-item quantitative questionnaire assessing sleepiness and workplace sleep attitudes that included the Epworth Sleepiness Scale (ESS).

Residents described multiple adverse effects of sleep loss and fatigue on learning and cognition; job performance, including professionalism and task performance; and personal life, including personal well-being and relationships with spouse or significant other and family. **Only 16% of the sample scored within the "normal" range on the ESS; 84% scored in the range for which clinical intervention is indicated. Sleepiness was consistent across institution, specialty, years of training, age, gender, marital status, and having children. More residents perceived that sleep loss and fatigue had major impact on their personal lives during residency, leaving many personal and social activities and meaningful personal pleasures deferred or postponed. Sleep loss and fatigue also had major impact on residents' abilities to perform their work.** This finding further substantiates the growing concern about the potential impact on professional development. These observations should be taken into account in developing new training guidelines and educational interventions for house staff.

Wyatt JK, Cajochen C, Ritz-De Cecco A, Czeisler CA, Dijk DJ. Low-dose repeated caffeine administration for circadian-phase-dependent performance degradation during extended wakefulness. Sleep. 2004 May 1;27(3):374-81.

The authors investigated whether the effectiveness of a novel high-frequency low-dose caffeine regimen in counteracting the deterioration of performance during extended wakefulness is related to its interaction with homeostatic or circadian signals modulating performance and sleep propensity. The study used a double-blind, placebo-controlled, parallel-group design in a 29-day forced desynchrony paradigm in

which the period of the sleep-wake cycle was scheduled to be 42.85 hours, i.e., far removed from the circadian range. Subjects were 16 healthy normal-sleeping men (aged 18-30 years). Caffeine (0.3 mg per kg per hour) or placebo was administered hourly during the 28.57-hour wake episodes.

The study found that plasma caffeine concentrations rose in an exponential saturating manner during wakefulness. Rising caffeine levels markedly attenuated wake-dependent deterioration of a number of measures of cognitive performance, particularly at the circadian performance nadir. Moreover, caffeine enhanced the ability of subjects to remain consistently awake for extended periods, holding subjects back from completing the full transition to sleep, but at the expense of increasing subjective sleepiness. The authors concluded that high-frequency low-dose caffeine administration is effective in countering the detrimental performance effects of extended wakefulness. These data are in accordance with the hypothesis that adenosine is a mediator of performance decrements associated with extended wakefulness and may lead to new strategies to use caffeine in situations in which neurobehavioral functioning is affected by sleep loss.

Baldwin DC Jr, Daugherty SR. Sleep deprivation and fatigue in residency training: results of a national survey of first- and second-year residents. *Sleep*. 2004 Mar 15;27(2):217-23.

The authors examined the relationship between residents' self-reported sleep hours, work hours, and other empirical correlates. Using the American Medical Association's Graduate Medical Education database, a national, random sample of PGY (postgraduate year) 1 and PGY2 residents in the 1998-1999 training year was surveyed by mail. Residents completed a 5-page survey with 44 questions requiring 144 separate responses about their residency experience. Completed surveys were received from 3,604 of 5,616 residents contacted, a 64.2% response rate. Although work hours and sleep hours were significantly correlated ($r = -.39$), this relationship was less robust than is generally assumed. Total average sleep hours varied across specialties but also within specialties. Just over 20% of all residents reported sleeping an average of 5 hours or less per night, with 66% averaging 6 hours or less per night. Residents averaging 5 or fewer hours of sleep per night were more likely to report serious accidents or injuries, conflict with other professional staff, use of alcohol, use of medications to stay awake, noticeable weight change, working in an "impaired condition," and having made significant medical errors. **Reduced sleep hours were significantly related to a number of work-related, learning, and personal health variables. Capping residents' work hours is unlikely to fully address the sleep deficits and resulting impairments reported by residents.**

Parshuram CS, Dhanani S, Kirsh JA, Cox PN. Fellowship training, workload, fatigue and physical stress: a prospective observational study. *CMAJ*. 2004 Mar 16;170(6):965-70.

Fatigue in physician trainees may compromise patient safety and the well-being of the trainees and limit the educational opportunities provided by training programs. Anecdotal evidence suggests that the on-call workload and physical demands experienced by trainees are significant despite duty-hour regulation and support from nursing staff, other trainees and staff physicians.

The authors measured the workload and the level of fatigue and physical stress of 11 senior fellows during 35 shifts in the critical care unit at the Hospital for Sick Children in Toronto. The authors determined number of rostered hours, number of admissions and discharges, number and type of procedures, nurse to patient ratios and related measures of workload. Fellows self-reported the number of pages they received and the amount of time they slept. The authors estimated physical stress by using a commercially available pedometer to measure the distance walked, by using ambulatory electrocardiographic monitoring to determine arrhythmias and by determining urine specific gravity and ketone levels to estimate hydration. The number of rostered hours was within current Ontario guidelines.

The mean shift duration was 25.5 hours (range 24-27 hours). The fellows worked on average 69 hours (range 55-106) per week. On average during a shift, the fellows received 41 pages, were on non-sleeping breaks for 1.2 hours, slept 1.9 hours and walked 6.3 km. Ketonuria was found in participants in seven (21%) of the 33 shifts during which it was measured. Arrhythmia (1 atrial, 1 ventricular) or heart rate abnormalities occurred in all six participants. These fellows were the most senior in-house physician for a mean of 9.4 hours per shift and were responsible for performing invasive procedures in two-thirds of their shifts. **The authors found that established Canadian and proposed American guidelines expose trainees to significant on-call workload, physical stress and sleep deprivation.**

Bartel P, Offermeier W, Smith F, Becker P. Attention and working memory in resident anesthetists after night duty: group and individual effects. *Occup Environ Med.* 2004 Feb; 61(2):167-70.

The authors investigated the effects of a single period of night duty on measures of attention and working memory in a group of residents (registrars) in anesthesiology. Emphasis was placed on individual deficits using a reference point of the equivalent effect of a blood alcohol concentration (BAC) >0.05% determined by other researchers. There were 33 subjects aged 26-42 years. Night duty was performed on a weekly basis. Baseline assessments were conducted at either 08 15 or 08 55 preceding night duty and repeated 24-25 hours later, just after the completion of duty. Questionnaires included items regarding duration of sleep and the Stanford Sleepiness Scale. A battery of four reaction time (RT) tasks of increasing difficulty, lasting approximately 35 minutes, was administered on a personal computer. These ranged from simple RT to progressively more complex RT tasks incorporating working memory. A significant change was regarded as >15% deterioration in respect of speed or accuracy.

The mean duration of sleep preceding night duty was 7.04 hours and 1.66 hours during the period of night duty. Inter-group comparisons revealed significant prolongation in mean response speed in the first three tests. Mean accuracy was significantly reduced only in respect of the two more complex tests. A >15% deterioration in response speed occurred in up to 30% of subjects on a single task, rising to 52% (17/33) overall. Deterioration occurred in a patchy distribution in most subjects, involving no more than one or two of the four tasks. As regards accuracy, the prevalence of deterioration increased with task complexity. The results were in general agreement with previous group analyses. A new dimension was added by the analysis of a broad spectrum of individual response to sleep deprivation. The effects of sleep loss in residents cannot be overlooked, even in a relatively benign work schedule.

Mak SK, Spurgeon P. The effects of acute sleep deprivation on performance of medical residents in a regional hospital: prospective study. *Hong Kong Med J.* 2004 Feb;10(1):14-20.

The authors sought to evaluate the effects of acute sleep deprivation on the level of perceived occupational stress and cognitive functioning in a group of medical residents. Subjects were 21 residents who had regular in-hospital on-call duties. From January to April 2002, participants were asked to complete the Raven Advanced Progressive Matrices (sets I and II) and Occupational Stress Inventory-Revised tests at the beginning of an on-call day. They then repeated the tests towards the end of their on-call duties on their next on-call day, at a mean (standard deviation) interval of 8.9 (2.3) days. Occupational Stress Inventory-Revised test scores were transformed into T-scores to provide information about an individual's scores relative to the scores of participants in a normative sample. The group slept for a mean (standard deviation) of 2.9 (1.0) hours during 29.3 (3.8) hours of on-call duties. **Before the on-call duties, participants' mean T-scores for the Occupational Stress Inventory-Revised test ranged from 50.6 to 54.5 for the Occupational Role Questionnaire, 52.0 to 57.0 for the Personal Strain Questionnaire, and 37.3 to 52.3 for the Personal Resources Questionnaire. After on-call duties, apart from a slight increase in Role Insufficiency T-scores (50.6 [5.9] versus 52.1 [6.0]);**

P=0.044), there was no significant change in all other scales of the Occupational Stress Inventory-Revised test. The scores of the Raven Advanced Progressive Matrices test remained stable after the on-call duties (11.3 [1.2] versus 11.5 [0.8], P=0.129 for set I; 29.9 [5.5] versus 30.2 [6.3], P=0.2 for set II). The authors concluded that acute sleep deprivation among medical residents was not associated with any significant changes in both cognitive functioning and level of stress perceived.

Gabbe SG, Morgan MA, Power ML, Schulkin J, Williams SB. Duty hours and pregnancy outcome among residents in obstetrics and gynecology. *Obstet Gynecol.* 2003 Nov;102(5 Pt 1):948-51.

The authors sought to assess the present status of resident duty hours in obstetrics and gynecology, identify existing policies concerning work schedules during pregnancy, and evaluate pregnancy outcome in female house officers. A questionnaire-based study was administered to residents taking the 2001 Council on Residency Education in Obstetrics and Gynecology examination. More than 90% of the residents reported that their institution had a maternity leave policy. The leave was usually four to eight weeks long and was paid. Nearly 95% of residents reported that they had to take over the work of residents on maternity leave. Most women residents worked more than 80 hours weekly throughout pregnancy, and few took time off before delivery. Most pregnancies occurred during the fourth year of training and did not seem to be adversely affected by the long work hours. **This study, performed before the institution of the new Accreditation Council for Graduate Medical Education resident duty hour policies, demonstrated that, although women house officers continued to work more than 80 hours per week during pregnancy, most had a good pregnancy outcome. Nevertheless, there was a higher frequency of preterm labor, preeclampsia, and fetal growth restriction in female residents than in spouses or partners of male residents.**

Horowitz TS, Cade BE, Wolfe JM, Czeisler CA. Searching night and day: a dissociation of effects of circadian phase and time awake on visual selective attention and vigilance. *Psychol Sci.* 2003 Nov;14(6):549-57.

How does sleepiness affect selective attention? The authors studied the effect of circadian phase and time awake on visual search. The generalized-cognitive-slowness hypothesis predicts that search rate will be slower, feature guidance less effective, and response time (RT) lengthened when observers are sleepy. Observers performed spatial-configuration (finding a 5 among 2s) and conjunction (finding red vertical among red horizontal and green vertical) search tasks during 38 hr of wakefulness under constant conditions. Adverse circadian phases and elapsed time awake did lead to increased RT (corrected for errors). However, contrary to the hypothesis, search rates (indexed by RT x Set Size slopes) were constant across the protocol. This was true for conjunction as well as for spatial-configuration search, indicating that feature guidance was also insensitive to sleepiness. The locus of sleepiness effects on search is probably downstream from the bottleneck of attentional selection. Observers did trade accuracy for speed when sleepy. This implicates decision-stage impairments.

Eastridge BJ, Hamilton EC, O'Keefe GE, Rege RV, Valentine RJ, Jones DJ, Tesfay S, Thal ER. Effect of sleep deprivation on the performance of simulated laparoscopic surgical skill. *Am J Surg.* 2003 Aug;186(2):169-74.

Resident work hours may impact patient care. The authors hypothesized that "call-associated" acute sleep deprivation has no effect on technical dexterity as measured on a minimally invasive surgery trainer, virtual reality (MIST VR) surgical simulator. Thirty-five surgical residents were prospectively evaluated pre-call (rested), on-call (rested), and post-call (acutely sleep deprived). Participants completed questionnaires regarding sleep hours and level of fatigue. Technical skill was assessed using the MIST

VR. Speed, errors, and economy of motion were automatically recorded by the MIST VR computer simulator. Data were analyzed by paired Student t test and analysis of variance.

The findings showed that estimated hours of sleep and subjective indicators of fatigue were different between rested and sleep-deprived residents. The number of errors and time to complete all tasks increased at the post-call assessment. Resident work schedules lead to sleep deprivation and fatigue. Call-associated sleep deprivation and fatigue are associated with increased technical errors in the performance of simulated laparoscopic surgical skills.

Hull JT, Wright KP Jr, Czeisler CA. The influence of subjective alertness and motivation on human performance independent of circadian and homeostatic regulation. J Biol Rhythms. 2003 Aug;18(4):329-38.

Endogenous circadian rhythmicity and sleep-wake homeostasis are robust regulators of human alertness and performance, yet few studies have examined how these regulatory processes affect motivation. Moreover, the influence of alertness and motivation on performance, independent of circadian phase and hours awake, has not been studied. Healthy subjects, 12 males and three females, ages 20 to 41, participated in a two-week 28-h forced desynchrony protocol to address these issues. Subjects performed a battery of tests every two hours during scheduled wakefulness. Performance on a mathematical addition test and ratings of alertness and motivation on visual analog scales were analyzed. Performance scores were categorized as being associated with the highest or lowest alertness and motivation ratings for each circadian phase/hours awake bin to determine whether high levels of alertness and motivation resulted in higher performance scores above and beyond the effects of circadian and homeostatic regulation.

Motivation varied significantly as a function of circadian phase and hours awake. Motivation and alertness were correlated. When circadian phase and hours awake were accounted for, performance was better when alertness and motivation ratings were highest and worse when those ratings were lowest. The present findings suggest that human performance is influenced by alertness and motivation independent of circadian phase and hours awake. Future studies examining the influence of circadian phase and sleep-wake homeostasis on human performance also should assess alertness and motivation to aid in the interpretation of performance data. Such studies also may aid in the development of countermeasures to improve human performance.

Shmuel S, Shlomo V, Natali B, Ayala L, Eliezer K. [Driver drowsiness--are physicians at a special risk?] Harefuah. 2003 May;142(5):338-41, 399, 398.

Sleepiness at the wheel is the main cause of approximately a fifth of road traffic accidents. The driver will often feel drowsy before the accident, therefore preventive measures can be taken in order to stay alert. The authors sought to estimate sleepiness among sleep deprived drivers and to explore methods they use to stay alert. They chose three professions at increased risk of sleepiness: physicians working night shifts, night shift nurses and hi-tech workers who work 12 hours or more a day at least twice a week. The subjects answered an anonymous questionnaire concerning past involvement in road accidents or "near misses", known risk factors for road accidents and methods used to fight sleepiness, as well as some demographic data.

A total of 115 drivers (38 physicians, 37 nurses and 40 hi-tech workers) participated in this study. The average age was 36.0 + 7.9 years and 53% males. **Thirteen percent had been involved in road accidents as drivers in the last year, 53% of them remember that the accident was due to sleepiness or fatigue. Thirty-seven percent remember at least one occasion of "near accident" due to sleepiness. Driving in the "dangerous" hours was positively associated with "near accidents" (69% vs. 29%, p < 0.001) and in accidents (17% vs. 11% P = NS). Physicians were involved in "near accidents" (p < 0.005) more often. The most frequent methods used to overcome sleepiness were:**

listening to the radio (86.1%), opening the window (65.2%) and turning on the air conditioning in the car (57.4%). The authors concluded that driving whilst sleepy is an important contributor to road accidents. It seems that sleep deprived workers and especially physicians working in shifts, are at an increased risk. This issue should receive a higher priority as part of preventive medicine among physicians themselves and their patients.

Buysse DJ, Barzansky B, Dinges D, Hogan E, Hunt CE, Owens J, Rosekind M, Rosen R, Simon F, Veasey S, Wiest F. Sleep, fatigue, and medical training: setting an agenda for optimal learning and patient care. Sleep. 2003 Mar 15;26(2):218-25.

The difficult issues surrounding discussions of sleep, fatigue, and medical education stem from an ironic biologic truth: physicians share a common physiology with their patients, a physiology that includes an absolute need for sleep and endogenous circadian rhythms governing alertness and performance. The authors noted that the community cannot ignore the fact that patients become ill and require medical care at all times of the day and night, but also cannot escape the fact that providing such care requires that medical professionals, including medical trainees, be awake and functioning at times that are in conflict with their endogenous sleep and circadian physiology. Finally, the community cannot avoid the reality that medical education requires long hours in a constrained number of years. Solutions to the problem of sleep and fatigue in medical education will require the active involvement of numerous parties, ranging from trainees themselves to training program directors, hospital administrators, sleep and circadian scientists, and government funding and regulatory agencies. Each of these parties can be informed by previous laboratory and field studies in a variety of operational settings, including medical environments. Education regarding the known effects of sleep, circadian rhythms, and sleep deprivation can help to elevate the general level of discourse and point to potential solutions. Empiric research addressing the effects of sleep loss on patient safety, education outcomes, and resident health is urgently needed: equally important are the development and assessment of innovative countermeasures to maximize performance and learning. Addressing the economic realities of any changes in resident work hours is an essential component of any discussion of these issues. **Finally, work-hour regulations may serve as one component of improved sleep and circadian health for medical trainees, but they should not be seen as substitutes for more original solutions that rely less on enforcement and more on collaboration.** By working together to address the problems of sleep and fatigue in its own trainees, the medical field can provide a valuable legacy to patients and to future generations of healthcare providers--a legacy of optimal medical education, healthy doctors, and healthy patients.

Rollinson DC, Rathlev NK, Moss M, Killiany R, Sassower KC, Auerbach S, Fish SS. The effects of consecutive night shifts on neuropsychological performance of interns in the emergency department: a pilot study. Ann Emerg Med. 2003 Mar;41(3):400-6.

The authors obtained preliminary information on the neuropsychological performance of house officers at the beginning and end of a shift while they worked consecutive night shifts in the emergency department. They prospectively studied interns working 12-hour consecutive night shifts in an urban Level I trauma center ED. All consecutive non-emergency medicine interns rotating for one month were eligible except those older than 40 years and those with sleep disorders or depression (identified by using the Profile of Mood Scale, Sleep Diagnostic Questionnaire). The authors tested research subjects at the beginning of a day shift and at the beginning and end of night shifts 1 and 3 of four consecutive night shifts at times of estimated baseline wakefulness (10 PM) and maximum fatigue (3 AM). The authors used 3 standardized neuropsychological tests: (1) Delayed Recognition Span Test (visual memory capacity); (2) Continuous Performance Test (attentional function, vigilance); and (3) Santa Ana Form Board Test (psychomotor speed, coordination).

The authors analyzed data with mixed-model analysis, with research subject as a random effect. Thirteen interns were eligible, and one declined. Twelve interns (six men and six women; age range 25 to 35 years) were enrolled. **The Delayed Recognition Span Test (number correct before first error) revealed significant deterioration from the beginning of the shift to the end of the shift (mean difference -2.2; 95% confidence interval -3.1 to -1.3). This represents an 18.5% decrease in visual memory capacity. There were no significant differences found for the other tests. Interns working nights demonstrated a significant reduction in visual memory capacity across the night shift. Research involving neuropsychological performance during night shifts in the ED is important. It might provide valuable insights into ways to improve performance during night shifts.**

Howard SK, Gaba DM, Rosekind MR, Zarcone VP. The risks and implications of excessive daytime sleepiness in resident physicians. Acad Med. 2002 Oct;77(10):1019-25.

The purpose of the study was to assess the levels of physiologic and subjective sleepiness in residents in three conditions: (1) during a normal (baseline) work schedule, (2) after an in-hospital 24-hour on-call period, and (3) following a period of extended sleep. In 1996, a within-subjects, repeated-measures study was performed with a volunteer sample of 11 anesthesia residents from the Stanford University School of Medicine using three separate experimental conditions. Sixteen residents were recruited and 11 of the 16 completed the three separate experimental conditions. Daytime sleepiness was assessed using the Multiple Sleep Latency Test (MSLT).

The results showed that the MSLT scores were shorter in the baseline (6.7 min) and post-call (4.9 min) conditions, compared with the extended-sleep condition (12 min, $p = .0001$) and there was no significant difference between the baseline and post-call conditions ($p = .07$). There was a significant main effect for both condition ($p = .0001$) and time of day ($p = .0003$). Subjects were inaccurate in subjectively identifying sleep onset compared with EEG measures (incorrect on 49% of EEG-determined sleep episodes). The authors concluded that residents' daytime sleepiness in both baseline and post-call conditions was near or below levels associated with clinical sleep disorders. Extending sleep time resulted in normal levels of daytime sleepiness. The residents were subjectively inaccurate determining EEG-defined sleep onset. Based on the findings from this and other studies, reforms of residents' work and duty hours are justified.

Veasey S, Rosen R, Barzansky B, Rosen I, Owens J. Sleep loss and fatigue in residency training: a reappraisal. JAMA 2002 Sep 4;288(9):1116-24

Reduced sleep time is commonplace for many interns and residents. Recent studies, however, suggest that sleep loss and fatigue result in significant neurobehavioral impairments in healthy young adults. The authors reviewed studies addressing the effects of sleep loss on cognition, performance, and health in surgical and nonsurgical residents. They also discussed the effectiveness of countermeasures for sleepiness, including recent work-hour restrictions. A more complete understanding of the issues of sleep loss during residency training can inform innovative strategies to minimize the effects of sleepiness and fatigue on patient care and resident safety.

