

Marcela C. Musgrove

Spring 2010

Human Factors and Healthcare

Residents, Work Hours and Sleep Deprivation

Problem

Historically, residents have been required to work long hours. Changes have been made in recent years to their work schedules to limit the hours worked per week as well as per shift. But while it might seem obvious to those coming from a human factors perspective that this is a step in the right direction for patient safety based on experiences in other professions such as aviation and trucking, the medical community has not been completely convinced and some argue that there is not sufficient research for the changes and they could actually be detrimental to patient care. It is essential to have an understanding of the historical and social context which led to the changes as well as the resulting debate and evidence showing whether these interventions have proved to be effective.

Brief History of Residents

Residents get their name from the fact that they originally lived in the hospital. They received no salaries, were not allowed to marry and were expected to be available 24/7. [16]The first surgical residency was implemented at John Hopkins in the 1890s under Dr. William Halsted. Halsted's work ethic was legendary; for him, "Residency was a test of mettle and faith, a superhuman initiation into a superhuman profession." [32] On the other hand, some cite his addiction to cocaine as possibly clouding his judgment and contributing to insomnia which influenced to his thoughts about how long doctors could safely work. [11]

Over the years, there have been several attempts for residents to organize to fight for changes. In 1934, residents unsatisfied with the lack of salaries, no teaching rounds and dangerous working conditions such as ambulance riding formed the Interne Council of New York. In 1936, the group went national and during the thirties and forties lobbied hospitals and states for higher pay and workmen's compensations for interns. It folded in 1952 after the AMA attacked it as communist. During the 1960s, activism occurred again with "heal-ins" which resulted in major pay increases because Medicare and Medicaid agreed to fund a large part of resident stipends. In 1975, 3,000 residents in NYC staged first major physician strike in US history over long hours. Hospitals wrote into residents' contracts work a maximum of every third night on call rather than the

traditional every other night. The strike attracted considerable attention from the media and brought residency reform issues to public eye for the first time.[16]

Libby Zion Case

The most notable case which brought resident work shifts to the attention of the public was the Libby Zion case [6,16,27,28] which happened in 1984. Libby Zion was an 18 year old college freshman who was admitted to New York Hospital at 11:40 pm for fever and uncontrollable shaking. She was seen by an intern and a junior resident who diagnosed her with "viral syndrome with hysterical symptoms". She was prescribed a shot of Demerol to control the shaking and left in the care of nurses while the junior resident Gregg Stone went to sleep in the next building and the intern, Luise Weinstein went to care for other patients.

Between 4 and 4:30 am Zion became more agitated and the nurses called Weinstein twice. Weinstein gave verbal orders over the phone, first to put Zion in physical restraints, and then to inject her with haldol. Shortly after 6 am Zion's temperature was taken again and found to be 108 F. At 6:30 am the patient went into respiratory arrest and could not be resuscitated.

The medical examiner's preliminary cause of death was listed as bilateral bronchopneumonia but remains a source of controversy. The most cited cause is serotonin syndrome, basically an adverse reaction between the Demerol Zion was given and Nardil, an anti-depressant she was on. Zion's father, who was a powerful lawyer and writer for the New York Times believed it was because of the poor patient care she received. Zion convinced the district attorney to convene a grand jury for murder charges. The grand jury exonerated the physicians but blamed the graduate medical education system, issuing a report highly critical of the hospital.

Although the case gets cited frequently in papers on the subject of work hours and fatigue in residents, it is clear that there were a number of possible factors involved. The intern was 24 hours into a 36 hour shift, but it is not clear that she would have made different decisions if she was just starting the shift. A bigger factor seemed to be the fact that there was no attending in the hospital to supervise her. Her giving the nurses orders over the phone while ignoring their pleas to come assess Zion again when she was worsening, was because she was spending time with one of the other 40 patients she had assigned to her so there was a definite staff shortage. Moreover, Zion's psychiatric symptoms seem to be given more weight than her medical condition. Stone withheld antibiotics even though Zion's white blood count was high, and Weinstein ignored Stone's recommendations to give cool soaks and compresses to bring down her temperature. Last but definitely not least, there is considerable doubt as to which drugs Zion actually had in her system and whether the doctors had a full

history of the various prescription drugs she had taken. During the trial, the hospital claimed cocaine had turned up in a toxicology report and could have caused her death, but no tox screen had been run at the time since Zion had denied use and other tests such as urine samples came up negative. The initial civil trial considered the death to be 50% Zion's fault on the basis of possible cocaine use, but her father fought the cocaine charges in order to clear her name.

