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Impact of extended duty hours on medical trainees

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ABSTRACT

Many studies on resident physicians have demonstrated that extended work hours are associated with a negative impact on well-being, education, and patient care. However, the relationship between the work schedule and the degree of impairment remains unclear. In recent years, because of concerns for patient safety, national minimum standards for duty hours have been instituted (2003) and revised (2011). These changes were based on studies of the effects of sleep deprivation on human performance and specifically on the effect of extended shifts on resident performance. These requirements necessitated significant restructuring of resident schedules. Concerns were raised that these changes have impaired continuity of care, resident education and supervision, and patient safety. We review the studies on the effect of extended work hours on resident well-being, education, and patient care as well as those assessing the effect of work hour restrictions. Although many studies support the adverse effects of extended shifts, there are some conflicting results due to factors such as heterogeneity of protocols, schedules, subjects, and environments. Assessment of the effect of work hour restrictions has been even more difficult. Recent data demonstrating that work hour limitations have not been associated with improvement in patient outcomes or resident education and well-being have been interpreted as support for lifting restrictions in some specialties. However, these studies have significant limitations and should be interpreted with caution. Until future research clarifies duty hours that optimize patient outcomes, resident education, and well-being, it is recommended that current regulations be followed.

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Background

Until 2003, the on-duty hours of residents traditionally averaged more than 80 h/wk, with a significant number reporting more than 110 h/wk, particularly during their internship.¹ Traditional in-house call included extended shifts of more than 36 hours every 2 to 3 days. Extended on-duty shifts are associated with both acute and chronic sleep deprivation and sleep fragmentation.^{2–4} Studies demonstrating that sleep deprivation adversely affected trainees emerged in the 1970s. One-third of residents reported that their long duty hours impaired their ability to work with adequate efficiency.^{5,6} In addition, extended work shifts adversely impacted the quality of care^{6,7} and interactions with patients^{6,7} and staff,¹ and resulted in significant medical errors.^{1,5} Many subsequent studies have demonstrated that extended work hours negatively impact resident well-being, education, and patient care. However, there are others that show no adverse effect. Potential reasons for the discrepancy will be explored in this review.

Over the last 30 years, there has been a dramatic change in the structure of medical training, precipitated by concerns for patient safety in the face of extended shifts and resident fatigue. Challenges to the tradition of extended shifts for residents were raised in 1984 after the death of Libby Zion, an 18-year-old college student who died within 24 hours of admission in a New York hospital. She was under the care of an intern and second-year resident, carrying a high volume of patients, who were supervised via telephone by an attending physician. The cause of her death was likely an uncommon, but fatal interaction between her antidepressant and a sedative she was administered. However, in addition to a lack of adequate supervision, the culpability of resident fatigue due to extended duty hours was raised.⁸ Although formal investigations did not provide convincing evidence that extended work hours or resident fatigue played a role in her death, it became the catalyst for work hour reform. As a result of the Libby Zion case, the Bell Commission was formed to evaluate the training and supervision of doctors in the state. In 1989, based on the recommendations of the committee, New York State limited duty hours to 80 hours a week (averaged for 4 weeks); however, no other states followed suit.

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In 1999, the landmark Institute of Medicine (IOM) *To Err is Human: Building a Safer Health System* raised grave concerns over the integrity of patient safety in hospitals.⁹ Concerns about the relationship between sleep deprivation and reduced performance led to legislative proposals to limit resident work hours. Finally in 2003, the Accreditation Council for Graduate Medical Education (ACGME) instituted national minimum standards which included limits to an 80-hour week (averaged for 4 weeks) and 24 hours of continuous duty with additional 6 hours for transfer of care and educational activities (Table 1).¹⁰ The requirements necessitated significant restructuring of resident schedules. Duty periods were broken down into more shifts of shorter duration, often using a night float system. The frequency of overnight calls for residents was decreased. Protected sleep periods were sometimes instituted. Overnight call in some specialties was transitioned to home call. Other modifications included increasing the number of residents, hiring ancillary staff and health professionals, shifting work to attending physicians, and restructuring the educational curriculum. These restrictions were further adjusted in 2011 to make specific recommendations based on postgraduate year and to address implementation of night float systems.