Cavallo A, Jaskiewicz J, Ris MD. Impact of night-float rotation on sleep, mood, and alertness: the resident's perception. Chronobiol Int. 2002 Sep;19(5):893-902.

See summary on page 121.

Rosekind MR, Boyd JN, Gregory KB, Glotzbach SF, Blank RC. Alertness management in 24/7 settings: lessons from aviation. *Occup Med.* 2002 Apr-Jun;17(2):247-59, iv.

Round-the-clock operational requirements pose physiological challenges for human operators. Fatigue due to sleep loss and circadian disruption can reduce safety, performance quality, and alertness. The authors describe the physiological factors underlying fatigue and provide examples from NASA research in aviation settings that demonstrate how fatigue affects real-world operations. **A comprehensive alertness management approach to address fatigue effectively includes education, alertness strategies, scheduling, policy, and healthy sleep components.** There is a need for cultural change that will encourage attitudes, behaviors, and practices that will reduce fatigue-related risks and improve safety, performance, and alertness in 24/7 operational settings.

Akerstedt T, Olsson B, Ingre M, Holmgren M, Kecklund G. A 6-hour working day--effects on health and well-being. *J Hum Ergol (Tokyo).* 2001 Dec;30(1-2):197-202.

The effect of the total amount of work hours and the benefits of a shortening is frequently debated, but very little data is available. The present study compared a group (N = 41) that obtained a 9 h reduction of the working week (to a 6 h day) with a comparison group (N = 22) that retained normal work hours. Both groups were constituted of mainly female health care and day care nursery personnel. The experimental group retained full pay and extra personnel were employed to compensate for loss of hours. Questionnaire data were obtained before and 1 year after the change. The data were analyzed using a two-factor NOVA with the interaction term year*group as the main focus. The results showed a significant interaction of year*group for social factors, sleep quality, mental fatigue, and heart/respiratory complaints, and attitude to work hours. In all cases the experimental group improved whereas the control group did not change. It was concluded that shortened work hours have clear social effects and moderate effects on well-being.

Defoe DM, Power ML, Holzman GB, Carpentieri A, Schulkin J. Long hours and little sleep: work schedules of residents in obstetrics and gynecology. *Obstetrics and Gynecology* 2001 June;97(6):1015-1018.

To investigate residents' work schedules and their attitudes toward limiting their hours, an anonymous survey regarding resident work hours and call schedules was administered to the 4674 obstetric-gynecologic residents who took the year 2000 Council on Resident Education in Obstetrics and Gynecology in-training examination.

A total of 4510 surveys were analyzed (96.5%). Three of four (75.5%) respondents reported working between 61 and 100 hours each week. Most (71.3%) reported sleeping less than 3 hours while on night call. Eight of ten reported having postcall clinical responsibilities. The reported number of hours on call declined and the reported number of hours of sleep increased with year of residency. Three of four residents wanted limits on their work hours. Residents who reported longer on-call hours or less sleep during night shift were significantly more likely to want a restriction on work hours. **Fatigue was the most commonly selected reason (77.6%) followed by "need more personal time" (76.3%), and "fear of compromising quality of care" (59.8%). Women were more concerned about fatigue than were men. Among residents who did not want work hour restrictions, "additional surgical experience" was the most commonly selected reason (69.0%).**

Residents in obstetrics and gynecology report working long hours, and experiencing periods of little sleep. Most want their work hours to be limited. Fatigue is a major concern among residents that want their hours limited. A sizable minority worries that such limits might also limit their experience.

Levey RE. Sources of stress for residents and recommendations for programs to assist them.

Academic Medicine 2001 Feb;76(2):142-150.

Bridging the gap between graduation from medical school and being board eligible in a medical specialty is a lengthy and arduous process. The fact that stress is typical during the residency training period is well-documented in the literature, as are its many situational, professional, and personal sources, which the author reviews: heavy work-load, sleep deprivation, difficult patients, poor learning environments, relocation issues, isolation and social problems, financial concerns, cultural and minority issues, information overload, and career planning issues. Stress can also stem from and exacerbate gender-related issues and problems for significant others, spouses, and family members. **The author also describes less commonly documented sources of stress-often overlooked or postponed so long that stresses are inevitable for all concerned.** These are associated with residents who perform marginally and in some cases should not have been passed on from medical school, or who are studying specialties not compatible with their skills and personalities, or who foster severe interpersonal problems on the job. Common effects of stress include anxiety, depression, obsessive-compulsive trends, hostility, and alcohol and substance abuse.

To respond to the problems that these many stressors present to residents, the Accreditation Council for Graduate Medical Education (ACGME) requires that all post-medical-school medical training programs make assistance services available for all residents. The author outlines essential elements of an assistance program, states how important such problems can be in saving both residents and their institutions needless difficulties and costs, and presents important issues for the consideration of all involved in residents' training.

Kowalenko T, Haas-Kowalenko J, Rabinovich A, Grzybowski M. Emergency medicine residency related MVCs? Is sleep deprivation a risk factor? Academic Emergency Medicine 2000;7(5):451.

Objectives: To determine the prevalence of MVCs and near-MVCs and the proportion due to sleep deprivation in EM residents. Hypothesis: EM residents are involved in MVCs due to sleep deprivation, and training characteristics contribute to this risk. Methods: EM residents were surveyed regarding driving history prior to and during residency, sleep duration, call schedule, shift or service, distance driven, season, gender and PGY status. Data were analyzed by appropriate repeated analysis techniques. **Sixty-seven (56%) of EM residency programs responded, with 697 residents completing surveys. 121 (17%) residents had 157 MVCs. The proportion of MVCs due to falling asleep was increased during as compared to before residency, (19.3% v. 4.1%, p<0.001, odds ratio = 6.7). MVCs were associated with 0 hrs of sleep (27%), PGY-I status (50%), while on EM (54%), surgery (20%), or IM (18%) rotations, q 4 day call schedule (40%), and spring season (37%). 331 (51%) of residents had 1260 near-MVCs. There was an increased prevalence of near-MVCs due to falling asleep at the wheel during versus before residency (60.3% v. 25.7%). Conclusion: EM residents are 6.7 times more likely to have a MVC due to falling asleep at the wheel during their residency.**

Mozurkewich EL, Luke B, Avni M, Wolf FM. Working conditions and adverse pregnancy outcome: a meta-analysis. Obstetrics and Gynecology 2000;95:623-635.

To evaluate the association between working conditions and adverse pregnancy outcomes by performing a meta-analysis of published studies. The authors searched the English-language literature in MEDLINE through August 1999 using the terms standing, posture, work, workload, working conditions, shift, occupational exposure, occupational diseases, lifting, pregnancy complications, pregnancy, small for gestational age (SGA), fetal growth retardation (FGR), preterm, and labor.

The researchers included observational studies evaluating the effect of one or more of the following work-related exposures on adverse pregnancy outcome: physically demanding work, prolonged standing, long work hours, shift work, and cumulative work fatigue score. Outcomes of interest were preterm birth,

hypertension or preeclampsia, and SGA. They conducted a meta-analysis based on 160,988 women in 29 studies to evaluate the association of physically demanding work, prolonged standing, long working hours, shift work, and cumulative work fatigue score with preterm birth. Also analyzed were the associations of physically demanding work with hypertension or preeclampsia and SGA infants. The data were analyzed using the Peto-modified Mantel-Haenszel method to estimate the pooled odds ratios (ORs) and 95% confidence intervals (CIs).

Physically demanding work was significantly associated with preterm birth (OR 1.22, 95% CI 1.16, 1.29), SGA (OR 1.37, 95% CI 1.30, 1.44), and hypertension or preeclampsia (OR 1.60, 95% CI 1.30, 1.96). Other occupational exposures significantly associated with preterm birth included prolonged standing (OR 1.26, 95% CI 1.13, 1.40), shift and night work (OR 1.24, 95% CI 1.06, 1.46), and high cumulative work fatigue score (OR 1.63, 95% CI 1.33, 1.98). The authors found no significant association between long work hours and preterm birth (OR 1.03, 95% CI 0.92, 1.16). The study concluded that physically demanding work may significantly increase a woman's risk of adverse pregnancy outcome.

Stone MD, Doyle J, Bosch RJ, Bothe A Jr, Steele G Jr. Effect of resident call status on ABSITE performance. American Board of Surgery In-Training Examination. Surgery 2000 Sep;128(3):465-471.

Long work hours that result in fatigue may adversely affect cognitive function. Chronically sleep-deprived surgical residents fear that being on call the night before sitting for a standardized test puts them at a potential disadvantage. The authors examined American Board of Surgery In-Training Examination (ABSITE) scores to assess the effect of call status on exam performance.

The study used results of the 1994 ABSITE for 424 residents in 15 New England general surgery programs were collected. The authors compared standard scores of residents for the total test, clinical management, and basic science components with resident call status (on/off) for the night before the exam. The results showed that **differences were apparent in total test scores (mean: off, 496.1; on, 466.0; P <.03) and clinical management scores (mean: off, 504.3; on, 470.6; P <.02) (t test, Mann-Whitney U test). Multivariate analyses revealed that differences in postgraduate year level and training track were significant contributors to differences in scores in all test components (analysis of covariance). Call status was not a significant factor in score variation after adjusting for these two factors.** The authors concluded that differences in ABSITE scores of residents were related to postgraduate year level and training track. Call status had no significant effect on ABSITE performance.

Steele MT, Ma OJ, Watson WA, Thomas HA. Emergency medicine residents' shiftwork tolerance and preference. Acad Emerg Med. 2000 Jun;7(6):670-3.

The study sought to determine the shift lengths currently worked by emergency medicine (EM) residents and their shift length preferences, and to determine factors associated with EM residents' subjective tolerance of shiftwork. A survey was sent to EM-2 through EM-4 allopathic EM residents in May 1996. This questionnaire assessed the residents' shift length worked, shift length preferences, night shift schedules, and self-reported ability to overcome drowsiness, sleep flexibility, and morningness-eveningness tendencies. When providing shift length preferences, the residents were asked to assume a constant total number of hours scheduled per month. Seventy-eight programs participated, and 62% of 1,554 eligible residents returned usable surveys. Current shift lengths worked were 8 hours (12%), 10 hours (13%), 12 hours (37%), combinations of 8-hour, 10-hour, or 12-hour (34%) shifts, and other

combinations (4%). Seventy-three percent of the respondents indicated that they preferred to work 8-hour or 10-hour shifts, and only 21% preferred a 12-hour shift. Shiftwork tolerance was recorded as: not well at all (2%), not very well (14%), fairly well (70%), and very well (14%). The EM residents' eveningness preference, ability to overcome drowsiness, sleep flexibility, younger age, and having no children at home were all associated with greater shiftwork tolerance. **CONCLUSIONS:** Emergency medicine residents generally tolerate shiftwork well and prefer 8-hour or 10-hour shift lengths compared with 12-hour shift lengths. Emergency medicine residencies with 12-hour shifts should consider changing residents' shifts to shorter shifts.

Steele MT, MA OJ, Watson WA, Thomas HA, Muelleman RL. The occupational risk of motor vehicle collisions for emergency medicine residents. Academic Emergency Medicine 1999;610:1050-1053.

The study sought to determine the prevalence and risk factors associated with motor vehicle collisions (MVCs) and near-crashes as reported by emergency medicine (EM) residents following various ED shifts. A survey was sent to all allopathic EM-2-EM-4 residents in May 1996 asking whether they had ever been involved in an MVC or near-crash while driving home after an ED shift. The residents' night shift schedules, self-reported tolerance of night work, ability to overcome drowsiness, sleep flexibility, and morningness/eveningness tendencies also were collected.

Seventy-eight programs participated and 62% of 1,554 eligible residents returned usable surveys. **Seventy-six (8%, 95% CI = 6% to 10%) residents reported having 96 crashes and 553 (58%, 95% CI = 55% to 61%) residents reported being involved in 1,446 near-crashes. Nearly three fourths of the MVCs and 80% of the near-crashes followed the night shift. Stepwise logistic regression of all variables demonstrated a cumulative association (R = 0.19, p = 0.0004) that accounted for 4% of the observed variability in MVCs and near-crashes. Univariate analysis showed that MVCs and near-crashes were inversely related to residents' shiftwork tolerance (p = 0.019) and positively related to the number of night shifts worked per month (p = 0.035).** The authors concluded that residents reported being involved in a higher number of MVCs and near-crashes while driving home after a night shift compared with other shifts. Driving home after a night shift appears to be a significant occupational risk for EM residents.

Suskin N, Ryan G, Fardy J, Clarke H, McKelvie R. Clinical workload decreases the level of aerobic fitness in housestaff physicians. Journ Cardiopulm Rehab. 1998 May-Jun;18(3):216-220.

The study examined the relationship between clinical workload and aerobic fitness. Twenty healthy intern and resident volunteers were studied in a cross over manner to compare their aerobic fitness after a one-month "easy" clinical rotation (ECR) to that after a one-month "hard" clinical rotation (HCR). The ECR and HCR were prospectively estimated as requiring <60 (ECR) and >70 (HCR) total hours per week of hospital work respectively. Aerobic fitness was determined by directly measuring peak oxygen uptake (peakVO₂) during peak cycle exercise testing after each rotation. Clinical workload for the month preceding the exercise test was estimated by documenting the amount of hospital work and sleep lost because of on-call duties. The average weekly amount of effective aerobic training for each rotation was also documented. **Trainees had a 206.4 (P = 0.0019, 95% CI 94-318.8) mL/min or 3 mL/kg/min (P = 0.0019, 95% CI 1.5-4.4) improvement of peakVO₂ after the ECR compared with the HCR. Trainees averaged 1 (95% CI 0.16-1.81) less hour per week of exercise training, 34.1 more hours per week of hospital work (95% CI 23.0-45.3, P < 0.0001) and lost 19.1 hours more sleep per month (95% CI 11.8-26.4, p < 0.0001) during the HCR compared with the ECR. There was no correlation between changes in peakVO₂ and changes in exercise training between the two rotations.** The authors concluded that clinical workload seems to adversely affect aerobic fitness independent of changes in exercise training. This supports previous less-objective survey data.

Marcus CL, Loughlin GM. Effect of sleep deprivation on driving safety in housestaff. Sleep 1996;19:763-766.

Sleep deprivation is known to affect driving safety. Residents are routinely sleep-deprived when on call. The authors hypothesized that this would affect their driving. They administered questionnaires regarding driving to 70 pediatric residents, who were on call every fourth night, and to 85 faculty members, who were rarely disturbed at night. Residents were questioned about events during their residency, and faculty were questioned about events during the preceding three years. There was an 87% response rate for each group.

Residents slept 2.7 +/- 0.9 (SD) hours when on call vs 7.2 +/- 0.8 hours when not on call (p < 0.001). 44% of residents had fallen asleep when stopped at a light, vs. 12.5% faculty (p < 0.001). 23% of the residents had fallen asleep while driving vs. 8% FAC (ns). A total of 49% of residents had fallen asleep at the wheel; 90% of these events occurred post-call. In contrast, only 13% of faculty had fallen asleep at the wheel (p < 0.001). Residents had received a total of 25 traffic citations for moving violations vs. 15 for faculty and were involved in 20 motor vehicle accidents vs. 11 for faculty. One traffic citation clearly resulted from a resident falling asleep at the wheel vs. none for faculty. The authors concluded that residents frequently fall asleep when driving post-call. The authors speculated that current resident work schedules might place some residents at risk for injury to themselves and others. Further study, using prospectively objective measures is indicated.

Spurgeon A, Harrington JM, Cooper CL. Health and safety problems associated with long working hours: a review of the current position. Occup Environ Med. 1997 Jun;54(6):367-75.

The European Community Directive on Working Time, which should have been implemented in member states of the European Community by November 1996, contains several requirements related to working hours, including the right of employees to refuse to work more than 48 hours a week. The United Kingdom government attempted to oppose the Directive, arguing that there is no convincing evidence that hours of work should be limited on health and safety grounds. Much of the research in this area has focused on the problems of shiftworking and previous reviews have therefore tended to emphasize this aspect of working hours. However, there is much less information about the effects of overtime work, which is a central element of the terms of the Directive. This paper reviews the current evidence relating to the potential effects on health and performance of extensions to the normal working day. Several gaps in the literature are identified.

Research to date has been restricted to a limited range of health outcomes--namely, mental health and cardiovascular disorders. Other potential effects which are normally associated with stress--for example, gastrointestinal disorders, musculoskeletal disorders, and problems associated with depression of the immune system, have received little attention. Also, there have been few systematic investigations of performance effects, and little consideration of the implications for occupational exposure limits of extensions to the working day. Existing data relate largely to situations where working hours exceed 50 a week and there is a lack of information on hours below this level, which is of direct relevance to the European Community proposal. Finally, it is clear from investigations relating to shiftwork that a range of modifying factors are likely to influence the level and nature of health and performance outcomes. These include the attitudes and motivation of the people concerned, the job requirements, and other aspects of the organizational and cultural climate. It is concluded that there is currently sufficient evidence to raise concerns about the risks to health and safety of long working hours. However, much more work is required to define the level and nature of those risks.

Richardson GS, Wyatt JK, Sullivan JP, Orav EJ, Ward AE, Wolf MA, Czeisler CA. Objective assessment of sleep and alertness in medical house staff and the impact of protected time for sleep. Sleep 1996 Nov;19(9):718-726.

The authors studied 26 physicians in postgraduate medical training ("house staff") to objectively quantify their sleep, alertness, and psychomotor performance while working on call. This study provided precise data on the extent of sleep deprivation during a typical call night, the workload factors predictive of sleep loss, and the extent to which protected time for sleep within the call night can ameliorate sleep loss and consequent daytime sleepiness. They used ambulatory EEG recording equipment and a standardized computer-based performance test to monitor sleep and alertness over the course of a 36-hour call day. Comparisons were made between interns provided with four hours of protected time for sleep by a covering resident ("night-float") and interns without such coverage. **The authors found evidence that hospital interns were severely sleep-deprived, to an extent even greater than prior behavioral observations have suggested. Interns in both conditions spent an average of less than five hours (295.4 minutes) in bed attempting to sleep and obtained an average of 3.67 hours (220.1 minutes) of sleep (range 37.4-358.4 minutes). Provision of the night-float for 4 hours did not significantly change total sleep time (TST) (212.8 minutes covered vs. 224.9 minutes uncovered), but sleep efficiency was significantly improved (86.5% vs. 70.3%; $p = 0.001$). Covered interns also obtained significantly more slow-wave sleep than the uncovered interns (65.4 minutes vs. 51.1 minutes; $p = 0.05$). However, measures of alertness and performance were not significantly different between the two groups and were only weakly related to TST.** These data suggest that significant chronic sleep deprivation is relatively unaffected by sleep obtained in the hospital and that provision of protected time for sleep does not significantly improve TST.

Rosekind MR, Smith RM, Miller DL, Co EL, Gregory KB, Webbon LL, Gander PH, Lebacqz JV. Alertness management: strategic naps in operational settings. J Sleep Res. 1995 Dec;4(S2):62-66.

Managing fatigue in complex operational settings requires attention to multiple factors, including hours of service, scheduling, education and training, counter-measures, technology, and research. Alertness-management strategies can be used to promote safety, performance, and productivity in operational settings. These strategies can involve both preventive (used prior to duty/shift) and operational (used during duty/shift) approaches. Studies have demonstrated the effectiveness of naps to improve subsequent performance and alertness. Strategic naps can be used effectively to promote performance and alertness in operational settings. Two potential negative effects of naps, sleep inertia and effects on subsequent sleep periods, are discussed. Sleep inertia can involve sleepiness and decreased performance immediately upon awakening from a nap. It should be a consideration prior to implementing nap strategies in work environments.

A study of planned rest periods in long-haul flight operations demonstrated the effectiveness of in-flight naps to promote performance and alertness during subsequent critical phases of flight (descent and landing). Empirical evaluation of alertness-management strategies during regular operations will be critical to their implementation. Combining strategies may be the most effective approach to managing fatigue engendered by 24-h operational demands. Other considerations prior to implementing alertness-management strategies in operational environments are discussed.

Lingensfelder T, Kaschel R, Weber A, Zaiser-Kaschel H, Jakober B, Kuper J. Young hospital doctors after night duty: their task-specific cognitive status and emotional condition. Med Educ. 1994 Nov;28(6):566-72.

Sleep deprivation is an unpleasant burden of young hospital doctors during their medical training. It may disrupt the balance between coping strategies available to them and the professional demands

encountered. Impaired medical care offered by sleep-deprived juniors may be a consequence. Valid research work on this subject is rare and surprisingly contradictory. Therefore, they evaluated the task-specific cognitive status and emotional condition of 40 young hospital doctors (27 men and 13 women, 29.9 +/- 2.9 years of age) at the University of Tuebingen, all of whom were in the beginning of their academic career. Subjects were tested twice acting as their own control, once at 8.00 am after a night off duty (OD) (at least 6 hours of uninterrupted sleep), and once at a similar time after a night on call (OC) being in the hospital for 24 hours. Standardized and reliable psychometric tests thought to represent daily routine medical function were performed.

