# Chapter 10 New Standards Addressing Fitness for Duty, Alertness Management, and Fatigue Mitigation

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> If sleep does not serve an absolutely vital process, it is the biggest mistake the evolutionary process ever made.
>
> Allan Rechtschaffen

## Sleep and Its Effect on Performance: A Brief History

In 350 BCE Aristotle wrote about human sleep as ''an inhibition of sense perception'' for ''conservation.''[1] Studies on the effect of sleep and sleep loss began with animals in the 1800s and the 1920s. Kleitman and colleagues[2] explored how sleep and wakefulness relate to circadian rhythms and studied the effects of sleep deprivation. One of Kleitman's students, William Dement,[3] described the cyclic patterns of rapid eye movement (REM) and non-REM sleep in humans and later in other mammals. In 1968, Allan Rechtschaffen and Anthony Kales created ''A Manual of Standardised Terminology, Techniques and Scoring System for Sleep Stages of Human Subjects,''[4] and in 1978, Mary Carskadon and colleagues[5] developed the first test to assess for sleepiness, known as the multiple sleep latency test. The first study in resident physicians, conducted by Friedman and colleagues[6] in 1971, showed that postcall residents made more errors in reading a standardized electrocardiogram than their rested colleagues.

In the ensuing 4 decades, individual studies and systematic reviews found that sleep deprivation had a negative effect on aspects of human performance important to physicians' work, including cognitive function, working memory, vigilance, fine motor skills, and mood.[6–12] Three meta-analyses[13–15] and 3 qualitative reviews[16–18] found that sleep deprivation reduced cognitive performance, mood, concentration, and effort. All subjects reported a decline in performance after 24 to 30 hours without sleep, and several highlighted chronic partial sleep loss, defined as sleep duration of fewer than 5 hours for several consecutive nights, as a significant cause of reduced performance. Chronic partial sleep loss is common in residents, and residents who reported sleeping 5 or fewer hours per night were more likely to report having worked in an ''impaired condition'' and having made medical errors.[19]

The meta-analyses also explored moderators in the effect of sleep loss on performance, including type of performance, as well as task duration and complexity. Research on type of performance found that vigilance appears to be affected first by sleep loss and to a higher degree than memory and cognitive function, with gross motor performance being quite resilient.[14,15,20] Hours without sleep influenced this effect, with long-term total sleep deprivation having the most pronounced negative consequences for performance.[14,15] A meta-analysis with a large sample of physician participants reported a decline in clinical performance of 1.5 standard deviations in sleep-deprived individuals.[15] Finally, interindividual variation in the effect of sleep loss on performance may be a moderator. Some individuals appear to be profoundly affected, whereas others are minimally affected by the same number of hours without sleep[21–23]; others may require longer sleep on a regular basis to maintain wakefulness.[24] Recent research has identified a gene allele associated with individuals' high susceptibility to sleep loss.[25]

A number of commentaries about physicians and their performance while sleep deprived have suggested that individual selection may result in physicians as a group being more resistant to the performance effects of sleep loss. While some selection undoubtedly is present, 2 other factors may explain why earlier studies have found that physicians are less affected by sleep loss. The first is that many residents experience chronic partial sleep loss owing to their working schedules; the second relates to differences in how studies were conducted.[15] Most research on sleep deprivation in nonphysicians has been conducted in highly controlled laboratory settings, while the common approach for studying residents involves field experiments that compare the performance of postcall residents to a ''rested'' comparison group or that study the same residents in a sleep deprived and a ''rested'' state. This approach results in studies with less rigid control on the number of sleep hours for the sleep-deprived group, which attenuates the effect size of sleep loss in these field studies.[15]

An important recent observation is that while older studies of the clinical implications of sleep loss have found it to be associated with greater complication rates,[26] and increased errors and lower effectiveness on actual and simulated care tasks,[27–29] more recent studies conducted under the 2003 ACGME common duty hour standards or comparable limits and conditions in other nations, including 24-hour call, have failed to find a reduction in clinical performance in physicians.[30–34] A study of surgical residents[35] also found no worsening of mood under conditions of acute sleep loss. Its authors[35] and an unpublished meta-analysis of articles on the effect of work and sleep hours on clinical performance and medical errors hypothesized that by eliminating some of the chronic sleep debt, the duty hour limits may have reduced the negative effect of acute sleep loss in postcall individuals (Ingrid Philibert, unpublished meta-analysis, December 2010).