The effects of the duty-hour restrictions on resident well-being, education, and patient safety have been examined in a number of studies and systematic reviews, and the results are conflicting. However, to measure the effect of the work hour restrictions, it is critical to first have an understanding of the effect of extended hours on these parameters. We review herein the known effects of extended work hours and resultant sleep deprivation on resident well-being, education, and patient safety and then the impact of the duty-hour restrictions. MEDLINE and PubMed databases were searched for peer-reviewed, English-language research studies, review articles, and meta-analyses on sleep loss in resident physicians, published between 1971 and 2016, using combinations of the Medical Subject Heading sleep deprivation, internship and residency, housestaff, intern, resident, or physicians in training and by examining reference lists of retrieved articles.

The effect of traditional extended shifts on residents

Resident well-being

Sleepiness

Extended work hours and decreased sleep are associated with sleepiness; this is reflected in higher scores on Epworth Sleepiness Scale,¹¹ Stanford Sleepiness Scale,^{12–14} and visual analog scale.¹⁴

Sleep latency on multiple sleep latency test was decreased in anesthesiology residents both during their traditional rotation (5 overnight calls/mo) and immediately after 24-hour call (6.7 ± 5.3 and 4.9 ± 4.7 minutes, respectively), reflecting the effects of both chronic and acute sleep deprivation.² In contrast, when they were able to sleep for 4 nights, the sleep latency normalized in almost all of them (12.0 ± 6.4 minutes); only 1 of the 11 participants remained hypersomnolent under all conditions. In another study, sleepiness and mood changes did not resolve after the first recovery night period in internal medicine residents, again potentially reflecting the effects of chronic sleep deprivation.³

Importantly, residents underreported their degree of sleepiness, which may reflect an impairment in their ability to perceive it accurately. Despite higher scores on sleepiness scales with extended work hours, surgical residents scored lower on a sleep deprivation impact scale when compared with nonsurgical residents who worked fewer hours and were less sleepy.¹⁵ In another study, anesthesiology residents demonstrated poor ability to discriminate microsleeps documented by electroencephalogram. They failed to report sleep in 49% of the episodes identified by electroencephalogram as sleep and when they reported that they had stayed awake, they were wrong 76% of the time.²

Mood

Studies demonstrating that sleep deprivation adversely affected the mood of medical trainees emerged in the 1970s. In 1971, Friedman et al¹⁶ reported that sleep-deprived internal medicine interns (with a mean of 1.8 hours of sleep) reported increased sadness, decreased vigor, egotism, and social affection. Difficulty thinking, depression, irritability, depersonalization, inappropriate affect, and memory deficit were reported by interns.¹⁷ In 1981, Small¹⁸ described the “house officer stress syndrome” characterized by episodic cognitive impairment, chronic anger, pervasive cynicism, and family discord, as being prevalent in a “benign form” in most house officers, caused by sleep deprivation and excessive workload. Severely affected house officers suffered from major depression, suicidal ideation, and substance abuse. Sleep deprivation was associated with higher stress levels in residents, which was worse in those with large patient loads, inadequate support from attending physicians, less robust social support systems, inadequate time to pursue personal matters, and competition from peers.¹⁹

Many subsequent studies demonstrated that residents developed mood impairment during their training. Increased anger, tension, confusion, depression, and fatigue were reported in surgical

Table 1
Comparison of duty-hour limitations between the 2003 and 2011 ACGME requirements and the 2009 IOM Recommendations

	ACGME 2003 requirements	IOM 2009 recommendations	2011 ACGME requirements
Maximum h/wk	80 h, averaged for 4 wk	80 h, averaged for 4 wk	80 h, averaged for 4 wk
Maximum duration of duty period	30 h 24 h consecutive duty 6 h additional allowed No new patients after 24 h	30 h (5-h nap required after 16 h) 16 h without nap No new patients after 16 h	16 h for interns 28 h for more senior residents 24 h consecutive duty 4 h additional allowed Napping recommended No new patients after 24 h
In hospital on-call frequency	Every 3rd night, averaged for 4 wk	Every 3rd night, no averaging	Every 3rd night, averaged for 4 wk
Minimum time off between scheduled duty periods	10-h off between all daily duty periods and in-house call	10 h after regular daytime duty 12-h off after night duty 14-h off after extended duty period and must not return before 6 AM	Should have 10 h and must have 8 h between duty periods (exceptions for residents in final years) 14 h after in-house call
Minimum off-duty time	24 h off in 7 days, averaged for 4 wk	24 h off in 7 days, no averaging, plus golden weekend (48 h/month)	24-h off in 7 d, averaged for 4 wk
Maximum frequency of in-house night duty (night float)	As per subspecialty	4 consecutive nights and must have 48-h off	6 consecutive nights Max 4 wk/y; max 1 consecutive wk

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