On-call activities were recorded by means of a sleep diary, whereas a questionnaire interrogated aspects of private and professional life. Neuropsychological function deteriorated significantly: number connection test (per cent of norms +/- SD, 103.2 +/- 9.8 OC vs. 107.8 +/- 10.5 OD, F = 27.7, P < 0.001), things-to-do list (correct items +/- SD, 6.7 +/- 1.2 OC vs. 7.4 +/- 1.5 OD, F = 12.7, P < 0.01), Vienna reaction timer (per cent of norms +/- SD, 95.6 +/- 9.0 OC vs. 97.7 +/- 10.4 OD, F = 4.8, P < 0.05), Stroop test (T-values +/- SD, 59.7 +/- 6.3 OC vs. 64.6 +/- 7.1 OD, F = 37.1, P < 0.001), ECG test (correct responses +/- SD, 38.3 +/- 7.3 OC vs. 43.4 +/- 6.5 OD, F = 45.2, P < 0.001) and status of mood (T-value +/- SD, 60.3 +/- 9.0 OC vs. 54.0 +/- 6.6 OD, F = 19.6, P < 0.001). Cognitive function and mood status of young hospital doctors after a night on call decrease considerably. In view of the special vulnerability of medical trainees to occupational stress all efforts are warranted to reduce sleep deprivation in the medical profession.

Klebanoff MA, Shiono PH, and Rhoads GG. Spontaneous and induced abortion among resident physicians. Journal of the American Medical Association 1991;261(21):2821-5.

Female resident physicians are believed to be at an increased risk for a variety of third-trimester pregnancy complications. However, early pregnancy complications have been less well studied.

The results compare spontaneous and induced abortions in a nationally representative sample of 5096 female medical school graduates (who experienced 1284 pregnancies) and of the sexual partners of 5000 of their male classmates (who experienced 1481 pregnancies). The response to the survey was 86.1%. **The life-table probability of spontaneous abortion was 14.8% for female residents compared with 12.6% for the sexual partners of male residents. However, female residents were more likely than the male residents' sexual partners to terminate a pregnancy voluntarily (8.2% vs. 2.7%). The increased risk of voluntary termination persisted when only married women were studied (3.6% vs. 1.4%). However, female residents' pregnancies were at approximately half the risk of voluntary termination compared with pregnancies among the general US population of women aged 25 to 34 years.** These results provide reassurance to those residents who would like to become pregnant but are concerned about the possible effect of their occupation on the course of the pregnancy.

Samkoff JS, Jacques CH. A review of studies concerning effects of sleep deprivation and fatigue on residents' performance. Academic Medicine 1991 Nov;66(11):687-693.

Possible effects of sleep deprivation and fatigue on the performance and well-being of residents have received little scientific examination until recently. This article is a review of the studies on this topic published since 1970. All those studies that dealt with residents' moods and attitudes demonstrated deleterious effects of sleep deprivation and fatigue. The implications of this finding for patient care deserve exploration. **Residents' acuity on performance tests requiring prolonged vigilance tended to deteriorate with acute sleep loss, while their performances on most brief psychomotor tests measuring manual dexterity, reaction times, and short-term recall were not adversely affected. The data presently available suggest that sleep-deprived or fatigued house officers can compensate for sleep loss in crises or other novel situations. However, sleep-deprived residents may be more prone to errors on routine, repetitive tasks and tasks that require sustained vigilance, which form a**

substantial portion of residents' workload. The authors concur with the recommendation of the Executive Council of the Association of American Medical Colleges that the total working hours for residents should not exceed 80 hours per week averaged over four weeks.

Klebanoff MA, Shiono PH, Rhoads GG. Outcomes of pregnancy in a national sample of resident physicians. *New England Journal of Medicine* 1990;323:1040-5.

The authors noted that physically demanding, highly stressful work during pregnancy has been reported to cause a variety of adverse outcomes. It has been difficult, however, to separate the effects of work from those of socioeconomic status. They assessed the issue by means of a national questionnaire-based survey. They studied the outcomes of pregnancy during residency for 4412 women who graduated from medical school in 1985 and for the wives of 4236 of their male classmates, who served as controls.

The rate of response to the survey was 87 percent (4412 of 5079) for the women residents and 85 percent (4236 of 4968) for the wives of the male residents. **There were no significant differences in the proportion of pregnancies ending in miscarriage (13.8 percent for residents vs. 11.8 percent for their classmates' wives, $P = 0.12$), ectopic gestations (0.5 percent vs. 0.8 percent, $P = 0.69$), and stillbirths (0.2 percent vs. 0.5 percent, $P = 0.20$). There were 989 women residents and 1238 residents' wives whose first pregnancy during residency resulted in the live birth of a singleton infant. Although during each trimester the women residents worked many more hours than the wives of the male residents, the frequency of preterm births (less than 37 weeks' gestation) was similar: 6.5 percent for residents and 6.0 percent for residents' wives (odds ratio = 1.1; 95 percent confidence interval, 0.7 to 1.5). Infants who were small for gestational age (with birth weights less than the 10th percentile for gestational age) were born to 5.3 percent of the residents and 5.8 percent of the residents' wives (odds ratio = 0.9; 95 percent confidence interval, 0.6 to 1.3). Adjustment for factors that differed between the women residents and the wives of male residents resulted in odds ratios of 1.2 (95 percent confidence interval, 0.8 to 1.7) for preterm delivery and 0.9 (95 percent confidence interval, 0.6 to 1.3) for the delivery of an infant who was small for gestational age. However, the women residents more frequently reported having had preterm labor (11 percent vs. 6 percent), but not preterm delivery (6.5 percent vs. 6.0 percent); preeclampsia was also more common among the women residents (8.8 percent vs. 3.5 percent). These results suggest that working long hours in a stressful occupation has little effect on the outcome of pregnancy in an otherwise healthy population of high socioeconomic status.**

Osborn LM, Harris DL, Reading JC, and Prather MB. Outcome of pregnancies experienced during residency. *The Journal of Family Practice* 1990;31(6):618-22.

To investigate potential adverse effects of residency training on pregnancy outcome, a cohort study was conducted among 45 university-affiliated residency programs. Outcomes of the first pregnancy experienced during residency were compared between 92 female residents and 144 spouses of male residents. **Despite long hours, sleep deprivation, and an increase in perceived stress, the female residents were as likely to give birth to a live, full-term newborn as the spouses of male residents. For white cohort members, an increased risk of premature labor without delivery was identified (RR = 12.3, 95% confidence interval 2.4-61.6). No significant differences were found in prematurity, spontaneous and therapeutic abortions, or presence of congenital abnormalities in the infants.** Method of delivery and use of anesthetics and of other medications were similar in both groups. Pregnancy outcomes between the two groups were similar; however, the increased risk for premature labor among female residents is a cause for concern and should be further investigated.

Grunebaum A, Minkoff H, Blake D. Pregnancy among obstetricians: a comparison of births before,

during and after residency. American Journal of Obstetrics and Gynecology 1987;157:79-83.

Questionnaires were sent to 1025 female board-certified obstetricians, and information was retrieved about pregnancy outcome. A total of 454 pregnancies, one third of which occurred during residency, were evaluated, and the relationship between pregnancy outcome and residency was assessed.

Children of primiparous women who were delivered during or after residency had significantly lower mean birth weights than those who were delivered before residency (p less than 0.001 and p less than 0.005, respectively), whereas birth weights of infants born to multiparous women were not significantly different. The low birth weight rate (less than 2500 gm) was significantly increased during residency (p less than 0.002), and infants born during residency were 7.5 times more likely to be growth retarded than those born outside residency (p less than 0.002). The incidence of other pregnancy complications was not found to be increased during residency. The data suggest a potentially negative impact of residency on the birth weights of infants born to female obstetricians in training.

Reuben DB. Depressive symptoms in medical house officers: effects of level of training and work rotation. Archives of Internal Medicine 1985; 145:286-288.

To measure depressive symptoms in medical house officers, a self-report questionnaire was administered to 68 medical house officers each month for an academic year. Of 844 possible responses, 737 forms were completed (87.3%). **Although the overall prevalence of depressive symptoms (21.4%) approximated that of the general population, subpopulations of residents with high prevalence rates of depressive symptoms could be identified. A 28.7% prevalence rate of depressive symptoms was noted for postgraduate year 1 (PGY-1) residents. Prevalence rates fell with each successive year of training. Depressive symptoms occurred in 34.8% of PGY-1 residents on ward rotations. Similarly, responses from PGY-1 and PGY-2 residents on intensive care rotations indicated prevalence rates of depressive symptoms for both groups of greater than 33%.** The impact of these symptoms on resident function and patient care has yet to be determined.

Data from the International Community

XII. Impact of International Duty Hour Regulations on Graduate Medical Education

Schijven MP, Reznick RK, Ten Cate OT, Grantcharov TP, Regehr G, Satterthwaite L, Thijssen AS, Macrae HM. Transatlantic comparison of the competence of surgeons at the start of their professional career. Br J Surg. 2010 Jan 21. [Epub ahead of print]

The objective in European Union and North American surgical residency programmes is similar-to train competent surgeons. However, residents' working hours are different. It was hypothesized that practice-ready surgeons with more working hours would perform significantly better than those being educated within shorter working week curricula. At each test site, 21 practice-ready candidate surgeons were recruited. Twenty qualified Canadian and 19 qualified Dutch surgeons served as examiners. At both sites, three validated outcome instruments assessing multiple aspects of surgical competency were used.

No significant differences were found in performance on the integrative and cognitive examination (Comprehensive Integrative Puzzle) or the technical skills test (Objective Structured Assessment of Technical Skill; OSATS). A significant difference in outcome was observed only on the Patient Assessment and Management Examination, which focuses on skills needed to manage patients with complex problems ($P < 0.001$). A significant interaction was observed between examiner and candidate origins for both task-specific OSATS checklist ($P = 0.001$) and OSATS global rating scale ($P < 0.001$) scores. Canadian residents, serving many more working hours, perform equivalently to Dutch residents when assessed on technical skills and cognitive knowledge, but outperformed Dutch residents in skills for patient management. Secondary analyses suggested that cultural differences influence the assessment process significantly.

Rodríguez D, Christopoulos P, Martins N, Pärgrmäe P, Werner HM. Working conditions survey and trainees situation: new approach to auditing the situation of European trainees in obstetrics and gynecology ten years later. Eur J Obstet Gynecol Reprod Biol. 2009 Dec;147(2):130-4.

The authors sought to (1) review the training and working conditions for trainees in obstetrics and gynecology (Ob/Gyn) in Europe, and (2) suggest further improvements in working conditions for trainees in Ob/Gyn. This was an observational, descriptive, and cross-sectional study. The sample is constituted of the answers from the representatives of 25 European Network of Trainees in Ob/Gyn (ENTOG) member countries to a survey designed by ENTOG's executive. The current survey is based on the former ENTOG working conditions survey published in 1997, but has been extended to include questions that have become important recently, and to include new countries that have entered the European Union (EU) since that time. The total number of trainees represented in this study is 6056. The male/female ratio is 35/65.

The average number of official working hours is 51.6 h weekly, but varies widely. The average number of duties/month is five, but varies widely from two to nine. Fewer than 50% of countries have a hospital visitation system implemented. Training abroad is possible in most training systems. Compared with the 1997 survey further harmonization is taking place. Steps towards harmonization are being made. Hospital visitation systems should be further introduced. Not all countries have remunerated training posts. Assessment should become more homogeneous. Compliance with the European Working Time Directive (EWTD) is a big challenge.

Fernandez E, Williams DG. Training and the European Working Time Directive: a 7 year review of pediatric anesthetic trainee caseload data. Br J Anaesth. 2009 Oct;103(4):566-9.

The implementation of the European Working Time Directive (WTD) has reduced the hours worked by trainees in the UK to a maximum of 56 h per week. With a further and final reduction to 48 h per week scheduled for August 2009, there is concern amongst doctors about the impact on training and on patient care. Paediatric anaesthesia is one of the specialist areas of anaesthesia for which the Royal College of Anaesthetists (RCoA) recommends a minimum caseload during the period of advanced training.

We conducted a retrospective analysis of theatre logbook data from 62 Specialist Registrars (SpRs) who had completed a 12 month period of advanced training in paediatric anaesthesia in our institution between 2000 and 2007. **After the implementation of the WTD 56 h week in 2004, the mean total number of cases performed by SpRs per year decreased from 441 to 336, a 24% reduction. We found a statistically significant reduction across all age groups with the largest reduction in the under 1 month of age group. The post-WTD group did not meet the RCoA recommended total minimum caseload or the minimum number of cases of <1 yr of age. Since the implementation of the WTD, there has been a significant reduction in the number of cases performed by SpRs in paediatric anaesthesia and they are no longer achieving the RCoA recommended minimum numbers for advanced training.**

Medford AR. Post-certificate of completion of training fellowships. Clin Med. 2009 Oct;9(5):441-3.

Postgraduate medical training has changed. There is a significant reduction in hours of experience and training time due to the European Working Time Directive, a relative lag in substantive consultant post expansion and a resulting 'bulge' of trainees joining the specialist register having attained a Certificate of Completion of Training (CCT). Until the necessary expansion takes place, it is therefore less likely that all post-CCT trainees will immediately acquire substantive positions. Traditional historical alternatives for career progression at this point have been a locum consultancy, a period of research or an overseas fellowship. This article discusses the pros and cons of another more controversial alternative: a post-CCT fellowship.

Melarkode K, Abdelaal A, Bass S. Training in paediatric anaesthesia for registrars--UK National survey. Paediatr Anaesth. 2009 Sep;19(9):872-8.

The aim of this National survey was to review the training provided in paediatric anaesthesia to all registrars across all deaneries in the United Kingdom. The Royal College of Anaesthetists (RCA) recognizes training in paediatric anaesthesia as an important training module for specialist registrars in years 1 and 2 of their training and recommends that this training should be delivered in 1-3-month blocks. METHODS: This was a simple online survey (<http://www.esurveyspro.com>). We aimed to contact all registrars via the Association of Paediatric Anaesthetists of Great Britain and Ireland and the RCA.

The survey indicated that there is wide variation in the duration of modular training across all deaneries. **Three hundred and sixty-two registrars (65.5%) thought that the implementation of the European working time directives (EWTD) would hamper training in this specialty. One hundred and sixty-seven trainees (42.7%) spent more than 75% of their time doing paediatric anaesthesia during their training module. Only 34 trainees (6.4%) had the opportunity to anesthetize children every week in District General Hospitals (DGHs), while 280 trainees (53.03%) said they did not have regular paediatric lists in DGHs. It will be necessary to increase the duration of modular training with the implementation of EWTD.** Modular training in paediatric anaesthesia should be provided as a dedicated and protected module. Training opportunities in DGHs are limited. There is also a need for new guidelines, as current guidelines regarding paediatric anaesthesia training will be outdated with the implementation of EWTD.

Papaspyros SC, Javangula KC, O'Regan DJ. Surgical training in the 48-h week: a novel simulation and educational tool. From amateur golfer to professional pilot. Eur J Cardiothorac Surg. 2009 Sep;36(3):511-5.

Compliance with the European Working Time Directive has made obvious the need for a surgical skills training system that will produce surgeons fast and reliably. We have previously proposed a model for objective assessment of surgical dexterity. In this paper we aim to place an updated version of that model into the context of a holistic approach on assessment of a trainee's progress towards becoming an independently operating surgeon. The PAR matrix breaks down an operation into clearly defined skills that need to be successively acquired. It consists of a 3 x 6 table depicting 18 skill-goals. The y-axis is divided into six levels and the x-axis into three columns. The initials of the three skills on each level form the acronym PAR. Each skill is further graded from 1 to 3 (unsatisfactory, competent, good). The levels are: Level 1--posture, address, relaxation; Level 2--pick-up, airtime, rotation; Level 3--placing, angles, rhythm; Level 4--precision, adaptability, reproducibility; Level 5--pace, awareness, relations; Level 6--planning, announce, review/reflection.

The format of the PAR model is such that it allows trainer and trainee to objectively assess progress, identify deficiencies and strengths and formulate an appropriate plan of action. Ergonomics and crew resource management skills are essential for a safe operating environment. The PAR matrix may prove helpful in selection of trainees and revalidation of trainee surgeons as a competence and performance testing method, placed in the appropriate training curriculum.

Biswas D, Rafferty A, Jassar P. Night emergency cover for ENT in England: a national survey. J Laryngol Otol. 2009 Aug;123(8):899-902.

To evaluate the quality of out-of-hours ENT on-call cover by junior doctors, in view of the European Working Time Directive and the recent changes in the National Health Service workforce due to the 'Modernising Medical Careers' initiative, in England. We performed a national survey of first-on-call doctors for ENT, using a telephone questionnaire. Hospital contact details were sourced from the National Health Service website. The inclusion criterion was hospitals providing acute ENT facilities overnight in England. RESULTS: One hundred and nineteen hospitals were contacted; 91 were eligible, and 83 interviews were conducted. **The grade of the first-on-call ENT doctor ranged from foundation year two (19 per cent) to registrar level or above (13 per cent). Forty-nine respondents (68 per cent) reported having no previous ENT experience. Fifty-three respondents (74 per cent) covered more than one specialty at night, with seven (10 per cent) covering four or more specialties. The second-on-call doctor was non-resident in 63 cases (88 per cent). Thirty respondents (42 per cent) stated that they did not feel comfortable managing common ENT emergencies as the first doctor on call. Otorhinolaryngology induction courses were offered in 37 of the respondents' hospitals (51 per cent), these courses were of varying duration. Night-time ENT care is often provided by junior doctors with little experience of the specialty, who are often also responsible for covering multiple specialties. Many reported not feeling comfortable managing common ENT emergencies.** Structured induction programs would help to provide basic knowledge and should be mandatory for all doctors covering ENT.

Cappuccio FP, Bakewell A, Taggart FM, Ward G, Ji C, Sullivan JP, Edmunds M, Pounder R, Landrigan CP, Lockley SW, Peile E; Warwick EWTD Working Group. Implementing a 48 h EWTD-compliant rota for junior doctors in the UK does not compromise patients' safety: assessor-blind pilot comparison. QJM. 2009 Apr;102(4):271-82.

There are currently no field data about the effect of implementing European Working Time Directive (EWTD)-compliant rotas in a medical setting. Surveys of doctors' subjective opinions on shift work have not provided reliable objective data with which to evaluate its efficacy. We studied the effects on patient's

safety and doctors' work-sleep patterns of implementing an EWTD-compliant 48 h work week in a single-blind intervention study carried out over a 12-week period at the University Hospitals Coventry & Warwickshire NHS Trust. We hypothesized that medical error rates would be reduced following the new rota. Nineteen junior doctors, nine studied while working an intervention schedule of <48 h per week and 10 studied while working traditional weeks of <56 h scheduled hours in medical wards. Work hours and sleep duration were recorded daily. Rate of medical errors (per 1000 patient-days), identified using an established active surveillance methodology, were compared for the Intervention and Traditional wards. Two senior physicians blinded to rota independently rated all suspected errors.

Average scheduled work hours were significantly lower on the intervention schedule [43.2 (SD 7.7) (range 26.0-60.0) vs. 52.4 (11.2) (30.0-77.0) h/week; P < 0.001], and there was a non-significant trend for increased total sleep time per day [7.26 (0.36) vs. 6.75 (0.40) h; P = 0.095]. During a total of 4782 patient-days involving 481 admissions, 32.7% fewer total medical errors occurred during the intervention than during the traditional rota (27.6 vs. 41.0 per 1000 patient-days, P = 0.006), including 82.6% fewer intercepted potential adverse events (1.2 vs. 6.9 per 1000 patient-days, P = 0.002) and 31.4% fewer non-intercepted potential adverse events (16.6 vs. 24.2 per 1000 patient-days, P = 0.067). Doctors reported worse educational opportunities on the intervention rota. While concerns remain regarding reduced educational opportunities, our study supports the hypothesis that a 48 h work week coupled with targeted efforts to improve sleep hygiene improves patient safety.

Al-Rawi S, Spargo P. A retrospective study of anesthetic caseload of Specialist Registrars following the introduction of new working patterns in the Wessex region. *Anaesthesia*. 2009 Mar;64(3):297-300.

The impact of implementing the European Working Time Directive (EWTD) and the consequent reduction in hours of work has led to concerns about training. This retrospective study compared total caseload, obstetric caseload, out-of-hours caseload and supervision levels of trainee anesthetists in one region of the UK (Wessex) before and after the implementation of EWTD compliant rotas. **Anesthetic trainee logbooks submitted at the annual Record of In-Training Assessment were compared between the years 1999 and 2006. The logbook data was divided into two groups, group A (13-h shift) and group B (24-h on-call rota). There was no difference in total caseload, obstetric caseload or supervision. Out-of-hours caseload was greater in group A (p < 0.01).**

Jaffer A, Bednarz B, Challacombe B, Sriprasad S. The assessment of surgical competency in the UK. *Int J Surg*. 2009 Feb;7(1):12-5.