## Fitness for Duty

Standards and regulations to promote patient safety and resident alertness for the learning process traditionally have focused on the number of hours worked. This includes state regulation of resident hours in New York State and the ACGME's 2003 common duty hour standards. However, focusing predominantly on duty hours neglects much of the science about sleep and performance that may influence multiple human factors. The concept of ''fatigue'' extends beyond sleep status and views other factors. This concept recognizes that the performance effect of sleep loss on performance is more complex than a linear association with hours without sleep and is influenced by the time of day and its effect on circadian rhythm,[36–39] as well as the length and complexity of the test or task, and whether it is self-paced or performed at a pace that is externally dictated.[14,40,41]

Limits on resident duty hours, applied equally to all residents in all situations, cannot incorporate information about the amount and quality of the sleep the individual resident had before presenting for work on a given morning; about the biologic factors that may predispose an individual to be more susceptible to the performance effects of sleep loss; nor about questions about the intensity of the activities residents engage in during their nonduty hours.

Sleep experts who have advocated for further restrictions in resident hours acknowledge that a host of factors, both genetic and adaptive, contributes to different individual responses to the amount and quality of sleep obtained.[22,42]

Without the ability to consider some of these attributes of individuals, tasks or contexts, the concern is that further restrictions in resident hours may reduce professional socialization and preparation for some of the demands of independent practice,[43] but still may not guarantee a rested and alert resident.

The ACGME Task Force asked the advice of experts in exploring whether tests existed that could determine an individual resident's fitness for duty. The ideal would be a quick, reliable, easy to administer, and inexpensive assessment tool that could accurately predict the ability to safely provide care, effectively participate in the learning process, and ensure the safety of the resident on activities such as driving home. To date, no reliable mechanism exists that would be feasible and practical for application in residency programs. Research in this area has been conducted for the past 2 decades and continues to focus on the development of a model of alertness and performance by using 3 relatively simple inputs: the time of day, the time since awakening, and the duration of prior sleep.[44] This has shown some success in predicting motor vehicle accidents.[45]

### Alertness Management/Fatigue Mitigation

There has been considerable research on the assessment of sleep for the past several decades, which has produced a number of methodologies, both investigational and clinical, including polysomnography, wrist actigraphy, sleep latency tests, and others.[1,3–5] These can be used to measure the amount of sleep, its quality, and the desire for sleep, with some of these providing information that can be used to make inferences about alertness. There also is an emerging science of how to maintain and manage alertness by identifying and addressing various factors that assist in maintaining wakefulness and alertness.

> Alertness management strategies can minimize the adverse effects of sleep loss and circadian disruption and promote optimal alertness and performance in operational settings. Sleep and circadian physiology are complex, individuals are different, the task demands of settings are different, and schedules are extremely diverse; therefore, no single strategy will fully address the fatigue, sleepiness and performance vulnerabilities engendered by 24-hour operational demands. Rather than attempt to eliminate fatigue, it may be more useful to consider the critical factors that can promote and optimize alertness management.[46]

The belief that there should be systematic attempts to manage alertness for individuals who need to work and function under stressful conditions for prolonged periods of time is not unique to medicine.[47] Physicians, nurses, police, firefighters, emergency personnel, fighter pilots, naval crews, and transportation workers all operate in environments where the timing of work is not always conveniently matched to the human circadian rhythm, and the length of the work may challenge individuals' ability to function effectively.[48] While to date few trials of alertness management strategies have been undertaken with resident physicians in clinical settings, a sizable body of research has addressed the effectiveness of alertness management strategies in pilots, air traffic controllers, shift workers, and adults in laboratory settings, with much of this work done at the NASA Ames Jet Lag and Fatigue Countermeasure Groups.[49–51]

### Rationale for the Standards on Alertness Management/Fatigue Mitigation

The 2011 ACGME common duty hour standards expand the 2003 requirements that included a requirement for educating residents and faculty about recognizing and responding to the signs of fatigue and sleep deprivation. In addition, they include new standards for education in alertness management and fatigue mitigation, and for programs to adopt fatigue mitigation strategies such as naps or backup schedules. The standards call for each program to do the following:

- Educate all faculty members and residents to recognize the signs of fatigue and sleep deprivation;
- Educate all faculty members and residents in alertness management and fatigue mitigation processes; and,
- Adopt fatigue mitigation processes, such as naps or backup call schedules, to manage the potential negative effects of fatigue on patient care and learning.

The underlying evidence indicates that while research has shown that self-assessment of fatigue by individuals is poor,[48] individuals can plan in advance to deal with fatigue and institute appropriate countermeasures.[47] Allowing for naps at opportune times during actual work conditions

| TABLE | **Effective Alertness Management** |
|---|---|
| Fatigue prevention strategies | |
| Obtain adequate sleep before presenting for duty | |
| Treat all sleep-related illnesses (insomnia, OSA) | |
| Obtain adequate exercise and nutrition | |
| Reduce use of alcohol or hypnotics for sleep when not on duty, if avoidable | |
| Fatigue mitigation strategies | |
| 10- to 45-minute naps | |
| 1- and 2-hour naps also increase efficacy, but may result in sleep inertia | |
| Caffeine when sleepy (and not when awake) | |
| Exercise/activity during duty | |
| Bright light | |