Bell Regulations

As a result of the public outcry following the grand jury report, a commission of physicians led by Bertran Bell was formed to look at residency training and give recommendations on reforms. As a result, major changes were made in New York State law in 1989. These consisted of:

- Maximum of 24 hr shifts, 80 hr workweek, 1 day off for residents
- Attending physicians need to be in hospital at all times
- Mandated private insurers to pay for hospital staff to compensate

These regulations proved to be hard to enforce. A 1998 survey found all NY hospitals noncompliant, with 77% of surgical interns working over 95 hrs/wk. [15] The regulations also turned out to be expensive, costing \$200 million annually.

Other Calls for Change

Following New York's changes, other calls also came from various sources. A petition was made to OSHA in 2001 by Public Citizen, AMSA, and Committee of Interns and Residents, a resident and fellow union in New York [23]. They argued that sleepy and overworked residents made medical errors and cited studies showing that sleep-deprived residents were at increased risk of being in an auto crash, having depression and giving birth to premature infants. OSHA denied the petition, saying the agency had no jurisdiction over work hours.

Several other state legislatures including California and Illinois attempted to pass legislation similar to that in New York. Several congressional bills were also proposed, the Patient and Physician Safety and Protection Act in 2001(HR 1228), 2003 (HR 3236) and 2005. Perhaps responding to this threat of being regulated from the outside, the ACGME, Accreditation Council of Graduate Medical Education, which accredits residency programs implemented reforms in 2003.

ACGME 2003 Duty Hours Rules

The changes in duty rules the ACGME put forth were very similar to the Bell Regulations in New York State.

- 80 hr workweek averaged over 4 wks
- 1 day in 7 off with no clinical duties or call
- In-house overnight frequency of no more than every third night
- Maximum onsite duty of 24 hours with up to 6 hrs for education and patient transfer and no new patients after 24 hrs)
- Limit on at-home or pager calls

The ACGME work group consisted of 14 members including representatives from emergency medicine, family practice, internal medicine, obstetrics-gynecology, pediatrics, psychiatry and surgery, 2 members of the public, and 2 residents. They admitted that 80 hours was based on a consensus rather than on definitive research that had determined an exact number of hours a week at which residents could safely and effectively learn and participate in patient care. [36] As with the Bell Regulations, there were problems with implementation and enforcement, with reports of residents fudging their hours and being afraid of reporting violations since their residency program might lose their accreditation.

Arguments Against Changes

The most common argument against the changes was that it would prevent “continuity of care”[18,20], the idea that doctors should follow their patient through the course of their illness. With shortened shifts came more frequent handoffs which have been a huge patient safety issue[4]; Wachter cited 40% more handoffs at his hospital [40]. Night floats were a common implementation when a hospital had a dedicated person covering the night shift so that the day residents could sleep. However Gawande cited a Harvard study showed that the covering residents made serious mistakes six times more often than even fatigued residents [20].

Another issue that some argued would be detrimental to patient safety was the decreased amount of education that a resident would supposedly receive in a shortened workweek[1]. This was something indicated as worthy of further study with the new generation of residents coming up in the new system. It is worth noting though that a frequent complaint of residents had been “scut” work, menial work such as transporting patients and drawing blood which takes hours from their day and could make the

difference in their getting sleep at night [15]. However, shifting this work to other staff leads to the next difficulty in implementing changes—economics. In order to meet staffing needs with resident's shorter hours, hospitals sometimes have to hire more expensive physician assistants and nurse practitioners.

The last factor which came through primarily in editorials was that of culture, especially in the surgery community [1,19]. Papers talked about the virtues of work ethic, self-sacrifice, “proving yourself worthy as a doctor” and creating a clock work mentality. There seemed to be a need to prove specialty by specialty the effect of changes. The attitude that “surgeons were different” seemed to be backed up by a review of 21 surgery papers on the changes that showed no changes in mortality and morbidity following the implementation[33] Another paper presented this year aimed to look at the effects of fatigue in neurosurgery by giving stimulation exercise to measure memory and attention while performing simulated surgical tasks. The groups did not show a statistically significant difference in their surgical skills. [2]

Studies That Supported Changes

Many studies supporting the ACGME changes come from the lab of Dr. Charles Czeisler, a sleep medicine professor who directs the Harvard Work Hours, Health and Safety Group. He wrote an early paper on applying circadian principles to shift work in 1982 and is regularly called on by the media to serve as an expert on the topic.