The assessment of surgical competence is a vital component of the surgical training process, the accreditation of specialists, and the maintenance of public confidence in the surgical profession [Grantcharov TP, Bardram L, Funch-Jensen P, Rosenberg J. Assessment of technical surgical skills. *Eur J Surg* 2002;168:139-44.]. The introduction of the Calman system, the European Working Time Directive, the Hospital at Night project, and financial pressures to increase productivity has nearly halved the surgical case load that trainees are exposed to. **With less time to acquire surgical proficiency, surgeons may be insufficiently skilled at completion of training [Moorthy K, Munz Y, Sarker SK, Darzi A. Objective assessment of technical skills in surgery. *BMJ* 2003;327:1032-7.]. We look at the current methods of assessing surgical competency and what new innovative methods are on the horizon.**

A Medline search was performed in April 2005 using the keywords 'surgical training', 'surgical competence', 'surgical simulation' and 'virtual reality'. Only papers published in English have been cited in this review. Articles were reviewed for relevance, impact within the field, and applicability to the UK training system. A large number of articles explore the potential of training techniques - including wet

and dry laboratories, computer simulators and virtual reality trainers - to complement traditional 'apprenticeship' surgical training. All of the methods demonstrate the ability to distinguish surgeons of varying competence. The advantages of the training methods discussed are many and there is great enthusiasm for introducing skills assessment within a nationally standardized and validated surgical curriculum [Aggarwal R, Moorthy K, Darzi A. Laparoscopic skills training and assessment. *Br J Surg* 2004;91:1549-58.], as well as using it as an adjunct to traditional methods of training.

Hanlon JG, Hayter MA, Bould MD, Joo HS, Naik VN. Perceived sleepiness in Canadian anesthesia residents: a national survey. *Can J Anaesth.* 2009 Jan;56(1):27-34.

See summary on page 136.

Taoda K, Nakamura K, Kitahara T, Nishiyama K. Sleeping and working hours of residents at a national university hospital in Japan. *Ind Health.* 2008 Dec;46(6):594-600.

See summary on page 136.

Skipworth RJ, Terrace JD, Fulton LA, Anderson DN. Basic surgical training in the era of the European Working Time Directive: what are the problems and solutions? *Scott Med J.* 2008 Nov;53(4):18-21.

Imposed reductions in working hours will impact significantly on the ability of surgical trainees to achieve competency. The objective of this study was to obtain the opinions of Scottish surgical trainees concerning the training they receive, in order to inform and guide the development of future, high-standard training programs. The authors conducted an anonymous questionnaire was sent to basic surgical trainees on the Edinburgh, Aberdeen and Dundee Basic Surgical Rotations commencing after August 2002. Thirty six questionnaire responses were analyzed.

Very few of the returned comments were complimentary to the existing training structure; indeed, most comments demonstrated significant trainee disappointment. **Despite "regular" exposure to operative sessions, training tutorials and named consultant trainers, the most common concern was a perceived lack of high-quality, structured, operative exposure and responsibility. Textbooks and journals remain the most frequently utilized learning tools, with high-tech systems such as teleconferencing, videos, CD-ROMS, and DVDs being poorly exploited.** Current surgical training is not meeting the expectation of the majority of its trainees. To solve this problem will require extensive revision of attitudes and current educational format. A greater emphasis on the integration of 21st century learning tools in the training program may help bridge this gap.

Bowhay AR. An investigation into how the European Working Time Directive has affected anesthetic training. *BMC Med Educ.* 2008 Aug 12;8:41.

The European Working Time Directive (EWTD) became law in 1993 but only applied to doctors in training in the United Kingdom in 2004. The trainees have in consequence had a reduction in their working hours but also a change to a shift pattern of working. For craft specialties, such as anesthesia, there are concerns that a reduction in working hours has also led to a reduction in the time available for learning and that ultimately this may affect patient care. However, there is scant research on the perceptions of trainees concerning the impact of the EWTD on their training and working lives. This study investigated what the anesthetic Specialist Registrars (SpRs) on the Mersey Deanery SpR rotation perceived to be training and also what effect the EWTD has had on that training and their quality of life,

both within and outside work. The project was a cross sectional survey, using a quantitative questionnaire with qualitative free text comments which were aggregated into overarching themes and sub themes.

117 SpRs were sent questionnaires in April 2005; 73 completed questionnaires were returned (response rate 62.4%). Hierarchies of training opportunities emerged with training by consultants being most valued. **71.8% (95% CI 60.7-81.3) of trainees believed the EWTD has had a deleterious effect on their training and experience and 74.3% (95% CI 63.2-83.4) thought that they will be less prepared for a consultant post. 69.9% (95% CI 58.7-79.5) considered that their quality of life outside work had deteriorated, with only 15% (95% CI 8.3-24.6) finding improvement. 38.6% (95% CI 27.8-50.3) felt they were not functioning as well as doctors, only 14.3% (95% CI 7.6-23.9) noting improvement. The trainees were still positive about anaesthesia and 73.2% (95% CI 62.2-82.5) would recommend this specialty to a student. The majority of anesthetic SpRs in the Mersey Deanery have not welcomed the changes brought by the EWTD to their training, experience and quality of life outside work.**

Elbadrawy M, Majoko F, Gasson J. Impact of Calman system and recent reforms on surgical training in gynaecology. J Obstet Gynaecol. 2008 Jul;28(5):474-7.

Specialist training in the UK has been affected by changes in recent years aimed at a reduction in junior doctors' working hours to comply with employment regulations and the introduction of structured training with specified duration. The Calman reforms implemented in 1996 introduced a focused system with defined competencies and a shorter training period. The previous system was based on experience gained in an apprentice-type setting with no defined duration of training. The European Working Time Directive (EWTD) regulates the number of working hours for junior doctors and aims for a 48-h working week by 2009. In the surgical disciplines a reduction in working hours and shorter duration of training could adversely affect the acquisition of operative skills. The concern among trainees and their trainers was that surgical exposure has been reduced and therefore trainees have limited surgical experience by the time they complete training. We conducted this study in a teaching district hospital to determine the effect of recent changes on gynecological surgical training.

We found that there was a 27% reduction in surgical activity between 1995 and 2005 from 3,789 to 2,781, whereas the number of trainees had increased by 67% from 6 to 10. The proportion of operative procedures performed by trainees decreased from 55% (2,078/3,789) in 1995 to 34% (951/2,781) in 2005 ($p < 0.001$). The average number of procedures performed by each trainee in 2005 was 95 compared with 346 in 1995, a 73% reduction ($p < 0.001$). Innovative approaches to surgical training in gynecology are required to produce a competent surgeon in a shorter time, or the risk of future consultants having limited surgical experience will increase.

Searle RD, Lyons G. Vanishing experience in training for obstetric general anaesthesia: an observational study. Int J Obstet Anesth. 2008 Jul;17(3):233-7.

Changes in the delivery of anaesthesia for caesarean section have meant that trainee experience in obstetric general anaesthesia has steadily declined. In the UK, working patterns for trainees have changed significantly with the introduction of the New Deal in 2000 and the European Working Time Directive in 2004. Because of an impression that training opportunities had worsened during this period we have reviewed data in obstetric general anaesthesia at St James's University Hospital since 1998. Data were collected retrospectively from prospective audit information contained within annual reviews collated by the Department of Obstetric Anaesthesia, St James's University Hospital Leeds between 1998 and 2006. Results before and after the implementation of training changes in 2000 and 2004 were compared.

Since 1998 the total number of obstetric general anaesthetics given per year has continued to decline. The number of trainees increased from 23 in 1998 to 40 in 2006, with the main increase occurring

between 2002 and 2003. The mean number of obstetric general anesthetics given per trainee fell to 1 per year in 2006. Since 1998 training opportunities in general anesthesia for caesarean section at St James's Hospital have continued to decline. This reflects both changing trends in the delivery of anesthesia for caesarean section and also changes in training hours and trainee numbers.

Lobato RD, Fernández-Alén J, Alday R. The impact of resident work hour limitations on medical student clerkships in Spain. *Neurocirugia (Astur)*. 2008 Jun;19(3):213-217.

The influence of new regulations limiting residents work hours on the total time dedicated and the quality of teaching of medical students in university hospitals is analyzed. Though different studies have shown contradictory results on the possible effects of reduced-hour work week on both patients, safety and resident learning, a great concern is arising in Europe and Japan where duty-hour restriction is much more drastic than in USA (48 and 40 hours vs. 80 hours, respectively). Deterioration of residents, training could also diminish the total time dedicated to and quality of medical student education.

Tsouroufli M, Payne H. Consultant medical trainers, modernising medical careers (MMC) and the European time directive (EWTD): tensions and challenges in a changing medical education context. *BMC Med Educ*. 2008 May 20;8:31.

The authors analyzed the learning and professional development narratives of Hospital Consultants training junior staff ('Consultant Trainers') in order to identify impediments to successful postgraduate medical training in the UK, in the context of Modernising Medical Careers (MMC) and the European Working Time Directive (EWTD). The method was a qualitative study. Learning and continuing professional development (CPD), were discussed in the context of Consultant Trainers' personal biographies, organizational culture and medical education practices. The authors conducted life story interviews with 20 Hospital Consultants in six NHS Trusts in Wales in 2005. Consultant Trainers felt that new working patterns resulting from the EWTD and MMC have changed the nature of medical education. Loss of continuity of care, reduced clinical exposure of medical trainees and loss of the popular apprenticeship model were seen as detrimental for the quality of medical training and patient care.

Consultant Trainers' perceptions of medical education were embedded in a traditional medical education culture, which expected long hours' availability, personal sacrifices and learning without formal educational support and supervision. Over-reliance on apprenticeship in combination with lack of organizational support for Consultant Trainers' new responsibilities, resulting from the introduction of MMC, and lack of interest in pursuing training in teaching, supervision and assessment represent potentially significant barriers to progress. This study identifies issues with significant implications for the implementation of MMC within the context of EWTD. Postgraduate Deaneries, NHS Trusts and the new body; NHS: Medical Education England should deal with the deficiencies of MMC and challenges of ETWD and aspire to excellence. Further research is needed to investigate the views and educational practices of Consultant Medical Trainers and medical trainees.

Garvin JT, McLaughlin R, Kerin MJ. A pilot project of European Working Time Directive compliant rosters in a university teaching hospital. *Surgeon*. 2008 Apr;6(2):88-93.

In response to the requirements of the European Working Time Directive (EWTD), a national implementation group was formed to liaise with local implementation groups at nine different pilot sites. As part of this process, a pilot EWTD compliant rota was run for six weeks amongst general surgical SHOs in University Hospital Galway. The authors devised a rota for nine general surgical SHOs, the aim being to achieve EWTD compliance. SHOs were asked to complete questionnaires to assess the

effectiveness of the pilot. During the pilot SHOs were rostered for an average of 53.6 hours. Actual hours worked were 58.1 hours. Fifty-two point five per cent of working weeks were non-compliant with the provisions of the EWTD. Seventy per cent of the time SHOs felt that continuity of care was not achieved. Eighty-one per cent felt that patient care deteriorated during the pilot. SHOs spent an average of 2.5 days per week engaged in sessions with their consultant. Fifty percent of SHOs missed elective operating sessions or outpatient clinics. SHOs attended an average of 1.3 emergency operations per week (range 0-8) and 5.5 elective procedures per week range 0-12). All SHOs reported a deterioration in quantity or quality of training. However, 69% reported an improvement in their quality of life during the pilot. With this tightly defined shift system, hours worked were in breach of the provisions of the EWTD. Sixty-nine per cent of SHOs reported an improvement in quality of life, but all reported a deterioration in training and 81% felt that patient care suffered.

Tait MJ, Fellows GA, Pushpanathan S, Sergides Y, Papadopoulos MC, Bell BA. Current neurosurgical trainees' perception of the European Working Time Directive and shift work. Br J Neurosurg. 2008 Feb;22(1):28-31; discussion 32-3.

The introduction of the shift system in response to the European Working Time Directive has had an enormous impact on the running of neurosurgical units in the UK. This study seeks to establish what provisions are currently in place for out of hours cover and what has been the effect of the introduction of shifts in three main areas: patient safety, training and 'work/life balance'. The on-call registrar at each UK neurosurgical unit was contacted by telephone. Data regarding current emergency provision were sought. Registrars who had worked both on-calls and the shift system during their career as a neurosurgical registrar were asked to make a comparison. Data were collected from all 33 UK units. Twenty-two still use a traditional 24-h on-call system. Twenty-one on-call rotas were classed as non-resident although 12/21 of those officially on non-resident rotas were in fact resident whilst on call. Twenty-two registrars had worked both systems as a neurosurgical registrar. Twenty-one (95.45%) felt that traditional on-calls gave better clinical exposure. Twenty-one (95.45%) felt that on-calls allowed the provision of better patient care. Nineteen (86.36%) felt that on-calls were safer. Thirteen (59.09%) reported that they were more tired when doing shift work than on-calls. Fourteen (63.63%) found that the on-call system gives more useful spare time and more time to deal with family commitments. Current neurosurgery registrars feel the shift system is less safe, harmful to training and worse in terms of work/life balance. More than one-third of units are claiming to have non-resident on-call systems in order to appear compliant with EWTD when registrars are in fact resident.

Waurick R, Weber T, Bröking K, Van Aken H. The European Working Time Directive: effect on education and clinical care. Curr Opin Anaesthesiol. 2007 Dec;20(6):576-9.

In 2009 the European Working Time Directive limits the weekly working hours to an average of 48 in all European Union member states. The recent published effects on education and patient care are discussed. In European Union member states with traditional long working hours for hospital doctors the reduced working hours led to a decrease in trainee case loads. A negative effect on patients care is only suspected, but not yet measured. In particular, British anaesthetists started a discussion about the required changes in training and assessment to counterbalance the lack of practice. European Surgical Disciplines demand for 48 h working time and 12 h teaching and education time per week for trainees. So far many member states have delayed the implementation of European laws in national laws. There are less measured clinical facts than political statements published. The actual working time directives in the European Union member states are inconsistent and further political development on this topic across the European Union remains unclear.

Soo A, Alam M, Mitchell T, Healy DG, Nölke L, Wood AE. A step towards being EWTD compliant: a single institution study of the cardiothoracic surgery experience. Ir Med J. 2007 Oct;100(9):596-8.

The introduction of the European Working Time Directive has led to intensive debate regarding the working conditions, training and service delivery of Non Consultant Hospital Doctors. Surgical specialties are especially affected by the directive as they have always been associated with long working hours. These have been defended on the basis that these were required to achieve surgical competence. This study aims to survey the working hours and examine the activity of cardiothoracic surgery trainees, who traditionally worked long hours, in a single institution. Arising from the survey results, a novel working model is proposed.

Herbertson R, Blundell A, Bowman C. The role of Clinical Support Workers in reducing junior doctors' hours and improving quality of patient care. J Eval Clin Pract. 2007 Jun;13(3):449-52.

The aim of the study was to see if the introduction of Clinical Support Workers (CSWs) at a teaching hospital could reduce the medical work intensity for junior doctors without compromising the quality of patient care. The 'New Deal' and 'European Working Time Directive' have prompted hospitals to take a close look at junior doctors' hours and work intensity in order to make posts compliant. Following the Department of Health's publication 'reducing junior doctors' hours', it was felt that certain clinical duties could be shared with nursing staff. **Two audits were undertaken 8 months apart. The first was to determine the areas where the introduction of CSW would make the biggest impact. The second was to determine if this impact had had an effect on the intensity of work carried out by the junior doctors. The CSW greatly reduced the number of cannulations and venepunctures performed by the doctors without any compromise to patient care.**

This study shows that other allied health professionals can be trained to carry out certain tasks that previously were only performed by doctors. This not only reduces the impact on junior doctors' hours but can also improve patient care, with fewer delays encountered when patients are waiting for a procedure.

Al-Ruzzeh S, Karthik S, O'Regan D. Objective surgical skill assessment: the diagonal operating matrix. Interact Cardiovasc Thorac Surg. 2007 Apr;6(2):188-91.

There is an urgent need for structured surgical training and assessment due to the reduction in the training duration with the European Working Time Directive (EWTD). The authors propose a model for objective skill assessment, the PAR-Diagonal Operating Matrix (PAR-DOM) which breaks down the task of vascular anastomosis into clearly defined skills. The PAR-DOM is made up of a 3x5 table and progress is made along vectors defined on the x-axis as PAR and on the y-axis as four levels. PAR defines three skills at each level. Each skill is graded from 1-3 (this may be taken as below average, average, above average). The skills at various levels are: Level 0 - Posture, Address, Relaxation; Level 1 - Pick-up, Airtime, Rotation; Level 2 - Placing, Angles, Rhythm; Level 3 - Precision, Adaptability, Reproducibility; Level 4 - Pace, Awareness, Relations. The PAR-DOM matrix provides a graphic representation of the progress of trainees over their training period assigned for them to stay with the trainer and also help identify individual strengths and weaknesses.

West D, Codispoti M, Graham T; Specialty Advisory Board in Cardiothoracic Surgery of The Royal College of Surgeons of Edinburgh . The European Working Time Directive and training in cardiothoracic surgery in the United Kingdom. Surgeon. 2007 Apr;5(2):81-5; quiz 85, 121.

The European Working Time Directive (EWTD) limited average working hours for junior doctors to 58 per week in 2004. The Cardiothoracic Specialty Advisory Board conducted postal and email surveys of cardiothoracic trainees' work patterns and attitudes in 2003 and 2005-6. **The results reveal an increase**

in shift-based working from 15% to 58% of respondents. One hundred per cent of respondents felt that the EWTD had had a negative impact on training, and only 30% were satisfied with their training to date. Satisfied trainees were more likely to work in larger units as assessed by ITU beds (20.6 vs. 8.9, $p < 0.001$) and cardiac cases/year (1586.2 vs. 828.4, $p < 0.001$). They had performed more cardiac cases than their peers (72.7 vs. 26.7, $p = 0.005$). Fifty-two per cent thought that their quality of life improved after EWTD implementation. The EWTD is unpopular amongst cardiothoracic trainees, who perceive it as harming training. Overall trainee satisfaction is low. Larger units and increased personal operative experience are associated with trainee satisfaction. Training programs must act vigorously to safeguard training quality before implementation of the 48-hour limit in 2009.

Ramsey RA, Anand R, Harmer SG, Sharma S, Wilbourn M, Brennan PA. Continuity of care and the European working time directive: a maxillofacial perspective. Br J Oral Maxillofac Surg. 2007 Apr;45(3):221-2.

The European Working Time Directive (EWTD) was introduced in 1993 and was heralded as both a challenge and an opportunity for the NHS to modernize its services. Continuity of care is usually viewed as the ongoing relationship between a patient and a single practitioner. Fragmentation of this continuity by many doctors being involved in a patient's management may weaken this relationship. The effect of the EWTD on junior doctors training in various specialties is well studied, the authors were interested in assessing the effect of the EWTD on the patient-doctor relationship in a maxillofacial setting and aimed for this paper to serve as an indicator of current practice and facilitate future research in this area.

Seventy-five consecutive patients were studied with 72 patient proformas analyzed. The authors' findings show greater same consultant patient contact than that of the specialist registrars and senior house officers. The authors feel that this is largely due to new work patterns introduced through the advent of the EWTD.

Lo SF, Spurgeon P. Working hours of surgical residence: perspective of a group of surgeons in a regional hospital in Hong Kong. Asian J Surg. 2007 Jan;30(1):60-6.

The Accreditation Council for Graduate Medical Education and European working time directive have restricted residents' workweek to 80 and 48 hours, respectively. Impacts on resident's training and health services are under evaluation in western countries. However, relevant studies are deficient in Hong Kong.: Surgeons in a regional hospital of Hong Kong were recruited. Opinions were collected by semi-structured questionnaire.

Response rate was 82%. Most respondents agreed that residents' work hours should be limited. Seventy-two percent thought that the addition of physician assistants, nurse practitioners and ancillary staff could help decrease the workload of residents. More than 60% thought that residents should have post-call afternoon off. Seventy-two percent worried that the number of operations residents performed would decrease. Only half agreed that long work hours were part of resident training and 56.3% agreed that the training period should be lengthened because of limiting work hours. Ninety-four percent agreed that sleep-deprived residents would create more medical errors; 72% thought that long work hours would impair quality of care. Surprisingly, only 28% thought that limiting work hours would compromise continued patient care. Most respondents opine that resident work hours should be regulated and welcome minor rescheduling of residents' workflow. The impacts on residents' training and patient care require further evaluation.

Woodrow SI, Segouin C, Armbruster J, Hamstra SJ, Hodges B. Duty hours reforms in the United States, France, and Canada: is it time to refocus our attention on education? Acad Med. 2006 Dec;81(12):1045-51.

