

Selected Articles on Resident and Physician Work Hours
Compiled by Ingrid Philibert, Updated October 2006
Articles are arrayed by topic, beginning with the most recent citation

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I. *Effect/Predicted Effect of National Duty Hour Limits in Surgical Specialties*

Dola C, Nelson L, Lauterbach J, Degefu S, Pridjian G. Eighty hour work reform: Faculty and resident perceptions. Am J Obstet Gynecol. 2006 Sep 21.

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.

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.**

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.

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.

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.

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; discussion 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.

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.

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.

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.**

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.**

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.**

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.

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 02, 5930 in 03), 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.

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.

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, Piepgras 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.

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.

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.**

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.**

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.

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.**

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.**

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.**

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.

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.

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, Lyson 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.

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 correct have been on call.

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.

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.

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.

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 n-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.

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.

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.

II. Effect/Predicted Effect of National Duty Hour Limits in Non-Surgical Specialties

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.

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.

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.

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 7.

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.

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.

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.

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.

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.**

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.**

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 in Teaching Hospitals

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.**

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 multifactorial, 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.

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 nonvalidated 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.**

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.

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, McMahan 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.**

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.

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.**

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.

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

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 nonsurgery-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 hours 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.

The authors assessed 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.**

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.

V. New Models of Care and Education Under Duty Hour Restrictions

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.

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.

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.**

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.

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, Ignieri 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.

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.

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.

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.

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.

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.**

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.

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.**

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.

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.

Nonphysician 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 such as ours will be encountered increasingly in inpatient subspecialty settings.

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.**

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.

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

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.

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.

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.

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.

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.

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.

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.

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.

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.**

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.

VI. Research on Duty Hours on US Residents in Surgical Specialties

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.

See summary on page 4.

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.**

Morton JM, Baker CC, Farrell TM et al. 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.: 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.

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.

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.

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.

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.

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.

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.**

Scher KS, Peoples JB. A study of the on-duty hours of surgical residents. Surgery Aug;108(2):393-397; discussion 397-399, 1990.

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.

Warner BW, Hamilton FN, Brunck BS, Bower RH, Bell RH Jr. Study of surgical resident working hours and time utilization. Journal of Surgery Research Jun;48(6):606-610, 1990.

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.

VII. Research on Duty Hours for US Residents in Non-Surgical Specialties

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 preimplementation (July 2002 through May 2003) and postimplementation (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. **Postimplementation, 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 postimplementation (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. Postimplementation, 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 preimplementation to postimplementation 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.

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 hours reforms, in violation of duty hours regulations.

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).

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-reporting of work hours by a cohort of Internal Medicine residents. Data was collected from 27 residents in training at Tripler Army Medical Center over a four 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 seven 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.

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.

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.

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.

Lawler LP, Fromke J, Jost RG, Evens RG. Results of and comments on the 2000 survey of the American Association of Academic Chief Residents in Radiology. Academic Radiology 2001 Aug;8(8):777-81.

The American Association of Academic Chief Residents in Radiology (A3CR2) annually surveyed radiology residency programs on issues related to training. The objective is to highlight national similarities, differences, and trends to help programs establish standards and improve residency training. Questionnaires were mailed to 180 accredited diagnostic radiology residency training programs in the United States. The survey covered the usual general topics and more specific topics considered every 4 years; for 2000 the latter were on-call issues and the chief residency year. Completed surveys were returned from 63 programs (35%). Important findings included increased caseload and call commitments, especially for smaller programs. Resident salaries appear to have increased more than the consumer price index. Non-emergent after-hour coverage and teleradiology are now a large part of the resident work practice. Women continue to be underrepresented, with a trend downward. Chief residents are more involved in organizing preparation for board examinations and have greater office facilities and more administrative duties.

The survey provided useful insights. All levels of residency face increased workloads. On-call hours have not changed, but the work has intensified and the use of teleradiology has increased. Many programs have adopted a "night-float" system, and non-emergent after-hours coverage should be considered in any program evaluation. Continued vigilance and sustained efforts are required to ensure that radiology is considered as a specialty by both men and women. With increased demands on attending physicians' time, chief residents may need to take on more administrative responsibilities.

Li J, Tabor R, Martinez M. Survey of moonlighting practices and work requirements of emergency medicine residents. American Journal of Emergency Medicine 2000 Mar;18(2):147-151.

The authors conducted an anonymous moonlighting and academic practice survey of all emergency medicine residents enrolled in accredited programs during 1997. Expanding on previous work, this survey included specific details and practice trends of moonlighting emergency medicine residents and for comparison also included academic work requirements. **The typical emergency residency program requires residents to work 204 hours monthly. However, the range of required work-hours is strikingly large (120-300). Half of emergency medicine residents moonlight. The typical moonlighting resident works as a solo emergency department practitioner in multiple facilities outside of residency-affiliated institutions. Moonlighting salaries generally double a resident's annual income and are used to pay off student loans and other debt. Residents with higher student debt are more likely to moonlight.** Despite the fact that most residency programs restrict moonlighting, a majority of moonlighting residents have violated an Accreditation Council for Graduate Medical Education prohibition restricting work within one period of a regular residency-scheduled shift. Half of all residents surveyed, whether involved in moonlighting practice or not, would violate a ban on the practice. Residents universally felt that moonlighting enhanced residency performance and was a positive educational experience. Use of these data may aid in the development of formal guidelines regarding emergency medicine moonlighting practice.

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.

See summary on page 48.

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.

Berry AJ, Hall JR. Work hours of residents in seven anesthesiology training programs. Anesthesia and Analgesia 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.

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.

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.

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.

VIII. New York State Regulations - Impact on Resident Work Hours

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 56.

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 12.

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

See summary on page 15.

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 38.

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 18.

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.

See summary on page 18.

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 19.

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 28.

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 31.

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.

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 48.

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 49.

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.

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.

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 52.

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 54.

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

See summary on page 23.

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 55.

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 32.

IX. Impact of Work Hours on Health and Cognitive Functioning

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.

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.

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.

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.

Philibert I. Sleep loss and performance in residents and nonphysicians: A meta-analytic examination. *Sleep* 2005;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 28.

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 29.

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.

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-slowing 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.

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.

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.**

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.**

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.

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.

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.

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.

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.

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.

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, Muelleman RL. The occupational risk of motor vehicle collisions for emergency medicine residents. Academic Emergency Medicine 1999;6(10):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. **METHODS:** 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. Journal of Cardiopulmonary Rehabilitation 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.

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.

Lingenfelter 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

X. Impact of International Duty Hour Regulations on Graduate Medical Education

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.

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.

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.

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.**

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.**

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.**

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 seem to indicate that medical staff in**

relation to work load is smaller than recommended. It also seems 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.**

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.

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.

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, 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. RESULTS: 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.

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 behaviour. 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.

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.**

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.

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.**

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.

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.

XI. Impact of International Duty Hour Regulations on Practicing Physicians

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.**

Costa G, Akerstedt T, Nachreiner F, Baltieri F, Carvalhais J, Folkard S, Dresen MF, Gadbois C, Gartner J, Sukalo HG, Harma M, Kandolin I, Sartori S, Silverio J. 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 substudies 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.

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 1998 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.