One of the most cited papers from his lab is Landrigan et al's “Effect of reducing interns' work hours on serious medical errors in intensive care units”[27]. It consisted of a one year randomized controlled trial designed intervention schedule eliminating extended (24hr+) work schedule and reduced hours worked to 63/wk. It used direct, continuous observation of the residents by 6 physician-observers with an independent rating of error by two doctors. It found a rate of serious errors in ICU 22% higher during traditional schedule than intervention schedule, with six times as many diagnostic errors during the traditional schedule. However, there was no statistically significant difference in preventable adverse events or patient mortality. It also wasn't possible to isolate the effect of shorter shift from shorter workweek hours, increased sleep, having an additional intern or increased handovers.

A similar paper from his lab published in the same issue of NEJM was Lockley et al's “Effect of reducing interns' weekly work hours on sleep and attentional failures”[30]. In this study, 20 interns completed daily sleep logs were followed, worked 84.9 hrs in traditional schedule, 65.4 hrs in intervention schedule, intervention had less than half rate of attentional failures during on-call nights. Oddly enough even with the differences in schedule, the interns only got 5.8 hrs more sleep per week, seeming to backup

other's assertions that even a shorter work week doesn't ensure that residents would use that time to get more sleep.

A third paper from his lab was Barger et al's [7] "Impact of Extended-Duration Shifts on Medical Errors, Adverse Events, and Attentional Failures". It consisted of a web-based survey of 2747 first year residents through self-report. Interns working five or more extended-duration shifts per month reported 300% more fatigue-related preventable adverse events resulting in a fatality. However, the study received criticism because it did not examine sleep deprivation as an independent variable and embedded it in their definition of medical error [39].

Arnedt et al looked at neurobehavioral performance of residents after heavy night call vs after alcohol ingestion [3]. It consisted of a two session within-subject study of 34 pediatric residents tested under 4 conditions: light call, light call with alcohol, heavy call, and heavy call with placebo. At each session, they underwent a 60 minute test battery, ingested either alcohol or placebo and repeated the test battery. The results were that post-call performance impairment during a heavy call rotation was 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.

Kellogg et al presented an ethnographic study of work hours reform that emphasized attention to social and political issues[25]. As an example, the hand-offs created after a night float system was put in place to implement the work hour changes were effective only 14% of the time. They first mention how the idea of handing off violated the traditional professional identity where they were expected to demonstrate toughness by working many continuous hours without apparent fatigue. The director and chief residents addressed this cultural challenge which increased the number of successful handoffs to 39%. Another challenge was the hierarchy violation when handing over to the more senior moonlighter serving as night float. The moonlighters were critical of the interns since they hadn't needed to hand off things when they were interns and thought that doing so was a sign of weakness. They replaced the senior moonlighter with an intern which resulted in smoother handoffs (79% successful).

Institute of Medicine Report

The U.S. House committee requested the Agency for Healthcare Research and Quality to commission the Institute of Medicine to determine whether long resident work hours compromise patient safety[11]. This resulted in the 400 page report "Resident Duty Hours: Enhancing Sleep, Supervision & Safety"[24]. It gave a very thorough review of sleep deprivation and safety and resident well-being. It said there

was too little data to estimate the extent to which fatigued residents affected patients and called for more long-term studies. It recommended further changes, cutting hours of resident physicians even more to 16 hours per shift OR a 5 hour ‘mandated’ nap in the current 30 hour system, Additionally it recommended that residents should not be awakened from sleep to treat patients and should not drive home after work shifts longer than 16 hours. These changes would cost \$1.7 billion annually. However a survey of family medicine residency program directors found that 71% disagreed that the proposed IOM duty hour regulations would improve patient safety [8,10]. The changes also apparently went against the recommendations of other medical groups: ABNS, Senior Society, ACGME, American Board of Medical Specialties (ABMS) and the Association of American Medical Colleges (AAMC) who said that the evidence did not support any further restrictions in work hours until additional research is conducted and that a single set of work hour rules may not be appropriate given the differences among specialties (medical vs. surgical) and the year of training (first year vs. chief resident). [1]

Conclusions and Recommendations

It is clear that the sleep medicine community is taking the lead in providing studies demonstrating the importance of adequate sleep for patient and resident safety. There is still room for more interdisciplinary studies with the medical community to give evidence-based solutions. Evaluation is sorely needed and many indicate the need for better designed and controlled studies which look at patient outcomes[21,25]. It seemed as if there are still problems with enforcement of existing rules and it would seem difficult to introduce changes so quickly after the other ones were made without really knowing the full impact. Many of the problems with implementing changes are related to other problems we discussed in class such as handoffs and communication. We can also potentially affect change with activism as shown with the campaign on Wakeupdoctor.org.