Resident duty hour restrictions have now been instituted in many countries worldwide. Such policies have resulted in a broad-based discussion in the medical literature concerning their effects on patient care, resident education, and resident well-being. To better understand the impetuses behind these changes, the authors examine not only the duty hour mandates currently in effect in the United States, Canada, and France, but also the events influencing their independent development in these three countries. **In the United States, an 80-hour resident workweek was mandated by the Accreditation Council for Graduate Medical Education out of concern for patient safety. In France, a 52.5-hour workweek was decreed by the government, reflecting the broader European Working Time Directive initiated out of concern for the negative impact of extended work hours on its population. In Canada, resident unions, whose primary interest has been one of resident well-being, have negotiated a series of reduced resident duty hours that approach those mandated in the United States.** At the core of these changes are unique differences in these countries' health care and medical education systems. The resulting diversity in the origin and nature of such regulations serves to highlight the lack of evidence that has guided their development and the need to refocus on the educational elements of postgraduate training.

Benes V. The European Working Time Directive and the Effects on Training of Surgical Specialists (Doctors in Training) : A Position Paper of the Surgical Disciplines of the Countries of the EU. Acta Neurochir (Wien). 2006 Nov;148(11):1227-1233.

Legislation launched with the EWTD was born as a "Protection of the clinical personnel against overwork for the benefit of Patients" (consumer protection and safety). It appeared that this legislation is in direct and severe conflict with former EU legislation to train competent surgical specialists. First experiences with the EWTD show far reaching and serious consequences on the training of surgical specialists as well as on medical care. There will be a reduction of about 30-35% of clinical and operative experience acquired during the usual 6 yrs of training, with many other negative aspects (see p. 7). **All measures proposed so far to overcome the ensuing problems are unworkable. The training of competent surgical specialists as required by the Directive 93/16 EEC is no longer possible and serious problems with safe patient care will occur in the short term, if no political actions are taken. The surgical specialties, represented in the UEMS, provide a proposal for a working hour model consisting of 48 hrs working time (incl. service duties) plus additional 12 hrs reserved and protected for teaching and training. This model would adhere to the EWTD on the one hand, yet maintain the desired standard of training. This proposed exemption from the EWTD would be limited to the time of specialist training.** The authors ask the responsible politicians to find a solution rapidly to prevent serious negative consequences. This motion is supported by the surgical specialties (neurosurgery, general surgery, orthopaedic surgery, pediatric surgery, cardio-thoracic surgery, vascular surgery, otolaryngology, list not complete) of the member states of the EU, representing more than 80,000 surgical specialists.

Lim E, Tsui S; on behalf of the Registrars and Consultant Cardiac Surgeons of Papworth Hospital 2003-2005 Impact of the European Working Time Directive on exposure to operative cardiac surgical training. Eur J Cardiothorac Surg. 2006 Oct;30(4):574-7.

To evaluate the impact of the reduced working hours, an anticipated decline in case load and increasing patient risk profile, the authors performed a cohort study to determine the factors that influenced operative surgical training. A historic cohort study design was utilized, and data were acquired from a prospective operative surgical database a year before, and a year after the introduction of the European Working Time

Directive (EWTD) compliant rota (1st August 2004). Logistic regression was used to determine the predictors of operative surgical training, and individual variables were ranked by likelihood ratio.

In total, 3312 cardiac surgical operations were performed over a 2-year period between 3rd August 2003 and 31st July 2005. The proportion of cases performed by trainees was 39% (626/1587) in the year before and 40% (695/1725) in the year after the introduction of WTD compliant rota. There were no differences in operative risk (logistic EuroSCORE of 8, P=0.853). Independent predictors for surgery performed by a trainee (in descending order of influence) were the consultant in charge (chi11(2) 273.1; P<0.001), procedure performed (chi5(2) 163.5; P<0.001), increasing seniority of trainee (chi2(2) 142.3; P<0.001), revision surgery (chi1(2) 45.9; P<0.001), lower EuroSCORE (chi1(2) 17.6; P<0.001), and better ventricular function (chi2(2) 7.8; P=0.020). The odds ratio of an operation performed by a trainee increased after the introduction of the EWTD compliant rota to 1.19 (95% CI 1.00-1.41; P=0.045). With a successful institution-specific training module and a commitment to training, exposure to operative surgical training can be sustained despite shortening of working hours.

Paterson P, Allison K. Maintaining standards of aesthetic practice in trainees subject to NHS restrictions. J Plast Reconstr Aesthet Surg. 2006;59(8):856-9.

The Specialist Advisory Committee (SAC) in plastic surgery within the United Kingdom (UK) recommends a modular training program to include aesthetic surgery. The intercollegiate board examinations test candidates on all aspects of aesthetic practice yet there is no formal, national aesthetic training in the UK. Closure of National Health Service (NHS) private patient facilities has reduced training opportunity [Nicolle FV. Sir Harold Gillies Memorial Lecture; Aesthetic plastic surgery and the future plastic surgeon. Br J Plast Surg 1998;51:419-24.] Calmanisation [Hospital doctors: training for the future. The Report of the Working Group on Specialist Medical Training (The Calman Report). London: HMSO; 1993.], the European Working Time Directive (EWTD) [; Phillips H, Fleet Z, Bowman K. The European Working time Directive-interim report and guidance from The Royal College of Surgeons of England working party chaired by Mr Hugh Phillips; 2003 [; Chesser S, Bowman K, Phillips H. The European Working Time Directive and the training of surgeons. BMJ Careers Focus 2002;s69-7.], and more importantly the implementation of "local" aesthetic guidelines have placed further pressures on training. **Reductions of NHS case mix will ultimately lead to a reduction in trainee experience. With increasing regulatory pressure from the Commission for Healthcare Improvement, standards of aesthetic practice can only be maintained by increasing private/independent sector involvement. At present a disparity exists between the demand and provision of aesthetic surgery training in the UK. Aesthetic surgery forms part of the training curriculum for plastic surgery and as such remains a training issue. A review of aesthetic surgery training is needed in the UK through consultation with trainers and trainee representatives.**

Carberry M. Hospital emergency care teams: our solution to out of hours emergency care. Nurs Crit Care. 2006 Jul-Aug;11(4):177-87.

The implementation of the European Working Time Directive and the compulsory reduction in junior doctors' hours provided the main driver and background for this project. The project aim was to implement Hospital Emergency Care Teams (HECT) on three District General Hospitals (DGHs) to provide emergency out-of-hours care. The project strategy centered on the recruitment, training and preparation of critical care nurses to undertake advanced assessment roles. Methods used to monitor and evaluate activity include the use of innovative hand-held computers. Main outcomes include, the conclusion that a multidisciplinary HECT of five could manage the overnight workload and level of acuity in a DGH of 420-500 beds, and that critical care nursing staff can be prepared for advanced supporting roles. Experiences gained provide valuable learning that could be used to influence similar

projects. Implications for practice include the development of a national framework to inform areas such as multidisciplinary competency-based education and training. Scientific evidence is required to evaluate the effect of HECT on hospital mortality and morbidity and quantify the staff, inpatient experiences.

Davis SJ, McDonald S. Covering ENT out of hours: how confident are senior house officers? J Laryngol Otol. 2006 Jul;120(7):587-90.

The implementation of the European working time directive has led to an increase in cross-specialty out-of-hours cover. This survey illustrates ENT out-of-hours cover arrangements and assesses the implications for senior house officers (SHOs) responsible for managing emergencies. A telephone survey of 100 ENT departments was conducted, asking the on-call SHO about departmental structure, on-call rota design, their previous ENT experience, access to SHO training and their confidence in managing emergencies. **44 per cent of departments used only ENT SHOs on the on-call rota. 73 per cent always had an ENT middle grade on call. In 60 per cent of hospitals, the ENT consultant was sometimes on call with only a non-ENT SHO. At the time of the study, 5 per cent of SHOs had no ENT experience, no access to training, were not confident in managing simple emergencies and were on-call without middle-grade cover.** The current junior on-call structure for ENT has implications for patient management.

Brennan PA, McCaul JA. The future of academic surgery-A consensus conference held at the Royal College of Surgeons of England, 2 September 2005. Br J Oral Maxillofac Surg. 2006 Jun 3; [

A consensus conference organized by the Association of Surgeons of Great Britain and Ireland (ASGBI) and the Association of Surgeons of Training (ASIT) was held at the Royal College of Surgeons of England on 2 September 2005. All Specialist Advisory Committees and specialist associations were represented, except for orthopaedic surgery. The future of both academic surgery and training were discussed. The authors concluded that the European Working Time Directive, and Modernising Medical Careers are likely to have an adverse effect on future of research in oral and maxillofacial surgery. Most surgeons were concerned about the future of training and the development of surgery in general.

[No authors listed] After-hours acute care. Night nurse. Health Serv J. 2006 May 18; 116(6006):suppl 8-9.

South Tees began a pioneering approach to the Hospital at Night program in January 2004. A wireless system for data collection was key to the success of shift-based team Benefits include less spending on on-call staff and compliance with the European working time directive.

Wasson J, Jacobsen N, Bowdler D, Hopkins C. Optimizing training opportunities for otolaryngology senior house officers: an audit. 13: J Laryngol Otol. 2006 Jul;120(7):583-6. Epub 2006 May 4.

Implementation of the European Working Time Directive and the Modernising Medical Careers initiative will mean junior surgeons must be trained in fewer hours over a shorter period. For this reason, junior surgeon training opportunities must be optimized. The authors undertook a departmental audit to identify where opportunities to train senior house officers (SHOs) in theatre were being lost, so that appropriate timetable changes could be made in order to optimize exposure to suitable surgical cases. During the first audit cycle, the SHOs followed their existing timetable and theatre attendance was monitored prospectively over a two-week period. **Only 30 per cent of theatre sessions were attended and case participation was only 27 per cent. Simple timetable changes were made to maximize SHO theatre**

attendance, and a second prospective two-week audit was undertaken. The new rota yielded 46 per cent theatre attendance and 48 per cent case participation.

Morton J, Williams Y, Philpott M. New Zealand's Christchurch Hospital at night: an audit of medical activity from 2230 to 0800 hours. N Z Med J. 2006 Mar 31;119(1231):U1916.

To audit medical activity at Christchurch Hospital New Zealand between 2230 and 0800 hours; specifically, to measure the volumes of tasks requiring completion overnight and to identify the competencies required for this as well as the level of teamwork that existed.: After a pilot study tested possible methods, Resident Medical Officers (RMOs) responsible for the care of adult patients at night were linked by a shift coordinator to recorders (mostly nursing students) trained to register the tasks performed, together with task urgency (as judged by the RMO) and duration. This information, checked each morning for completeness, was entered immediately into a database and analyzed later. Telephonists logged all outbound calls through the hospital switchboard to on-call medical staff; theatre and admission records were recorded as usual. Anaesthetic and Radiology Registrar activity was self-recorded. The setting was Christchurch Hospital is a 650 bed tertiary centre, which covers most specialties.

In the absence of leadership, the RMOs were not working as a team. Consequently some were overextended while others were inactive. House officer tasks were largely generic--not specialty specific; there was no formal handover from the afternoon or day shifts and the level of hospital medical staffing did not reflect the activity levels over the time period studied. **A review of the beep policy is urgently needed. A third of the admissions were to General Medicine, and basic medical activities (including admitting, reviewing, and prescribing drugs and fluids) for patients admitted under all specialties represented the majority of the night workload. Medical registrars had reduced some of the traditional multiple clerking by admitting patients themselves. The workload and its distribution over time was remarkably similar to that found at the 17 pilot sites in the United Kingdom, where Out of Hours Multidisciplinary Teams (OoHMT) were introduced.** We recommend that Christchurch Hospital use these data to plan the composition and leadership of an OoHMT.

Horrocks N, Pounder R; RCP Working Group . Working the night shift: preparation, survival and recovery--a guide for junior doctors. Clin Med. 2006 Jan-Feb;6(1):61-7.

Following the implementation of the European Working Time Directive Regulations, almost all junior doctors in the UK now work full night-shifts. An RCP 50-member working group was established to develop a practical guide to help junior doctors prepare, survive and recover from working night shifts. The guide, set out in this paper, examines the evidence concerning the hazards of shiftwork, and techniques that can be used to reduce risk. **The main advice is to minimize sleep debt by taking additional two-hour sleeps in the afternoon before a shift, and 20- to 45-minute naps during the night shift. It is hoped that the advice will make the challenge of night shift work not only easier to tolerate, but also safer for both hospital patients and their doctors.**

Mann S. The evolution of restricted hours of duty for resident medical officers in New Zealand: a personal view. Clin Med. 2005 Nov-Dec;5(6):650-2.

The New Zealand Health Service had to start adapting to significant restrictions in junior medical staff's hours of work in the mid-1980s. Some consequences of this presage those that will occur in the UK and Europe with the implementation of the European Working Time Directive (EWTD). These naturally include continuity of patient care, changing responsibility and hours of senior medical and administrative staff, some aspects of medical professionalism and training issues. Life does, however, go on.

White MC, White ML, Walker IA, Jackson E, Thomas ML. Impact of the European Working Time Directive on the training of pediatric anesthetists. *Anaesthesia*. 2005 Sep;60(9):870-3.

The European Working Time Directive and the New Deal have decreased the number of hours worked by anesthetic trainees. The authors evaluated the effect of the implementation of the Working Time Directive in May 2004 on training. During two 6-month periods, one before and one after the change, the authors determined the number of operating lists undertaken by each Specialist Registrar in Anaesthesia. **After implementation of the Working Time Directive, the mean number of lists performed by Specialist Registrars decreased from 24 to 21 lists per registrar per month, a 13% decrease. Exposure to subspecialty lists was the same in both periods, but this was at the expense of general lists and those in remote locations.** The authors conclude that the Working Time Directive has had a measurable impact on the training of pediatric anesthetists, but that the significance of this change for clinical practice has not yet been measured.

Higgins R, Gallen D, Whiteman S. Meeting the non-clinical education and training needs of new consultants. *Postgrad Med J*. 2005 Aug;81(958):519-23.

This review highlights the non-clinical training needs of new consultants, identifying strategies for meeting these needs. Non-clinical activities are integral to the consultant's role and senior clinicians need training in these areas. Concerns over the quantity and quality of current provision are compounded by changes the European Working Time Directive and Modernising Medical Careers initiative will bring. Accelerated progression to senior level and reduction in time for training suggest a pressing need to respond to the needs of new consultants. Ad hoc initiatives in a range of healthcare contexts offer examples of how training needs may be met, including mentoring and continuing professional development schemes. A multi-professional strategy, incorporating elements of higher professional education in general practice and other NHS initiatives (particularly management/leadership training), may offer an appropriate framework within which to capitalize on existing opportunities. There are, however, resource implications that need to be addressed.

Lamont PM, Scott DJ. The impact of shortened training times on the discipline of vascular surgery in the United Kingdom. *Am J Surg*. 2005 Aug;190(2):269-72.

Political initiatives and European health and safety working time regulations have combined to reduce the time available for surgical training in the United Kingdom in the future by a third. For the safety of patient care, surgeons must evolve strategies to cope with these reduced training times so that they preserve the current high level of competence exhibited by UK trainees when they attain the right to independent surgical practice recognized by appointment as a Consultant Surgeon. Such strategies include a focus on dedicated training time, the use of simulators, and a move towards progression based on satisfactory completion of a defined curriculum and competency assessment rather than the amount of time served. With insufficient time to train in every aspect of general surgery, a move towards fragmentation into its sub-specialty components seems unavoidable. Such a move offers an opportunity to re-evaluate conventional surgical training and to consider the evolution of a system-specific vascular specialist with patient-focused expertise in vascular surgery, endovascular radiology, and vascular medicine.

Vadia S, Kahn D. Registrar working hours in Cape Town. *S Afr J Surg*. 2005 Aug;43(3):62-4.

The number of hours worked by general surgical registrars in Europe and the USA has been reduced so as to reduce fatigue and the possibility of errors. The impact of these restrictions on surgical training remains unresolved. To date there are no officially reported data on the number of hours worked by registrars in

South Africa. The aim of this study was to document the hours worked by registrars in general surgery in Cape Town. **Thirty-three general surgical registrars at the University of Cape Town were asked to complete a time sheet over a 2-week period, indicating hours spent in hospital as part of a normal working day, hours spent in hospital outside of a normal day, hours at home on 'cold call' and hours off duty. Of the 33 registrars, 25 completed the time sheet. Registrars at Groote Schuur Hospital worked an average of 105 hours per week (68 hours in hospital and 37 hours on call at home). Registrars at New Somerset Hospital worked 79 hours per week (70 hours on site), while registrars at Red Cross Children's Hospital, G. F. Jooste Hospital and the Trauma Unit worked 60 - 69 hours per week. In the Surgical Intensive Care Unit (SICU) registrars worked 75 hours per week.** In conclusion, general surgical registrars at the University of Cape Town work hours in excess of European and American work-hour restrictions.

Harrison M, Eardley W, McCarron B. Time to hand over our old way of working? Hosp Med. 2005 Jul;66(7):399-400.

The European Working Time Directive and the change to shift working have highlighted the need for a high level of continuity of patient care. Continuity of information, through a competent and professional handover allows doctors to be not only made aware of the issues important to each patient's care, but also allows a knowledge-based approach to that patient's management.

Exter A. The European Court of Justice and working time in the health care sector: relevance to the Czech Republic. Med Law. 2005 Jun;24(2):337-41.

In a recent court ruling, the European Court of Justice concluded that a Member State violated the European Directive on working time. The issue concerned the meaning of working time as defined by the Directive. It appeared that the time an employee is present and available at the workplace, with a view to providing his professional services, had to be considered as working time. That conclusion may affect the organization of health services in other Member States, such as the Czech Republic.

Morris-Stiff GJ, Sarasin S, Edwards P, Lewis WG, Lewis MH. The European Working Time Directive: One for all and all for one? : Surgery. 2005 Mar;137(3):293-7.

The European Working Time Directive (EWTD) became law in Britain on October 1, 1998. As a result, the maximum period that may be spent as a resident in hospitals is 56 hours per week and after August 2009, 48 hours per week. The aim of this study was to determine the views of senior house officers (SHOs), specialist registrars (SpRs), and general consultant surgeons (CONs) in Wales on the influence of the EWTD on surgical training and clinical experience. In this cohort study, a postal questionnaire was sent to 150 SHOs in surgical specialties, 50 general surgical SpRs, and all 84 CONs in the Welsh Deanery. **The response rates were 81%, 78%, and 71% for SHOs, SpRs, and CONs, respectively. The vast majorities at all grades (88% SHOs, 100% SpRs, and 96% CONs) were unhappy with the introduction of EWTD legislation to clinical medicine. Most felt that EWTD legislation will have a negative effect on clinical experience (96% SHOs, 97% SpRs, 96% CONs); patient care (83% SHOs, 85% SpRs, 96% CONs); and training (94% SHOs, 100% SpRs, 93% CONs). Furthermore, a large proportion felt surgical training should be exempt from EWTD regulations (76% SHOs, 87% SpRs, 89% CONs). A significant proportion at each grade was opposed to the introduction of shifts in order to comply with regulations (78% SHOs, 87% SpRs, 89% CONs), and an alarming number have considered leaving the National Health Service when the regulations are enforced (29% SHOs, 41% SpRs, 33% CONs).** This study shows that, in Wales at least, a vast majority of surgical trainees and consultants alike are opposed to the introduction of the EWTD and believe it will have a detrimental effect on training, patient care, and doctors' lives outside of medicine.

Hellawell GO, Kahn L, Mumtaz F. The European working time directive: implications for subspecialty acute care. Int J Clin Pract. 2005 May;59(5):508-10.

The requirements of the new deal for junior doctors' hours has meant that many smaller trusts are unable to provide adequate cover on-call for medical and surgical subspecialties. The care of the acute subspecialty patients has, therefore, shifted to general teams in many trusts. The authors assessed what impact this had upon the outcome of acute urological cases in the authors' district general hospital by prospectively monitoring acute renal colic admissions over a 12-month period and surveyed the provision of services in other regional hospitals. **The shift in care of the acute urological patient was associated with considerable morbidity for patients admitted in the authors' hospital. The additional financial burden due to this morbidity was estimated to be 33000 pounds/annum.** The implementation of the new deal must be achieved with every care to minimize the clinical and financial costs of withdrawing acute subspecialty services.

Akerstedt T, Kecklund G. The future of work hours--the European view. Ind Health. 2005 Jan;43(1):80-4.

In Europe the way work hours are handled varies between different countries. However, there are some issues that dominate the discussion in Europe and seem representative for what is happening. **One such is the reduction of working hours--which was attempted in several countries but which now seems to be backfiring--probably related to the competition from countries outside Europe. Another area is compressed work hours--the drive towards maximizing the hours per work day in order to increase the number of days off. The health effects are debated--some find clear positive effects. A third area is company oriented flexible work hours, permitting the employer to make moderate changes in work hours when needed. The health impacts have not been evaluated but the loss of individual influence at work is obvious.** In some parts of Europe self-determined work hours have been tried with very positive effects. The EU work hour directive is intended to provide uniformity but permits a counterproductive "opting out", creating problems of imbalance.

Dornhorst A, Cripps J, Goodyear H, Marshall J, Waters E, Boddy SA; Improving Working Lives Intercollegiate Committee . Improving hospital doctors' working lives: online questionnaire survey of all grades. Postgrad Med J. 2005 Jan;81(951):49-54.