Abbreviation: OSA - obstructive sleep apnea

has been tested in pilots on long-haul flights,[52] nurses,[53] and air traffic controllers,[54] with improved postnap performance found across this range of occupations, with performance dimensions relevant to the work of physicians. Preventive strategies (coming to work rested and ready for duty), in addition to operational strategies (napping, use of caffeine) have been assessed and have proved effective.[55]

> The program director and institution must ensure a culture of professionalism that supports patient safety and personal responsibility.
>
> Residents and faculty members must demonstrate an understanding and acceptance of their personal role in the following: assurance of the safety and welfare of patients entrusted to their care; provision of patient- and family-centered care; assurance of their fitness for duty; management of their time before, during, and after clinical assignments; recognition of impairment, including illness and fatigue, in themselves and in their peers.

The 2011 ACGME common program requirements for the first time mention attention to being rested and fit for duty as an element of residents' personal and professional obligations. This is based on research showing that obtaining appropriate rest between duty periods greatly improves operational effectiveness in several occupational sectors.[49–55] Maintaining good sleep hygiene when not at work can include regular bedtimes, use of the bedroom for sleep, eating only lightly (or not at all) before sleep, avoiding alcohol or caffeine before sleep, and getting out of bed if not asleep in 30 minutes.[56–61] Operational alertness management strategies must allow for individual, workload, and task variation and are best when several strategies are used collectively. What is important is to be aware of which strategies work. Strategic napping, use of selected stimulants,[62] physical activity,[63] and eating properly have been shown to be of benefit. The use of stimulants has been studied in shift workers; of these stimulants, caffeine is the safest and easiest to use (TABLE).[62,64,65] To obtain the best effect in managing alertness, caffeine should not be used as a ''food,'' but rather as a drug to be taken when one is most fatigued, and not taken before sleep periods or when waking from a nap.

Naps in the workplace have been tested in some occupations, with beneficial effects on alertness.[52–54] Scientific studies suggest that a minimum of 2 hours is required for completion of 1 ''cycle'' through the various stages of sleep.[66,67] Longer naps of up to 1 hour have been associated with sleep inertia, or difficulty waking up after napping.[46,68,69] In some contexts, very brief naps have been demonstrated to improve alertness and reduce errors in laboratory experiments, with nap length ranging from 10 or 20 minutes, but also 30 seconds and 90 seconds.[54,70–73]

The 2008 Institute of Medicine report[74] on resident duty hours included a recommendation for 5-hour naps. However, the only 2 studies of a prolonged nap period for residents found them ineffective in improving alertness.[75,76] An early formal study of a 4-hour protected sleep period showed that sign-out to night-float residents for

4 hours did not significantly change total sleep time (it did increase slow-wave sleep) nor did it have significant effect measures of alertness and performance.[75] In the second study, residents rarely fully used the nap period provided to them, owing to an unwillingness to sign out the pager for their own patients, and the study also found that residents with shorter nap periods felt more rested.[76]

Making fitness for duty part of residents' professional obligations recognizes both its important contribution to managing alertness for patient care and the learning process; it also responds to comments the Task Force received that indicated some confusion in the graduate medical education community about the extent to which program leaders can influence the activities and behavior of residents during their hours outside of the educational program. Other standards, which promote alertness management in the clinical setting, include a reiteration of the importance of appropriate space conducive to sleep and rest in the hospital. Included are enhanced standards that formally make residents and faculty collectively responsible for the safety and welfare of patients and that call for a transfer of responsibility for the patient to another rested provider; the standard for appropriate backup to maintain continuity of care when a resident is too fatigued to perform his or her patient care responsibilities; and the new standard for provision of safe transport home for residents too fatigued to drive safely.

> All residents and faculty members must demonstrate responsiveness to patient needs that supersedes self-interest. Physicians must recognize that under certain circumstances, the best interests of the patient may be served by transitioning that patient's care to another qualified and rested provider.

> Each program must have a process to ensure continuity of patient care in the event that a resident may be unable to perform his or her patient care duties.

> The sponsoring institution must provide adequate sleep facilities and/or safe transportation options for residents who may be too fatigued to safely return home.

In addition to continued education of residents and faculty about sleep, performance, and alertness management, the requirements expand the role of program directors, faculty, and resident colleagues in identifying and intervening in instances when residents exhibit signs of fatigue. Fully meeting the intent of these standards may necessitate change in the culture of some programs and sponsoring institutions, with faculty taking an active role in supporting residents' decision to leave when fatigued; counseling residents who appear fatigued but are reluctant to leave; and assisting residents in making appropriate decisions about the circumstances when patient care and learning are served by staying beyond the limits and when patients benefit from transferring the care to a rested resident or team. To avail themselves of something as simple as safe transportation home, residents need to recognize their own limits and request it, knowing their safety may be compromised by driving. Programs will need to institute the necessary changes in their learning environment to allow residents to make these decisions.

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