Bibliography

1. American Association of Neurological Surgeons (AANS). (2008, December 2). Neurosurgeons Raise Concerns About Institute of Medicine Resident Work Hour Report. Retrieved from <http://www.newswise.com/articles/view/547007/>
2. American Association of Neurological Surgeons (AANS). (2010, April 23). Research Analyzes Whether Neurosurgical Resident Fatigue Impacts

Performance. Retrieved from <http://www.newswise.com/articles/research-analyzes-whether-neurosurgical-resident-fatigue-impacts-performance>

3. Arnedt, J. T., Owens, J., Crouch, M., Stahl, J., and Carskadon, M. A. (2005). Neurobehavioral performance of residents after heavy night call vs after alcohol ingestion. *JAMA*, 294(9):1025-1033.
4. Arora, V. (2010, March 10). Patient handoffs limit residents work hour cap gains | KevinMD.com. Retrieved May 1, 2010, from <http://www.kevinmd.com/blog/2010/03/patient-handoffs-limit-residents-work-hour-cap-gains.html>
5. Arora, V. M., Georgitis, E., Woodruff, J. N., Humphrey, H. J., and Meltzer, D. (2007). Improving sleep hygiene of medical interns: Can the sleep, alertness, and fatigue education in residency program help? *Arch Intern Med*, 167(16):1738-1744.
6. Asch,D.A. & Parker, R.M. (1988). The Libby Zion case. One step forward or two steps backward? *New England Journal of Medicine*, 318(12), 771-5.
7. Barger LK, Ayas NT, Cade BE, Cronin JW, Rosner B, Speizer, F., Czeisler, C. . (2006) Impact of Extended-Duration Shifts on Medical Errors, Adverse Events, and Attentional Failures. *PLoS Med* 3(12): e487.
8. Bein, B. (2010, February 3). More Limits on Resident Duty Hours Would Have 'Detimental' Effect, Say Program Directors. *AAFP News Now*. Retrieved from <http://www.aafp.org/online/en/home/publications/news/news-now/resident-student-focus/20100203afmrd-survey.html>

9. Block, A., & Norton, D. (2008). Nurse Labor Effects of Residency Work Hour Limits: Introduction. *Nursing Economics*, 26(6), 368-373.
10. Carek, P., Gravel, J., Kozakowski, S., Pugno, P., Fetter, G., Palmer, E. (2009) Impact of Proposed Institute of Medicine Duty Hours: Family Medicine Residency Directors' Perspective. *Journal of Graduate Medical Education*: Vol. 1, No. 2, pp. 195-200.
11. Czeisler, C. (2009, October 24). It's Time To Reform Work Hours For Resident Physicians. *Science News*, 176(9), 36.
12. Czeisler C (2009) Medical and genetic differences in the adverse impact of sleep loss on performance: ethical considerations for the medical profession. *Trans Am Clin Climatol Assoc.*;120:249-85.
13. Czeisler CA. (2006) The Gordon Wilson Lecture: Work Hours, Sleep and Patient Safety in Residency Training. *Trans Am Clin Climatol Assoc.*; 117:159-189.
14. Dawson, D. and Zee, P. (2005). Work hours and reducing fatigue-related risk: Good research vs good policy. *JAMA*, 294(9):1104-1106.
15. Dimitris, K. D., Taylor, B. C., and Fankhauser, R. A. (2008). Resident work-week regulations: Historical review and modern perspectives. *Journal of Surgical Education*, 65(4):290-296
16. Duncan, D. (1996). *RESIDENTS: The Perils of and Promise Educating Young Doctors* (1st ed.). Scribner.
17. Ellman, P. I., Law, M. G., Tache-Leon, C., Reece, T. B., Maxey, T. S., Peeler, B. B., Kern, J. A., et al. (2004). Sleep deprivation does not affect operative results in cardiac surgery. *Ann Thorac Surg*, 78(3), 906-911.

18. Fischer, J. E. (2004). Continuity of care: a casualty of the 80-hour work week. *Academic medicine : journal of the Association of American Medical Colleges*, 79(5):381-383.
19. Fischer, J. (2005). Surgeons: employees or professionals? *The American Journal of Surgery*, 190(1):1-3.
20. Fletcher, K. E., Saint, S., and Mangrulkar, R. S. (2005). Balancing continuity of care with residents' limited work hours: defining the implications. *Academic medicine : journal of the Association of American Medical Colleges*, 80(1):39-43.
21. Fletcher, K. E., Davis, S. Q., Underwood, W., Mangrulkar, R. S., McMahon, L. F., & Saint, S. (2004). Systematic Review: Effects of Resident Work Hours on Patient Safety. *Annals of Internal Medicine*, 141(11), 851-857. doi:VL - 141
22. Gawande, A. (1997, October 10). Drowsy Docs. Retrieved from <http://www.slate.com/id/2666>
23. Greene, J. (2001, May 21). Petition asks OSHA to limit resident work hours :: May 21, 2001, *amednews*. Retrieved from <http://www.ama-assn.org/amednews/2001/05/21/prsa0521.htm>
24. Institute of Medicine. (2009). *Resident Duty Hours: Enhancing Sleep, Supervision, and Safety* (1st ed.). National Academies Press.