In 2001, the Department of Health produced the Improving Working Lives (IWL) for Doctors document. This is the first national survey which asks hospital doctors what changes are needed to improve their working lives. An online questionnaire was run over a period of six weeks and was open to all doctors of all grades. Doctors were asked to choose their top five factors from a list of 35 diverse choices or to provide alternatives in free text. Demographic data were also collected.

1603 hospital doctors working in the UK completed the online questionnaire. Improved secretarial or managerial support was the first IWL choice for consultants, with different aspects of clinical and non-clinical support representing their top four choices. Junior hospital doctors and staff and associate specialist grades (staff grades, associate specialists, and clinical assistants) identified improved support for education and training as their first choice, while among the female specialist registrars, it was improved support for childcare. Greater opportunities to develop new skills was an important issue for doctors in the surgical specialties and improved access to mentoring was important for all junior doctors, staff and associate specialist grades, and doctors from black and ethnic minority groups. Hospital doctors in the UK need more support to improve their working lives. The principle needs are better secretarial and managerial support for consultants; education, training, and mentoring for junior doctors and staff and associate specialist grades; and improved opportunities to develop new skills for those in surgical specialties. Support with childcare is an important issue for female specialist registrars. The Department

of Health, NHS trusts, deaneries, and Royal Colleges need to endorse policies that promote a training and working environment that will improve working lives for all hospital doctors, ensuring that appropriate and continuing support is available from the time doctors enter the new foundation programmes and proposed run-through grades, to their time spent as consultants in today's NHS.

Jones GJ, Vanderpump MP, Easton M, Baker DM, Ball C, Leenane M, O'Brien H, Turner N, Else M, Reid WM, Johnson M. Achieving compliance with the European Working Time Directive in a large teaching hospital: a strategic approach. Clin Med. 2004 Sep-Oct;4(5):427-30.

This paper describes the strategy which achieved European Working Time Directive (EWTD) compliance at the Royal Free Hampstead NHS Trust in medicine and surgery. Compliance with EWTD regulations was assessed by diary card exercise, clinical care assessed through critical incident reports, electronic handover documents and nursing reports, training opportunities assessed by unit training directors, cost controls assessed by finance department analysis, and workload assessed by staff attendance on wards, in casualty and in theatres. There was a change in focus of care to a consultant-led, specialist registrar- (SpR-) driven service extending into evenings and on weekends, coupled with a move to a multi-skilled team for night cover, and to a move from traditional on-call shifts to a full shift system across both medicine and surgery. Compliance with the EWTD was achieved whilst maintaining good standards of clinical care, ensuring training opportunities for doctors in training, controlling payroll costs, removing the need for locums, and reducing workload for both junior doctors and consultants.

Sim DJ, Wrigley SR, Harris S. Effects of the European Working Time Directive on anaesthetic training in the United Kingdom. Anaesthesia. 2004 Aug;59(8):781-4.

Decreases in the hours worked by trainee anaesthetists are being brought about by both the New Deal for Trainees and the European Working Time Directive. Anticipated improvements in health and safety achieved by a decrease in hours will be at the expense of training time if the amount of night-time work remains constant. This audit examined the effects of a change from a partial to a full shift system on a cohort of trainee anaesthetists working in a large district general hospital in the South-west of England. Logbook and list analyses were performed for two 10-week periods: one before and one after the decrease in hours. **An 18% decrease in the number of cases done and an 11% decrease in the number of weekly training lists were found for specialist registrars. A 22% decrease in the number of cases done and a 14% decrease in the number of weekly training lists were found for senior house officers. Furthermore, a decrease of one service list per specialist registrar per week was seen, which will have implications for consultant manpower requirements.**

Jagsi R, Surender R. Regulation of junior doctors' work hours: an analysis of British and American doctors' experiences and attitudes. Soc Sci Med. 2004 Jun;58(11):2181-91.

Regulations of junior doctors' work hours were first enacted in the United States (US) and United Kingdom (UK) over a decade ago, with the goals of improving patient care and doctors' well-being while maintaining a high quality of medical training. This study examines experiences and attitudes regarding the implementation of these regulations among physicians and surgeons at two teaching hospitals, one in South-East England, and the other in New England, US. This paper presents the findings of a survey questionnaire and a series of in-depth interviews administered to a sample of junior doctors and the consultants responsible for their supervision. The study finds that the different policy mechanisms employed in the two countries have had different degrees of success in reducing the work hours of junior doctors. The results also indicate, however, that even in settings in which hours have been reduced significantly, the regulations have only had limited effects on the quality of medical care, junior doctors' well-being, and the quality of medical education. A number of barriers to the success of the regulations in

achieving their objectives are identified, and the relative merits of political action and professional self-regulation are discussed. This research suggests that recently enacted policies requiring further reductions in junior doctors' hours in both the US and UK may face similar barriers when implemented. Understanding the lessons that emerge from implementation of the original regulations is essential if future reforms are to succeed and a high-quality system of health care is to be sustained.

Roche-Nagle G. The European Working Time Directive: a survey of surgical specialist registrars. Ir Med J. 2004 Jun;97(6):175-8.

On 1 August 2004 junior doctors in the Irish health care system and other healthcare systems throughout Europe will no longer be excluded from the provisions of the European Working Time Directive. Their working hours will then be limited by law, first to 58 hours a week and then, by 2009, to 48 hours. This will demand even more profound changes for the Irish health care system than seen so far. **This survey was undertaken to elicit the opinions and first-hand experiences of surgical specialist registrars (SpRs) throughout Ireland on different working patterns, and the impact of being on-call on their surgical training and lives. The working time directive will undoubtedly shake the foundations of surgery in Ireland and Europe, and meeting the directive by 2009 will require fundamental change if both it and the challenge of providing first class surgical training and safe patient care are to be met.**

Romanchuk K. The effect of limiting residents' work hours on their surgical training: a Canadian perspective. Acad Med. 2004 May;79(5):384-5.

Restrictions in residents' work hours have been in place in Canada for roughly a decade, having been negotiated rather than imposed. The changes in residents' schedules that resulted are roughly equivalent to the limitation of 80 duty hours per week in the United States. When work-hours restrictions began, surgery faculty were worried that residents' experience would be compromised. But these fears have not materialized. Why? The author maintains there are many reasons. (1) Most surgical procedures are now faster, and lengthy inpatient care has diminished, all of which saves time. (2) Formerly difficult or risky procedures are now performed more frequently and safely, which increases residents' education about difficult conditions. (3) A variety of resources (e.g., skills-transfer courses, surgical simulators, etc.) are now available for residents to learn and evolve surgical techniques, and residents take advantage of these resources, being highly motivated to learn the best in the time available to them. (4) There have been positive changes in residents' education that have helped them become more efficient learners than before, with improved resources and skills for faster access to information. The author maintains that in his present surgery residency program, the residents still work extremely hard but are more protected from the unending demands for patient care. They have more time for orderly study and greater opportunities to develop skills other than technical ones. They are in a happier work setting, which the author strongly believes facilitates improved patient care.

Rawnsley A, Hurst K, Robinson M. Clinical and education implications of shift work. Med Teach. 2004 Feb;26(1):71-3.

Yorkshire teaching hospital staffs' perceptions before and after implementing a junior doctor shift system are reported. The study is placed in context by discussing the European Working Time Directive and the New Deal for Doctors. **Five education and clinical issues are examined using data from activity diaries and attitude questionnaires. Interesting findings emerge that sometimes contradict the literature. Important recommendations are made to ease the NHS's inevitable move towards shift work.**

Alex J, Rao VP, Cale AR, Griffin SC, Cowen ME, Guvendik L. Surgical nurse assistants in cardiac surgery: a UK trainee's perspective. Eur J Cardiothorac Surg. 2004 Jan;25(1):111-5.

The authors sought to assess the impact of surgical nurse assistants on surgical training based on a comparative audit of case-mix and outcome of coronary revascularizations assisted by surgical nurse assistants vs. surgical trainees. Relevant recent articles on Calman reform of specialist training and European working time directive (EWTD) on junior doctor working hours were reviewed for the discussion. For the audit prospectively entered data of elective and expedite first time coronary artery bypass grafting cases from 2000 to 2003 were analyzed. Group A (n=233, Consultant+Surgical nurse assistant), group B (n=1067, Consultant+Junior surgical trainee). Chi-square test, t-test and Fisher's test were used as appropriate for statistical analysis. Comparative preoperative variables were gender (P=0.8), body mass index (P=0.9), smoking (P=0.3), diabetes mellitus (P=0.2), hypertension (P=1), peripheral vascular disease (P=0.5), previous cerebrovascular accident (CVA)/transient ischemic attack (TIA) (P=0.3), renal dysfunction (P=0.4), preoperative rhythm disturbances (P=0.3), previous Q-wave myocardial infarction (MI) (P=0.4), Canadian Cardiovascular Society angina class (P=0.4), New York Heart Association heart failure class (P=0.4) and left ventricular function (P=0.4). Patients in group B were of higher risk due to age (P=0.01), coronary disease severity (P=0.05), left main stem disease (P=0.001), Parsonnet score (P=0.0001) and Euroscore (P=0.005). Regarding the myocardial protection technique, intermittent cross-clamp fibrillation was used more frequently in group A while antegrade-retrograde cold blood cardioplegia and off-pump coronary artery bypass were used more in group B (P=0.0001). The cross-clamp (P=0.0001) and operation time (P=0.0001) were significantly lower in group A despite a comparable mean number of grafts (P=0.2). There was no significant difference in the immediate postoperative outcome ventilation time (P=0.2), intensive care unit stay, postoperative stay (P=0.2), re-exploration for bleeding (P=0.5), inotrope+intra-aortic balloon pump (P=0.2), postoperative MI (P=0.9), postoperative rhythm disturbances (P=0.9), CVA/TIA (P=0.8), renal dysfunction (P=0.6), wound infection (P=0.7), sternal re-wiring (P=0.2), multi-organ failure (P=0.4) or mortality (P=0.1). Surgical nurse assistants can be used effectively in low-risk cases without compromising postoperative results. However, initiatives to tackle the EWTD should be focused on areas that do not compromise the training needs of junior surgical trainees. An intermediate grade between the present senior house officer and registrar grades could be a way forward.

Scallan S. Education and the working patterns of junior doctors in the UK: a review of the literature. Med Educ. 2003 Oct;37(10):907-12.

The author sought to identify and review UK research relating to the effects of patterns of work on the education of junior doctors, describe the trends in the research, and assess progress in the UK in reducing the number of hours worked by junior doctors alongside that of other countries and identify areas for future research. A total of 77 research studies, mostly written after 1995, were identified as relevant from approximately 900 references generated by searching Medline and using a 'snowball' technique. The articles identified were qualitatively reviewed to identify their key research conclusions and/or the main points of argument. These were collated and presented in a qualitative review. **This showed that research in the UK is contradictory regarding the effects of working patterns and the views of doctors towards them. Further research is needed to examine in depth the differences in the effects of working patterns on education between hard-pressed and non hard-pressed specialties, hospitals and regions. When viewed in an international context, the UK ranks among a number of countries with similar medical systems that are moving towards reducing the hours worked by doctors in training, all of which are at different points in the process.**

The author concluded that the literature review helped to identify the popular wisdom surrounding the debate on junior doctors' hours, the progress of the UK when compared to that of other countries and gaps in research. Further research is needed to refine understanding of this area.

Cass HD, Smith I, Unthank C, Starling C, Collins JE. Improving compliance with requirements on junior doctors' hours. BMJ. 2003 Aug 2;327(7409):270-3.

Compliance with UK regulations on junior doctors' working hours cannot be achieved by manipulating rotas that maintain existing tiers of cover and work practices. More radical solutions are needed. The authors conducted an audit of the changes in the pediatric night rota in a large children's hospital. Compliance with regulations on working hours was assessed by diary cards; workload assessed by staff attendance on wards; patient safety assessed through critical incident reports.

The assessed the development of new staff roles, followed by change from a partial shift rota comprising 11 doctors and one senior nurse, to a full shift night team comprising three middle grade doctors and two senior nurses. **As a result of these changes compliance with the regulations on working hours increased from 33% to 77%. Workload changed little and was well within the capacity of the new night team. The effect on patient care and on medical staff requires further evaluation.** The authors noted that reduction of junior doctors' working hours requires changes to roles, processes, and practices throughout the organization.

MacLellan AM. Residents' duty hours in the province of Quebec, Canada. Acad Med. 2003 Jan;78(1):11-3.

The author describes the five decades of efforts by residents in the medical schools of the province of Quebec, Canada, to negotiate scientific, cultural, social, and economic issues that affect them as trainees. At present, the residents' association, the Federation des Medecine residents du Quebec negotiates collective agreements on working conditions and other issues with the Quebec Ministry of Health, not the hospital association. The federation has become recognized as an important body throughout Canada, and its representatives regularly participate in meetings concerning the country's health care system. **The author describes the duty hour provisions of the current collective agreement (1996-2002), and remarks that in general, the agreement's regulations are helpful to residents, prevent the possibility of abusive work schedules, and, among other benefits, provide generous time off for conferences, examinations, and study time. However, some residents, particularly those in surgical disciplines, believe that the work-hours provisions are too restrictive, as they wish to maximize their acute-care surgical experiences in the operating room via frequent on-call hours.** At present, residents in all disciplines are allowed to remain in the hospital to attend to patient care duties as much as they wish, but they may not be on official call more than is stipulated by the collective agreement. These agreements have also created some difficulties in providing coverage for patients; the author discusses various solutions to this problem.

Urowitz M, Crescenzi AM, Muharuma L. Residents' duty hours in the province of Ontario, Canada. Acad Med. 2003 Jan;78(1):9-10.

The author explains the history of the Professional Association of Internes and Residents of Ontario (PAIRO), Canada, founded in 1968-69 to represent postgraduate medical trainees in negotiations with the Ontario Hospital Association over issues of trainees' stipends. Over the years, the negotiations evolved to cover a number of other issues, including duty hours, and established the principle that binding arbitration would be used to resolve any disputes between the two parties that could not be resolved through negotiation. **At present, PAIRO negotiates a biannual collective agreement with the Ontario Council of Teaching Hospitals (OCOTH), whose features the author describes. The most important provisions of the 2000-2002 PAIRO-OCOTH agreement on the limits of duty hours are described. The author then comments that while such limits have benefited programs and residents, there is concern that the limits decrease the opportunities for trainees to be involved in the care of patients**

with a wide variety of medical conditions. Also, the duty-hours limits have required some services to use attending physicians or outside health professionals to perform duties previously carried out by trainees, creating problems that the author describes.

Mather HM; Royal College of Physicians Trainees Committee. The Royal College of Physicians specialist registrar shift survey. Hosp Med. 2002 Jul;63(7):429-31.

A survey of all medical specialist registrars in the UK reveals that a large majority oppose shift working patterns because of their adverse impact on training and quality of life, and on continuity and quality of patient care. This conflicts with the current drive to switch virtually all trainees to shifts by 2004, to comply with the European Union Working Time Directive. More debate is urgently needed.

Frey R, Klosch G, Reinfried L, Decker K, Saletu B, Laggner AN. [Fatigue and stress sensitivity of physicians after 16 hours on duty at the emergency department]. Wiener Klinische Wochenschrift 2001 Apr 17;113(7-8):254-258.

In addition to their 40-hour working week (Mon-Fri, 8 a.m.-4 p.m.) residents at the emergency department of the General Hospital of Vienna have to do approximately six 24-hour duties. **The reasons for conducting the present field study were physicians' complaints about tiring night duties. 11 residents (four women, seven men; aged between 28 and 43 years, $x = 33.5 \pm 4.9$ years; working at the emergency department for 4-50 months, $x = 31 \pm 20$ months) were tested on an ordinary working day at 9 a.m. and midnight. Self-rating concerning sleep duration, perception of stress and workload on the days of the investigations were found to be representative of other prolonged duties. Subjects reported a usual nocturnal sleep duration of only 6-7 hours.** Stress was regarded as moderate by most of the volunteers. Blood pressure and pulse rates did not show diurnal changes. Generally, residents felt significantly ($p < 0.01$) less awake at night than in the morning, but reported only slight vegetative and somatic stress reactions or annoyances as assessed by the Fahrenberg self-rating scale. **Interindividual differences were found; residents who had been working at the emergency department for a longer period experienced a more pronounced impairment.** Further studies are required in order to objectify a nocturnal decrease in vigilance (by means of computer-assisted EEG) and to evaluate potential performance deficits (by means of psychometric tests).

Fredriksen A. [Activities and staffing in intensive care units in Norway--still need of better registration]. Tidsskr Nor Laegeforen 2001 Feb 28;121(6):694-697.

Standards in Intensive Care Medicine were approved by the Board of the Norwegian Medical Association in 1997. Their purpose is to clarify issues of responsibility, accountability and management in intensive care units. It also gives recommendations on management, staffing, education and resources. In order to obtain a reference point for any future assessment of the impact of the Standards document, a survey was carried out, addressing workload, medical staff, and questions of accountability, responsibility and cooperation. Sixteen hospitals responded (76%). **The results indicate that medical staff in relation to work load is smaller than recommended and that junior doctors only to a small extent are present in the intensive care units during ordinary working hours, and consequently have little opportunity to learn from working with experienced colleagues. However, both conclusions, especially the first one, are not entirely reliable, as close examination of the answers indicate that important concepts concerning the description of work load and staffing are poorly defined, and that the monitoring of work load is insufficient.** The authors concluded that staffing and workload in intensive care units are still insufficiently defined and monitored. The training environment for specialists is not optimal.

McGill A, Hutchinson S, Andrzejowski J, Francis G. Working patterns of trainee anaesthetists in the UK: results of a national postal survey. *Anaesthesia*. 2001 Jan;56(1):50-4.

The 'New Deal' restrictions on junior doctors' hours have major implications for the staffing of anaesthetic departments and the provision of adequate training. The results of a national postal survey demonstrate a decline in traditional on-call arrangements, especially in hard-pressed work sectors such as intensive care. **A substantial number of anaesthetic departments have still completely to satisfy the hours restrictions in many work sectors. Many departments experience recruitment difficulties and express concern about both service and training issues.**

Lambert TW, Goldacre MJ, Evans J. Views of junior doctors about their work: survey of qualifiers of 1993 and 1996 from United Kingdom medical schools. *Med Educ*. 2000 May;34(5):348-54.

The authors investigated the views of junior doctors about their work using questionnaire surveys. Doctors who graduated from medical schools in the United Kingdom in 1996, surveyed at the end of their pre-registration year (2926 respondents), and graduates of 1993 surveyed 3 years after qualification (2541 respondents). **Almost 70% of the 1996 qualifiers felt that they worked excessive hours and 80% felt that they undertook too many routine non-clinical duties. Only 24% agreed that their postgraduate training was of a high standard and 22% felt they were being asked to perform clinical tasks with inadequate training.** A total of 70% were dissatisfied with arrangements for cover for absent doctors. Most respondents regarded senior doctors and nurses as supportive, but hospital management was not. Although 65% were satisfied with their future prospects, only 36% had been able to obtain useful careers advice. Job enjoyment was reasonably high, with two-thirds scoring 6 or more on a scale from 1 (not enjoying at all) to 10 (greatly enjoying), but 70% of respondents felt that they had insufficient time for family and social activities. A briefer questionnaire sent to the 1993 qualifiers in 1996 showed similar results. The authors concluded that more needs to be done to ensure that junior doctors are trained appropriately for the tasks they undertake, to ensure that they regard their training highly, to reduce excessive non-clinical work, and to provide reasonable working hours and cover.

Nash GF, Reddy KM, Bloom IT. A regional survey of emergency surgery: the trainees' perspective. *Ann R Coll Surg Engl*. 2000 Mar;82(2):95-6.

The reduction of junior doctors' hours and the 'Calmanisation' of higher surgical trainees have led to an inevitable decrease in clinical experience. The development of subspecialisation within general surgery limits the diversity of elective operative experience, while the resident surgical registrar continues to be faced by the same range of emergencies. Procedures such as tracheostomy, thoracotomy and emergency burr hole, although rare in an emergency setting, are seldom seen by surgical trainees outside ENT, cardiothoracic and neurosurgical departments, respectively. However, these life saving procedures continue to be within the remit of the general surgeon, and were considered as essential knowledge in the operative viva of the FRCS examination.

Bourne MC, Paterson-Brown S. Calman and the new deal--compromising doctor training and patient care. *Scottish Medical Journal* 1999 Oct;44(5):147-148.

Since coming into line with European law in 1995 junior doctors are expected to work no more than **72 hours per week** and the European commission is currently working to reduce the working week even further to **a maximum of 48 hours**. Many junior and senior doctors have expressed concern over the training opportunities which would be missed by junior doctors working a shift pattern to reduce hours. Using a confidential questionnaire the authors approached 136 trainees in a large teaching hospital for their views.

Goldberg I, Paice E. Flexible specialist training compared with full-time training. Hospital Medicine 1999 Apr 60(4):286-290.

The educational and training quality of flexible training posts compared very well and in some instances was better than that obtained in full-time training. The hours of work were fewer, but as a proportion not as small as is sometimes recognized by the Colleges and is comparable with many full-time training programs in other European Union countries.

Henderson NC, Cookson DT, Plumley R, Cairns M, Paterson-Brown S. The influence of a nurse practitioner on out of hours work intensity for surgical house officers. Scottish Medical Journal 1999 Apr;44(2):52-53.

The authors prospectively studied the influence of a nurse practitioner service on out of hours work intensity of surgical house officers. Data collection was achieved by prospective audit. The study was set in the surgical wards in a large teaching hospital. The main outcome measures were; 1) the nature and frequency of overnight calls to the nurse practitioner, and 2) the outcome of these calls (doctor not bleeped, telephone advice given by doctor or doctor attended ward). A total of 645 calls were made over the 75 night study period (8.6 calls/night). Two hundred and ninety-six calls were managed by the nurse practitioner alone. This represents a 46 percent reduction in work intensity for the surgical house officer. This study illustrates the benefits of a nurse practitioner service and also identifies important areas for undergraduate education in preparing medical students for the common problems encountered during the surgical on-call period.

Albert W, Freitag M, Ludwig K. The employment schedule act--effects on the young surgeon]. Langenbecks Archive der Chirurgie Supplement 1998 115:806-812.

Since January 1, 1996, new regulations of working hours have been introduced in the hospital with regard to emergency service and compensation through leisure time. The average payment was reduced by 23 percent for surgeons on call. By this means, three additional surgeons could be employed. **For every resident in training there is now less time for his residency than before. Sufficient surgical residency requires enough time on the ward and in the operating room. Thus, other conditions for residency programs are necessary to avoid unfulfilled tasks being pushed into the pre-existing area of non-documented working hours. Research and any scientific activity take place in leisure time.**

Dilworth JP, Mitchell DM. Comparison of the views of junior doctors, consultants and managers on work and training. Journal of the Royal College of Physicians of London 1998 Jul-Aug;32(4):344-350.

The objective of the study was to determine the views of junior hospital doctors on their working conditions, NHS reforms and training, and to compare their views with those of consultants and managers. A questionnaire was distributed to 52 junior doctors, 19 consultants and 14 middle or senior grade managers in an acute NHS trust. The findings showed that junior doctors had strong feelings about several areas covered in the questionnaire; in particular, more structured training without the requirement to undertake a higher degree would be welcomed. **Shift systems are unpopular and the reduction of 'non-medical' tasks with a reduction in work intensity is perceived to be more important than further reductions in hours available for work.**

Kapur N, House A. Working patterns and the quality of training of medical house officers: evaluating the effect of the 'new deal'. Medical Education 1998 Jul;32(4):432-438.

The 'new deal' on junior doctors' hours of work has led to the widespread introduction of working patterns such as full shifts and partial shifts in the United Kingdom. The impact of these changes on the training of medical staff is unclear. The subjects of the current study were 36 pre-registration medical house officers working shift rotas and on-call rotas at a teaching hospital in the north of England. They were studied over a 12-month period using a self-report questionnaire seeking their views on the quality of their training experience and their satisfaction with the in-service training they received. Nursing staff, consultant and medical student opinion was also sought. **Partial-shift and full-shift systems led to reduced hours of work when compared to on-call rotas (mean hours: partial shift 65.0; full shift 59.8; on-call 72.7), but they were associated with significantly lower training experience and training satisfaction scores for the house officers than were on-call systems (P < 0.01).** Shift systems were unpopular among consultants and medical students but not nursing staff. Despite reducing excessive hours of work, shifts may be detrimental to the training of medical house officers. The further imposition of shift working should be suspended until such time as the impact of new working patterns on the training of medical staff has been determined.

Cooper N. Junior doctors. Be part of the deal. Health Serv J. 1998 Apr 17;108(5600):30-1.

A survey of junior doctors in trusts in one English region found the majority did not know whether or not their post met Department of Health requirements on hours and conditions. Most did not know that average hours worked per week should not exceed 56. Most of the acute trusts had groups to implement these New Deal regulations. But almost two-thirds of junior doctors were unaware of these. Ignorance of the New Deal by junior doctors and other NHS personnel could hamper accreditation of trusts.

Paice E. Is the new deal compatible with good training? A survey of senior house officers. Hospital Medicine 1998 Jan;59(1):72-74.

A survey of senior house officers revealed that the New Deal on junior doctors' hours had not been fully achieved, and that education and training was variable. The report explores the relationship between hours and intensity of work, experience gained, and the educational quality of posts. **It suggests that the acquisition of experience has more to do with working in a well-organized, well-supervised educational environment than with putting in long hours or doing without sleep.** It concludes that the New Deal is compatible with good training.

Baldwin PJ, Dodd M, Wrate RW. Young doctors' health--I. How do working conditions affect attitudes, health and performance? Social Science and Medicine 1997 Jul;45(1):35-40.

Long hours and other difficult working conditions are thought to affect the health of young doctors, but there has been little evidence to support these assertions. Data are presented from a class cohort of junior doctors in the U.K. showing the relationships between working conditions, health and performance. Long hours appear to have short-term consequences in terms of the doctors feeling unwell and reporting poor performance, as measured by the somatic and social dysfunction scales of the General Health Questionnaire, but there are no demonstrated long-term health consequences. Instead, a number of working conditions, number of emergency admissions, number of deaths on the ward and the number of minor menial tasks contribute to a perception of being overwhelmed, as revealed by factor analysis of the Attitudes to Work questionnaire. This factor correlates significantly with a range of long-term physical and mental health measures as well as measure of work performance.

Baldwin PJ, Dodd M, Wrate RM. Young doctors' health--II. Health and health behaviour. Social Science and Medicine 1997 Jul;45(1):41-44.

There is little published information on the health of young doctors, apart from a number of studies which show increased rates of psychiatric symptoms. Nor is there much known of their health behavior. Anecdotal accounts suggest that doctors' own health care is poor, especially in terms of their willingness to consult other doctors. This paper presents data from a longitudinal study of a class cohort of young doctors first interviewed when they were students.

The findings showed that residents suffer from frequent minor physical ailments, with women reporting more ailments than men. Despite this, they took less sick leave. Overall, the doctors took very little time off work. Using the GHQ-28, with a threshold of 5/6, 30 percent of doctors fell into the "caseness" category for psychiatric symptoms. This is in keeping with findings elsewhere. From the doctors' own reported health behavior, both in terms of their response to illness over the past year, as well as their predicted response to hypothetical illness, they have developed maladaptive patterns. These include continuing to go to work when unfit, self-prescribing, and consulting friends and colleagues rather than going for a formal consultation. This is seen as inappropriate, especially in cases of mental illness. A third of the young doctors are not registered with a local general practitioner and the majority has no clear idea of the role of the Occupational Health Service. The results are discussed in terms of the need to change attitudes to health care and to develop guidelines, staffing and services to enable doctors to take better care of themselves.

Baldwin PJ, Newton RW, Buckley G, Roberts MA, Dodd M. Senior house officers in medicine: postal survey of training and work experience. BMJ. 1997 Mar 8;314(7082):740-3.

The authors described working conditions for senior house officers in medicine in Scotland and to relate these to the quality of clinical training they receive. All senior house officers in medicine and related specialties in post in Scotland in October 1995 (n = 437); 252 (58%) respondents. A survey assessed covered hours, working patterns, measures of workload, an attitudes to work scale, and experience of education and training. In the week before the questionnaire, doctors on rotas had worked a mean of 7.4 (95% confidence interval 5.8 to 9.0) hours in excess of their contracts, compared with 3.7 (2.0 to 5.5) hours for those on partial shifts. The most common reason for this was "the needs of the patients or the service."

Those on partial shifts reported significantly less continuity of care with patients than those on rotas (Mann-Whitney U test, $z = -4.2$, $P < 0.0001$) or full shifts ($z = -2.08$, $P = 0.03$). Doctors in general medicine reported significantly higher measures of workload (number of acute admissions, number of times called out, and fewest hours' uninterrupted sleep) than those in subspecialties. Consultants' clinical teaching and style of conducting a ward round were significantly related to factors extracted from the attitudes to work scale. The quality of senior house officers' training is detrimentally affected by a variety of conditions, especially the need for closer support and supervision, the need for greater feedback, and the lack of time that consultants have to dedicate to clinical training. Efforts should be made to improve these conditions and to reinforce a close working relationship between trainee and supervising consultant.

Panayiotou BN, Fotherby MD. Junior hospital doctors' views on their training in the UK. Postgraduate Medical Journal 1996 Sep;72(851):547-550.

To ascertain the views of senior house officers and registrars on the educational and training component of their posts, a questionnaire was sent to all full-time doctors working in training posts in general and/or geriatric medicine at three district general and three teaching hospitals. Completed questionnaires were received from 64 (61 percent) of 105 doctors who were contacted. Most had a careers counselor or tutor, although less than two-thirds thought they had benefited from this arrangement. **The majority of doctors**

attended at least two medical tutorials or meetings per week; most wanted to attend more but were unable to because of other work commitments. Supervision by more senior staff on the ward was deemed by most to be satisfactory, but less so in outpatient clinics. **Overall, one-third of doctors thought that training was inadequate and three-quarters wanted a greater amount of formal education. The majority of junior doctors' time was spent on routine work and most considered. Training' constituted less than 10 percent of their working time. Doctors in training require more sessions designated as educational, with protected time to attend these.**

Kay L, Pless T, Brearley S. Survey of surgical training in Europe. Medical Education 1996 May;30(3):201-207.

The Permanent Working Group of European Junior Hospital Doctors (PWG) conducted a survey among surgical trainees in member countries with the aim of describing postgraduate training in surgery throughout Europe. In each country, 10 trainees with surgical training of 2-5 years and 10 trainees with surgical training of 6-9 years answered a questionnaire, completed a diary and kept a log book of operations for one week. A total of 165 surgeons from 12 countries completed the survey. A trainee had to care for an average patient load varying from 30 to 80 patients at any one time. **The average number of working hours ranged from 52 to 88 h per week, including up to 18 h of unpaid work. The different tasks carried out within these working hours varied considerably, as did the proportion of tasks with educational value.** Trainees participated in four to 11 major operations each week, but the number of operations a week did not reflect the number of operations conducted under supervision. In some countries, the majority of the trainees stated that they received their training mainly through unsupervised experience. The average number of days spent on courses and congresses varied from four to 15 days per year, with great variation in the percentage of expenses paid.

Countries with favorable working conditions, such as fewer working hours, shorter shifts and a day off after being on duty, seemed to have gained these advantages by a reduction in working hours with educational value, rather than by a reduction in routine work. It is concluded that conditions of surgical training vary greatly between the European countries in relation to duration, working hours, tasks undertaken, and resources used on training. Every country is capable of improving its surgical training.

Bohmer T, Pedersen T. [Interruptions of physicians' work at hospitals. A threat to quality?] Tidsskr Nor Laegeforen. 1996 Apr 20;116(10):1226-8.

When the working hours of junior doctors at a medical clinic were reduced from 44 to 40.7 hours per week a questionnaire was distributed to the doctors themselves and to the different categories of nurses to find out how this change had affected the schedule for investigation and treatment of the patient, care of the patient, discharge from hospital, and collaboration with other health professionals. **In the opinion of doctors and nurses alike, the reduced working hours had led to delays in investigation of patients, poorer care, problems in connection with discharge from hospital, and poorer collaboration with other professional groups. It could well be difficult to achieve normal working hours or junior doctors in hospitals with patients under continuous treatment without this having a decided negative effect on continuity of treatment.**

Hale PC, Houghton A, Taylor PR, Mason RC, Owen WJ, Bonell C, McColl L. Crossover trial of partial shift working and a one in six rota system for house surgeons in two teaching hospitals. J R Coll Surg Edinb. 1995 Feb;40(1):55-8.

The objective of this study was to compare an on call rota and partial shift working pattern for house surgeons in two hospitals. The study was conducted using a crossover trial of working both systems for 6

weeks each in two groups of newly appointed house surgeons. Assessment was by questionnaire to house surgeons, consultants, registrars, nursing staff and patients. The study took place at the departments of general surgery at Guy's and Lewisham Hospitals, London. A total of 12 house surgeons attached to four surgical firms and their consultants and registrars were the subject of the authors' study. **In addition the permanent nursing staff on designated general surgical wards and those patients of greater than 48 h stay on those wards on the day of assessment took part. Expectations of reduced fatigue levels using the partial shift system were not fulfilled. In contrast, this working pattern led to perceived disruption of the running of the surgical firms and demoralization of the house surgeons. Standards of patient care were, however, equally high using a rota or partial shift system.** This comparison of a partial shift working pattern to an on call rota of similar average weekly hours demonstrated a marked preference for an on call rota from both medical and nursing staff although patients found both systems acceptable.

Thickett A, Bush D. Knowledge of junior doctors regarding the New Deal. *Health Trends* 1995 27(3):86-88.

Junior doctors' knowledge of the content and local implementation of the New Deal for junior doctors was surveyed in one English region. Data were analyzed from 254 replies (response rate 60 percent); a majority (86 percent) knew that the initiative was intended to reduce their working hours, but detailed knowledge was lacking. **Less than half could identify the correct limits on contracted hours for full or partial shift working patterns, while 73 percent knew that they should not be contracted for more than 72 hours per week for an on-call pattern, the most common and traditional pattern worked. Only 20 percent knew that hours actually worked should not exceed 56 per week. Only 13 of 114 doctors who believed their posts conformed to the New Deal knew the correct hours limits.** Only 11 percent knew any member of the hospital local implementation group for the New Deal. The results of the survey indicate that junior doctors are not well informed about the details of the New Deal, or its local implementation-four years into the New Deal, this situation needs to be improved, especially as junior doctors are now to be asked to validate the progress of the initiative.

Hartley C, Rothera MP. A new deal for ENT surgeons--The Manchester experience 1992-3. *Ann R Coll Surg Engl.* 1994 Sep;76(5 Suppl):228-31.

The objective was to reduce junior doctors' hours by introducing an on-call system involving cross-cover at SHO level between two separate ENT units. The authors used prospective collection of data on the cross-cover system introduced in September 1992 with analysis after 12 months, within ENT departments within Salford and Central Manchester. They studied five SHOs and four registrars within the two ENT units. **This showed that SHOs worked a 1 in 5 rota providing first on-call cover for two adjacent ENT units. The system has proved to be an effective means of decreasing junior doctors' hours, though actual hours exceed the contracted hours by approximately 8 hours per week. Initial problems of contacting SHOs were overcome by the introduction of new bleep arrangements while the system produced a number of unforeseen benefits.** The experience in Manchester suggests that major ENT units do not necessarily require resident first on-call staff, though formal arrangements are recommended to cope with acute emergencies requiring immediate attention.

The authors commented that an effective on-call system has been devised which decreases junior doctors' hours by combining the on-call rotas of two adjacent ENT units. Recommendations for the successful implementation of such a system are presented.

Vassallo DJ, Chana J, Clark CL, Smith RE, Wood RF. Introduction of a partial shift system for house officers in a teaching hospital. BMJ. 1992 Oct 24;305(6860):1005-8.

The authors sought to introduce a partial shift system to reduce the hours of work of preregistration house surgeons to an average of 64 a week to comply with the New Deal for junior doctors; (2) to test linking the partial shift concept to an existing structure of "on call" firms. The study involved a formal assessment after three months of a pilot partial shift system for eight house surgeons on three firms instituted on 1 November 1991, followed by questionnaire and interview evaluation at three and six months of a revised system implemented on 1 February 1992. The setting was the department of general surgery at St Bartholomew's Hospital, London. Participants were 24 house surgeons attached to three surgical firms. **In eight weeks each house surgeon worked one week (five shifts) of night duty, one week of "cover" (afternoon and evening) duty, and six weeks of normal daytime hours. Each weekday a house surgeon from the firm on call worked an extended daytime on call shift until 10 pm. Weekend duties were split between two house surgeons from the firm on call. A computer generated graphical display of the rota was used to facilitate leave planning. Average working hours were reduced to below 64 per week, including prospective cover, without detriment to patient care and educational standards. Within the shift system individual house surgeons could be on call with their own firm by day and at weekends. Opinions were equally divided among junior staff as to their preference for either on call or partial shift systems.** The principles of this partial shift system are generally applicable and the model can readily be adopted by district general hospitals.

McKee M, Black N. Does the current use of junior doctors in the United Kingdom affect the quality of medical care? Soc Sci Med. 1992 Mar;34(5):549-58.

Current proposals in the U.K. envisage a reduction in both junior staff numbers and the hours they work. The proponents of change argue that this will improve patient care, although there are also opposing arguments, based mainly on the need to maintain continuity of care and ensure juniors gain sufficient clinical experience. By means of a literature review and interviews with junior doctors, this paper examines the effect of the existing system of hospital medical staffing on quality of care. **There is evidence that the existing system reduces the quality of care, principally through mistakes associated with inadequate supervision, and lowered humanity of care due to tiredness. The training value of nighttime and weekend work is low, and many doctors find it unsatisfying. In contrast, many doctors value providing continuity of care and a few appreciate the opportunity to gain unsupervised experience.** Overall, the disadvantages of the existing system outweigh the advantages, and change is required to improve the quality of care. There are, however, several obstacles to change, and there are doubts about the extent to which the current proposals will be implemented.

Nasmyth DG, Pickersgill A, Hogarth M. BMJ. 1991 Jan 12;302(6768):93-4. Reducing hours of work of preregistration house officers: report on a shift system.

To determine the advantages and disadvantages of a shift system of working compared with the conventional on call system for preregistration house officers. A shift system of working was employed in the unit from 1 August 1989 to 31 July 1990. During attachments of three or six months four house officers rotated at intervals of one month among three daytime shifts and one night shift (Mondays to Fridays only). Weekends (48 hours) were worked on a one in three rota by the doctors working a day shift. The views of the house officers working this shift system were sought in writing and by direct interview. The setting was a professorial surgical unit, Royal Liverpool Hospital. Participants were 14 house officers who were attached to the unit for three or six months during their preregistration year. **The shift system was preferred to conventional on call without exception. The incidence of chronic tiredness was reduced and formal hand-over between shifts resulted in more informed decision making by doctors while on call. During annual leave it was sometimes necessary to revert to the**

conventional one in three on call system to ensure that daytime work was completed. Other disadvantages were the long weekend shift and an inequitable distribution of the night shift. The house officers recommended extending the shifts to weekends and working the night shift one week in four. A shift system of working was effective in reducing chronic tiredness among house officers, who found it preferable to conventional on call arrangements. Shift working is feasible only if the daytime duties of the doctor working at night can be completed by the other doctors on the rota.

Turnbull NB, Miles NA, Gallen IW. Junior doctors' on call activities: differences in workload and work patterns among grades. BMJ. 1990 Nov 24;301(6762):1191-2.

The study examined the workload and work patterns of junior doctors of all grades while on call. It entailed a pilot study of activity data self recorded by junior doctors, with the help of students during busy periods. Sites included a general surgical firm and a general medical firm based at University Hospital, Nottingham, and subjects were four registrars, three senior house officers, and five preregistration house officers.

Senior house officers and preregistration house officers spent nearly half of all their on call duty time working, but less than half of that time was spent in direct contact with patients. Registrars were on call more often than the house officers but spent less than one fifth of their on call duty time working, and almost two thirds of that time was spent in direct contact with patients.

Workload while on duty is excessive for both senior and preregistration house officers. Changes in some administrative procedures and employment of more non-medical staff during on call periods might reduce the time spent on non-clinical activities, thereby reducing the overall workload and allowing more time for patient contact.

Leslie PJ, Williams JA, McKenna C, Smith G, Heading RC. Hours, volume, and type of work of preregistration house officers. BMJ. 1990 Apr 21;300(6731):1038-41.

To determine the hours, volume, and type of work undertaken by preregistration house officers. DESIGN-Continuous observation of 472 hours of work performed by 12 preregistration house officers based in medical wards, using standard procedures for studying work patterns. The setting was a teaching hospital with 340 beds assigned to general medicine and coronary care; participants were 12 of 16 preregistration house officers in medicine at the hospital. The study assessed hours, volume, and type of work undertaken by preregistration house officers in February 1989, as recorded by trained observers on a one to one basis. **Hours of duty ranged from 83 to 101 hours each week, the longest period of continuous duty being 58 hours. Each shift, house officers spent up to 25 minutes traveling between wards and an average of 85 minutes treating patients in wards that were cross covered. Between 50% and 71% of house officers' time was spent on patient oriented duties during the day; this fell to between 21% and 53% at night. Each doctor spent an average of 40 minutes filing when off duty after 6 pm.** Established procedures for studying workload were effective in monitoring doctors' hours, providing accurate information on the volume and type of work, which is essential to resolve the problems of medical staffing. The study showed that more house officers were needed and that the cross cover system should be stopped. As a result three extra preregistration house officers were appointed.

Wilson AM, Weston G. Application of airline pilots' hours to junior doctors. BMJ. 1989 Sep 23;299(6702):779-81.