25. Kellogg, K., Breen, E., Ferzoco, S., Zinner, M., and Ashley, S. (2006). Resistance to change in surgical residency: An ethnographic study of work hours reform. *Journal of the American College of Surgeons*, 202(4):630-636.
26. Klingensmith, M., & Firlik, K. (2009). The Ethical Dilemma of Duty-Hour Reporting. *Virtual Mentor*, 11(11), 835-841.
27. Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, Lilly CM, Stone PH, Lockley SW, Bates DW, Czeisler CA. (2004). Effect of Reducing Interns' Work Hours on Serious Medical Errors in Intensive Care Units. *N Engl J Med*, 351(18), 1838-1848. doi:[10.1056/NEJMoa041406](https://doi.org/10.1056/NEJMoa041406)
28. Lerner, B. H.. (2009, March 3). A Life-Changing Case for Doctors in Training. *The New York Times*. Retrieved from <http://www.nytimes.com/2009/03/03/health/03zion.html>
29. Lerner, B. H. (2006, November 28). A Case That Shook Medicine. *The Washington Post*. <http://www.washingtonpost.com/wp-dyn/content/article/2006/11/24/AR2006112400985.html>
30. Lockley SW, Cronin JW, Evans EE, Cade BE, Lee CJ, Landrigan CP, Rothschild JM, Katz JT, Lilly CM, Stone PH, Aeschbach D, Czeisler CA; Harvard Work Hours, Health and Safety Group. Effect of reducing interns' weekly work hours on sleep and attentional failures. *N Engl J Med*. 2004 Oct 28;351(18):1829-37
31. Martin, M. (2010, March). Resident Workload Debate Unveils Bigger Picture. *AAMC Reporter*. Retrieved from: <http://www.aamc.org/newsroom/reporter/march10/resident.htm>

32. Mukherjee, S. (2004). A Precarious Exchange. *N Engl J Med*, 351(18), 1822-1824. doi:[10.1056/NEJMmp048085](https://doi.org/10.1056/NEJMmp048085)
33. Pape, H. C. and Pfeifer, R. (2009). Restricted duty hours for surgeons and impact on residents quality of life, education, and patient care: a literature review. *Patient Safety in Surgery*, 3(1):3+.
34. Petersen LA, Brennan TA, O'Neill AC, Cook EF, Lee TH. Does housestaff discontinuity of care increase the risk for preventable adverse events? *Ann Intern Med*. 1994; 121:866-72.
35. Philibert, I. (2005). Sleep loss and performance in residents and nonphysicians: a meta-analytic examination. *Sleep*, 28(11):1392-1402.
36. Philibert, I., Friedmann, P., Williams, W. T., and for the members of the ACGME Work Group on Resident Duty Hours (2002). New requirements for resident duty hours. *JAMA*, 288(9):1112-1114.
37. Rosenbaum, J. R. (2004). Can residents be professional in 80 or fewer hours a week? *The American journal of medicine*, 117(11):846-850.
38. Schenarts, P., Anderschenschenarts, K., and Rotondo, M. (2006). Myths and realities of the 80-hour work week. *Current Surgery*, 63(4):269-274.
39. Szklo-Coxe, M. (2006). Are Residents' Extended Shifts Associated With Adverse Events? *PLoS Medicine*, 3(12). doi:[10.1371/journal.pmed.0030497](https://doi.org/10.1371/journal.pmed.0030497)
40. Veasey, S., Rosen, R., Barzansky, B., Rosen, I., and Owens, J. (2002). Sleep loss and fatigue in residency training: A reappraisal. *JAMA*, 288(9):1116-1124.
41. Wachter, R. (2007). *Understanding Patient Safety* (1st ed.). McGraw-Hill.
42. West, C. P., Tan, A. D., Habermann, T. M., Sloan, J. A., and Shanafelt, T. D. (2009). Association of resident fatigue and distress with perceived medical errors. *JAMA*, 302(12):1294-1300.