The authors sought to determine the staff required if the rules for airline pilots' hours of work are applied to junior doctors. Junior anaesthetists recorded their workload from 1 March 1988 to May 31 1988 in a district general hospital in the United Kingdom. Two groups of three junior anaesthetists sharing a one in

three rota to provide continuous emergency cover. By using the guidelines published by the Civil Aviation Authority in The Avoidance of Excessive Fatigue in Aircrews schedules were drawn up to cover the hours that junior doctors had been on duty. **Each anaesthetist provided emergency and routine cover for 48-112 (mean 75) hours each week. To cover the work of six junior anaesthetists on an annual basis would require 26 doctors if they were working within the Civil Aviation Authority's guidelines.**

The authors concluded that junior anaesthetists' hours are much longer than those of airline pilots. Both professions entail considerable periods of monitoring interspersed with episodes of high demands on physical and cognitive skills. Errors induced by fatigue made by anaesthetists and pilots could result in death. The medical profession should define rules similar to those of the aviation authority to prevent junior doctors having to work unsafe numbers of hours.

XIII. Impact of International Duty Hour Regulations on Practicing Physicians

Søreide K. Trauma and the acute care surgery model - should it embrace or replace general surgery? Scand J Trauma Resusc Emerg Med. 2009 Feb 4;17(1):4.

The specialties dealing with emergency medicine and emergency surgery are in need for a new roadmap. While the medical and surgical management of emergency conditions very often go hand-in-hand, issues relating to emergency and trauma surgery have particular concerns, which are global in magnitude. Obviously, choosing a career dealing (solely) with emergencies and trauma is associated with concerns related to lifestyle issues and, for surgeons, maintenance of adequate operative experience with the increased non-operative management. Also, dealing with patients' whose outcome may be dismal with high associated morbidity and mortality is often not viewed as rewarding.

The global flux of medical students away from general surgical training and trauma surgery in particular is an example of how recruitment to specialties dealing with uncomfortable, unpredictable, and "out-of-office-hours" work may be in dire straits. How surgeons around the world will deal with this challenge will likely be diverse and tailored according to the needs of any given region, be it North America, Europe, or Scandinavia. However, refurbishing the training in General Surgery in order to ensure proper care for acute surgical illness and trauma appears mandated in order to keep in line with the centennial words of Halstead that "every important hospital should have on its resident staff of surgeons at least one who is well and able to deal with any emergency that may arise".

O'Donoghue K, Sheridan CP, O'Sullivan K, Greene RA, Higgins JR. Timing of birth related to obstetric practice and neonatal outcome. Ir Med J. 2008 Jul-Aug;101(7):205-7.

Several studies have reported time of birth is associated with differences in obstetric practice. We investigated the relationship between timing of birth and obstetric and neonatal outcomes, to help plan working patterns under European Working Time Directive (EWTD) legislation. This was a retrospective observational study undertaken in a tertiary-level university teaching hospital. Data were derived from the labor ward register of births for all women who delivered after 24weeks gestation in 2004. Births during on-call hours refer to those that occurred at weekends and after 1630 and before 0830 on weekdays. The majority of infants, 67.3%, were born in on-call hours. Infants were more likely to be delivered by ventouse ($p < 0.0001$), but there was no difference in caesarean section (CS) rates. 83.0% of operative deliveries performed for failure to advance in the second stage of labor took place in on-call hours, as did 77.5% of emergency CS for fetal distress. 38.9% of infants born during on-call hours on weekdays followed induced labors, compared to 24.7% of births at weekends and 17.7% of births in non on-call hours ($p < 0.001$), while 80.0% of deliveries by emergency CS after induction occurred during on-call hours. The majority of perinatal deaths occurred among infants born during on-call hours, even when excluding congenital malformations, and most infants with low Apgar scores were born during on-call hours. Complicated deliveries were more likely to occur in on-call hours. This study confirms previous reports that time of birth impacts on neonatal outcome. Increased demands on staff working out-of-hours have implications for healthcare, staffing and implementation of new working hours under EWTD legislation.

Bamford N, Bamford D. The effect of a full shift system on doctors. J Health Organ Manag. 2008;22(3):223-37.

This paper aims to investigate the implications and impact from the implementation of European Working Time Directive (EWTD) compliant working patterns (the introduction of shifts) on doctors. The study entailed a qualitative, case study based research method was used. Data collection involved: the

application of semi-structured, open-ended interviewing to elicit information based upon categories defined from the literature survey; follow-up conversations with many interviewees; participant observation; thematic coding and analysis of the results.

Findings showed that shifts are here to stay. All doctors interviewed acknowledged that, but there was a general feeling of minimal flexibility in the system. A recurrent theme when asked how things could be improved was to split-up the week of night shifts into two shorter periods. Some doctors, particularly those working full-time with small children, already split their weekends in order to spend time with their family. The methodology applied was appropriate, generating ample data to facilitate discussion and from which to draw specific conclusions. A perceived limitation is the single case approach; however Remenyi argues this can be enough to add to the body of knowledge. Practical implications - The research generated suggestions for how shifts could be scheduled to make them more palatable for those who work them. Specific recommendations for future research are made. The research questions of the paper draw out the personal implications for doctors of their employers' adherence to the implementation of EWTD.

Ikenwilo D, Scott A. The effects of pay and job satisfaction on the labor supply of hospital consultants. 1: Health Econ. 2007 Mar 5.

There is little evidence about the responsiveness of doctors' labor supply to changes in pay. Given substantial increases in NHS expenditure, new national contracts for hospital doctors and general practitioners that involve increases in pay, and the gradual imposition of a ceiling on hours worked through the European Working Time Directive, knowledge of the size of labor supply elasticities is crucial in examining the effects of these major changes. This paper estimates a modified labor supply model for hospital consultants, using data from a survey of consultants in Scotland. Rigidities in wage setting within the NHS mean that the usual specification of the labor supply model is extended by the inclusion of job quality (job satisfaction) in the equation explaining the optimal number of hours worked. Generalized Method of Moments estimation is used to account for the endogeneity of both earnings and job quality. **The results confirm the importance of pay and non-pay factors on the supply of labor by consultants. The results are sensitive to the exclusion of job quality and show a slight underestimation of the uncompensated earnings elasticity (of 0.09) without controlling for the effect of job quality, and 0.12 when controlled for job quality. Pay increases in the new contract for consultants will only result in small increases in hours worked.** Small and non-significant elasticity estimates at higher quantiles in the distribution of hours suggest that any increases in hours worked are more likely for consultants who work part time. Those currently working above the median number of hours are much less responsive to changes in earnings.

Wilkinson C. A qualitative study to determine the re-stratification of nursing. Br J Nurs. 2007 Mar 22-Apr 11;16(6):364-7.

The theory of occupational closure is a neglected area in the field of nursing. This article attempts to determine its relevance to nursing within the current political and economic climate where skills shortages within the field of medicine and the introduction of the European Working Time Directive in Britain, has presented new opportunities for nursing on several fronts. The study attempted to identify the impact of this policy upon the working relationships of doctors and nurses. It also attempted to determine how doctors and nurses classify the work of nursing in current context and the reasons for so doing. A series of semi-structured interviews were conducted with a group of doctors and nurses working in a large teaching hospital in the English Midlands. **The study showed that a re-stratification of nursing has occurred whereby a three-tier classification system has emerged within the hierarchy of nursing. The findings have opened up a debate concerning issues of power, territorialism and new directions for the future of nursing.**

Midttun L. Medical specialists' allocation of working time. Health Policy. 2007 Sep;83(1):114-27.

The aim of this study is to map the time-allocation of medical specialists and to examine how it relates to internal organizing of work, wage incentives, physicians' preferences and the demand structure in the population. With regards to internal organizing of work and wage incentives, special attention is granted to the private-public divide in specialized healthcare. **Survey data from 1183 Norwegian physicians is employed and the empirical models are estimated by means of ordinary least squares (OLS) regression analysis, linear logit analysis, binomial logistic regression analysis and multilevel analysis.**

Physicians working in the private sector and physicians combining private and public work spend relatively more time on patient-assignments than their public counterparts, while public physicians allocate more time to administrative and research/educational tasks. These findings support the proposition that work time allocations mirror the differences in on-call commitments, wage incentives and the division of labor between the sectors. Furthermore, whereas the demand-specific set of variables in the model contributes moderately to the explanation of working time allocation, internal organizing of work and physicians' preferences exert significant effects across the sectors. Future research should focus on physicians' time allocation since the topic will remain relevant as the European Union's (EU's) Working Time Directive continues to shake the European healthcare systems with traditions for long workdays.

[No authors listed] After-hours acute care. Night nurse. Health Serv J. 2006 May 18;116(6006):suppl 8-9.

See summary on page 184.

Goldmann K, Steinfeldt T, Wulf H. Anaesthesia education at German university hospitals: the teachers' perspective -- results of a nationwide survey. Anesthesiol Intensivmed Notfallmed Schmerzther. 2006 Apr;41(4):204-9.

The principal purpose of this study was to collect data on the conditions and practice of anaesthesia education as well as the teaching qualification of consultants at German university hospitals. Based upon the collected data, areas of weakness and strength as well as measures required to improve anaesthesia training are described. A questionnaire containing 26 items was mailed to 607 consultants employed at 41 German university hospitals in June 2003. A total of 255 questionnaires was analyzed (response rate: 43 %). Genuine training activities account for 14 % of the working hours of the participating consultants. On average, at the institutions of participating consultants, novices work for a duration of 1 month together with a consultant anesthetist before they give anesthetics without direct and constant supervision. When asked to describe the predominant method of training at their institution 71 % indicated "case-oriented teaching"; however, 53 % chose "see one, do one, teach one" and 49 % "learning by doing" as method of training as well (multiple choice). According to 63 % of respondents, departmental educational activities usually happen after their regular working hours. "Daily workload" (96 %), "time pressure" (96 %), "lack of time" (96 %) and "lack of personnel" (90 %) were indicated as the main obstacles of teaching. According to 80 % of respondents, a dedicated financial budget for education does not exist; instead, financial resources of third parties (industry) (58 %), of the state (for research und undergraduate education) (60 %) and of patients service (66 %) are used to ensure training of anesthesia residents. Due to a lack of a dedicated financial budget for resident training and an increasing economic pressure, "lack of time" and "lack of personnel" are the main factors leading to the situation at German university hospitals that consultants can only spend 14 % of their working hours for teaching purposes despite of sufficient qualification and motivation. As a consequence, novice anesthetists are faced with the situation to be working without direct and constant supervision after 1 month of training.

Exter A. The European Court of Justice and working time in the health care sector: relevance to the Czech Republic. Med Law. 2005 Jun;24(2):337-41.

In a recent court ruling, the European Court of Justice concluded that a Member State violated the European Directive on working time. The issue concerned the meaning of working time as defined by the Directive. It appeared that the time an employee is present and available at the workplace, with a view to providing his professional services, had to be considered as working time. That conclusion may affect the organization of health services in other Member States, such as the Czech Republic.

Costa G, Akerstedt T, Nachreiner F et al. Flexible working hours, health, and well-being in Europe: some considerations from a SALTSA project. Chronobiol Int. 2004;21(6):831-44.

The project brought together researchers from 9 EU-Countries and resulted in a number of actions, in particular the following: (a) There is an urgent need of defining the concept of flexible working hours, since it has been used in many different and even counterintuitive ways; the most obvious distinction is where the influence over the working hours lies, that is between the "company-based flexibility" and the "individual-oriented flexibility"; (b) The review of the Legislation in force in the 15 European countries shows that the regulation of working times is quite extensive and covers (Council Directive 93/104/EC) almost all the various arrangements of working hours (i.e., part-time, overtime, shift, and night work), but fails to provide for flexibility; (c) According to the data of the Third EU Survey on Working Conditions, longer and "irregular" working hours are in general linked to lower levels of health and well-being; moreover, low (individual) flexibility and high variability of working hours (i.e., company-based flexibility) were consistently associated with poor health and well-being, while low variability combined with high autonomy showed positive effects; (d) Six sub-studies from different countries demonstrated that flexible working hours vary according to country, economic sector, social status, and gender; overtime is the most frequent form of company-based flexibility but has negative effects on stress, sleep, and social and mental health; individual flexibility alleviates the negative effects of the company-based flexibility on subjective health, safety, and social well-being; (e) The literature review was able to list more than 1,000 references, but it was striking that most of these documents were mainly argumentative with very little empirical data.

The authors concluded that there is a large-scale intervention ongoing with almost completely unknown and uncontrolled effects. Consequently, there is a strong need for systematic research and well-controlled actions in order to examine in detail what flexible working hours are considered, what and where are their positive effects, in particular, as concerns autonomy, and what regulation seem most reasonable.

Ihse I, Haglund U. The Swedish 40-hour workweek: how does it affect surgical care? Surgery. 2003 Jul;134(1):17-8.

The authors examined the effect of severe work hour restrictions in Sweden on the length of residency education, and on the competence of practicing Swedish surgeons. The reported data from a study in one Swedish university hospital that showed that neither residents nor junior practicing surgeons reached the annual minimum case load of 200 operations or 400 hours in the operating room. Limited work hours have also enforced sub-specialization of surgeons, with physicians training in surgery of the upper abdomen, breast, colorectal area, or even subareas within these. **The number of surgeons in Sweden increase three- to four-fold since 1970, despite a reduction in their scope of practice. The authors comment that an oversupply of surgeons and strict regulation of work hours has led to far-reaching sub-specialization among surgeons and may contribute to reduction in the competence of surgical practitioners in Sweden.**

Poissonnet CM, Iwatsubo Y, Cosquer M, Quera Salva MA, Caillard JF, Veron M. A cross-sectional study of the health effects of work schedules on 3212 hospital workers in France: implications for the new French work schedules policy. J Hum Ergol (Tokyo). 2001 Dec;30(1-2):387-91.

This study was designed to investigate the effects of work schedules on the health of hospital workers at the Assistance Publique-Hopitaux de Paris (AP-HP). Out of 40 hospitals, 17 volunteered to participate in this study. The Standard Shiftwork Index and a questionnaire concerning physicians' work schedules were used. Ten thousand questionnaires were distributed anonymously to hospital workers between March and April 1999. Professional categories comprised head nurses, nurses, nursing auxiliaries, hospital agents, midwives and full time physicians. Departments included internal and geriatric medicine, general pediatrics, orthopedic and general surgery, operating and emergency rooms, and anesthesiology and intensive care units. 3250 questionnaires were returned. Demographics for the respondents were: 79.2% female, average age 38.1 +/- 9.1 years old.

Eleven work schedules were identified. One fourth of the personnel had fixed morning work schedules. The highest level of job satisfaction was found in personnel working in pediatrics while dissatisfaction was strongest in the gerontology and, emergency room personnel. General Health Questionnaire (GHQ) scores were high for head nurses, operating room nurses and junior doctors as well as for personnel with rotating and flexible shifts. This study will be used to make recommendations concerning the reduction of working time for French hospital workers.

Wagener A. [Legal occupational standards and clinical reality] Z Arztl Fortbild Qualitatssich. 2000 Dec;94(10):854-8; discussion 862-3.

Permanently rising costs--especially caused by the high proportion of staffing costs (depending on the system)--conflict with a continuous budgetary coverage and the consequent exhaustion of an individual hospital's commercial reserves. The solution to this problem cannot be found by making far-reaching staff cuts, because the liability law alone already presents an insurmountable hurdle in this respect.

Furthermore, the pressure on hospitals for rationalization is increased because high legal requirements--such as are given for example by the law regulating working hours--must be implemented in practice. There is a need for new, intelligent solutions in order to satisfy the legal requirements to their full extent. The responsible senior consultants, who will in future hold the function of "health managers" with budgetary responsibility, must be able to fulfill these new duties as well as further ones. It is the legislator's task to create the requisite legal basis--especially in Labour law.

Decker P, Stratmann P, Decker D, Hirner A. [The employment schedule act from the viewpoint of the ordinary surgeon]. Langenbecks Archive der Chirurgie Supplement 1998 115:802-805.

In Germany, the law of labor time was instituted in hospitals on January 1st, 1996 to regulate working hours, times of rest, breaks, and Sunday and holiday work. Problems in the realization of this law arise in daily practice, especially with regard to maximum working hours and post on-call times of rest. The compliance with the law would necessitate an enormous increase in new jobs for physicians, which is associated with an unsupportable rise in costs. Solutions are either a reduction in performance or the omission to document the productivity. Therefore, surgeons in salaried employment in German hospitals constantly face the conflict of legality and legitimacy.

Dohrmann P. [Implementing the employment schedule act at a university clinic--"surgical research during illegal time periods"]. *Langenbecks Archive der Chirurgie Supplement* 199 8 115:799-801.

The realization of the new regulations for working time in hospitals by law (ArbZG) creates a new status for clinical research. The ArbZG clearly includes regulations for times spent on research and teaching. The strict regulations for resting periods, which have to be respected, allow research activities almost only in time spans other than official working time. The council of the European Union has excluded research activities from the guidelines for working time regulations, so there are no limitations on the time spent on research. In contrast, the German regulations for working time include time spent on research, so there is a national disadvantage for research in comparison to other European countries.

Haffner J, Moesgaard F, Leppaniemi A, Magnusson J, Kvernebo K, Wallin G, Engaras B. How much is the workload of surgeons in Scandinavia? *Nordic Medicine* 1998 Dec;113(10):341-345, 359.

According to figures presented at the Biannual General Meeting of the Scandinavian Surgical Society, the mean number of operations performed per surgeon at some clinics of different sizes in Denmark, Finland, Iceland, Norway and Sweden ranged from 90 to 240 in 1996. This corresponds to 2.6 to 8.5 hours actual operating time, though figures are misleading since time spent assisting at operations, or on endoscopies, minor diagnostics and outpatient procedures, and essential pre- and post-operative tasks is not included. This level of operative activity is considered barely sufficient for training surgeons or for maintaining surgical skills. Surgeons could devote more time to surgery if a greater proportion of their non-surgical workload was taken over by other hospital staff, which would also reduce the number of surgeons required.

Kienzle HF. [The employment schedule act: temporal and economic limits]. *Langenbecks Archive der Chirurgie Supplement* 1998 115:795-798.

This Employment Act is designed to decrease the stress burden for hospital doctors by removing avoidable night and shift work and is supposed to lead to an improved working environment. This act will also leave room for family and professional commitments as well as for social activities. Despite continuous efforts within clinical work, there is huge information deficit for detailed handovers and the information given to succeeding colleagues. Operations may need to be deferred, and misunderstandings between patients and relatives are likely to arise. Good co-operation with the nursing staff is suffering. A doctor is likely to miss around 60 days per annum through training. Legal consequences may arise through gaps and negligent paperwork.

Lindhardt A, Sogaard U. [Physician time spent on training, supervision and research at the Roskilde county hospital Fjorden]. *Ugeskrasken Laeger* 1997 Apr 21;159(17):2554-8

Postgraduate training for young doctors is an obligation for clinical departments. However there is a general impression that it has been difficult to acknowledge training as an activity in importance to patient treatment, and thus to give it the necessary priority. For a period of two weeks in 1994, all activities performed by doctors at a psychiatric hospital during working hours were registered. Special attention was given to activities concerning training and educational issues. These consisted of element such as theoretical courses, tutoring in daily clinical work and supervision of psychotherapy giving sessions. Furthermore it was registered whether the doctor had been receiving or giving the training. **Junior registrars, senior registrars and consultants used 15, 13 and 5 percent of their time on training activities, however, during the period concerned the activities mainly consisted of attending external courses. Tutoring in the daily clinical work was non-existent.** It is proposed that clinical

positions that have training as a described part of their function should be secured.

Dusmet M, Reymond M, Merlini M. [The 60 hour week in surgery: possible or impossible]? Helvetica Chirurgia Acta 1993 Jun;59(5-6):855-860.

The number of hours of work per week by doctors is the subject of great controversy in many countries. This has led to restrictive legislation in several states or countries (New York and Great Britain, for example) which is both cumbersome and restrictive. The authors have polled the Swiss surgeons (both trained and in training) in teaching hospitals on this subject with a questionnaire that also covered some other aspects of training. A majority wishes that the working week be limited (to 60 h/week). However a real limit of 60 h per 7-day week (including call duty) is not reasonable. Furthermore the other problems are considered to be more important by 84 percent of respondents. Thus the overall opinion is that there are too many surgeons training in a poorly structured system, both on a personal and institutional basis.

Petersen H, Willumsen E, Grottum KA, Kjrus S, Mikkelsen B, Kleppe A. [Consequences of reduced working hours for continuing education of physicians]. Tidsskr Nor Laegeforen 1993 Jun 10;113(15):1877-1881.

Since 1960 the working hours for hospital doctors in training have been reduced by 12.5 hours per week. A questionnaire was sent to all departments in Norway involved in the education of specialists, asking them about the consequences of this reduction. **The survey showed that the working time actually paid for today is not so short (42-46 hours per week). It showed indirectly, however, that the time available for education must have been reduced. About 50% stated that the reduction in working hours has had a negative effect on the extent and quality of the education.** Nearly all confirmed a conflict of priorities between clinical routines and education. There were seldom opportunities to read medical literature or do research during working hours. There has been no reduction in routine work nor any increase in staff, in spite of a considerable increase in duties connected with the education of specialists.