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CLINICAL REVIEW

Graduate medical training, learning, relationships, and sleep loss

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Summary 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.

Introduction

Recent reviews now clearly identify a growing consensus that unrestricted hours-of-service adversely affect resident performance.[1–5] These reviews also identify gaps in study design and needed data to establish and improve known relationships among resident physician sleep, sleepiness, and patient care. A recent meta-analysis of studies on resident performance provides a comprehensive review of this literature.[6] Effective July 1, 2003, duty hour requirements were adopted by the Accreditation Council on Graduate Medical Education (ACGME). These specify that duty hours must be limited to 80 h/week, averaged over a 4-week period, inclusive of all in-house call activities.[7] Recent studies with better design suggest that the ACGME established hours of service may be too long to prevent decrements in vigilance, motor ability, and/or medical error.[8] An editorial reflecting on this recent evidence suggests that an 80-h work week may still result in preventable errors of omission and commission due to human failure to adapt to sleep loss and requirements for vigilance at all times of the day.[5]

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In this review, we address issues that go beyond the effect of sleep loss on resident performance per se, and discuss the literature on the implications of sleep loss on personal, social, and professional growth and development. This literature is most often at an observational level; however, there are parallel models in other workplaces that illustrate the potential implications of sleep loss on post-graduate career and life skills. To counteract these effects, regulation and legislation were enacted. For these to be effective, educational initiatives are necessary that identify both personal as well as institutional or systems level solutions.

Learning of medical knowledge

To acquire new knowledge and to consolidate learning requires an active brain.[9,10] Circadian rhythm affects learning and performance.[11] Studies have documented serious consequences of both short and long-term sleep loss on cognition and judgment, as well as the cumulative detrimental effects on learning and cognition resulting from current schedules[1,2,12] with modest but predictable amounts of sleep loss over time.[13] Furthermore, the influence of human circadian physiology dictates both that wakefulness and alertness are in most people at optimal levels during daylight hours, and that sleep propensity is maximized at night.[14] While there are individual differences in these effects, there is no evidence that, as a group, physicians have a special resistance to the effects of sleep loss (Fig. 1).

The absence of appropriately timed (and adequate) amounts of sleep is associated with a decline in waking function.[15] The consequences of work-related sleep loss and shift work in physicians in training are potentially serious in scope, and occur in various contexts and domains.[16,17] While there is controversy about the issue of whether sleep is an important feature in learning new material,[18,19] fatigue does impact on information processing and motivation.[20,21] Focus groups of resident physicians report that sleepiness at any time of the day intruded on sustained reading and medical scholarship, activities that were reported to be as highly valued in undergraduate learning.[22] A significant impact on learning is reported to occur even in the era of the 80 h regulations.[23,24] One reason to pay attention to fatigue is its inherent impact on acquisition of practical knowledge and clinical skills that is the stated reason for this period of transition from medical school to medical practice.

Sleep loss and professionalism

Resident physicians develop a professional identity in residency that persists into practice.[25] The process occurs through role modeling and socialization.[26] Professionalism is a broad concept that may be regarded as having three domains: interpersonal skills, doctor patient communication skills, and civic professionalism.[27] Professionalism is related to personal attributes such as ethics, humanism, altruism, and personal values. Increasingly more attention is being paid to how and how well this professional demeanor develops as well as how it could be measured.[28–30] Review of three decades of literature indicates that professionalism is circumscribed by specific elements. About half of medical schools had written criteria for their concept of professionalism and methods in place to assess it.[29]

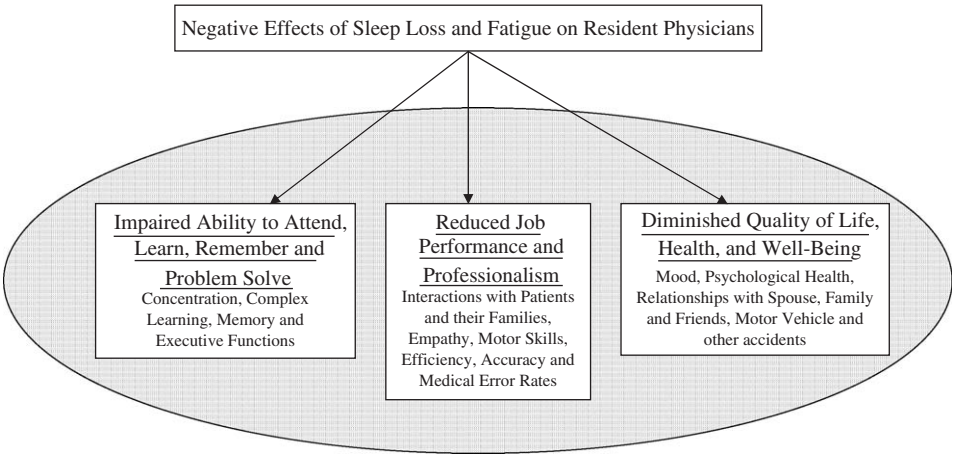

Figure 1 This is a conceptual model illustrative of the personal effects of sleep loss and fatigue on resident-physicians. What is not represented is the potential additive impact of medical errors of omission or commission, which also result from sleep loss and fatigue, on these domains.

An important question that needs further exploration is, "does the assessment of professionalism attempt to uncover the reasons for the behavior as well as the behavior itself?" Generally it does not, yet uncovering reasons behind unprofessional behavior is potentially very important. More to the point, it is unfortunate that unprofessional behavior is seldom considered a 'state' that may be accounted for by sleep loss and fatigue or at the very least correlate very highly with its occurrence. Rather, the majority of studies consider professionalism a 'trait' that characterizes an individual's qualities of character and demeanor, i.e. internally rather than environmentally determined. The general impact of sleep and fatigue on professionalism was first identified in focus group studies of residents across several specialty training programs in five different academic medical centers.[22] Study designs to address more precisely these relationships would need to capture both the individual and the programmatic features of chronic sleepiness on professional development after graduate training.

Sleep loss and developing family life and friendships

One developmental task in early adulthood is to develop relationships and family life. Residents are no exception and they are learning how to establish and maintain adult relationships with others in their lives not only with colleagues but increasingly with spouses and children, as well.[29,31] Such connections are known to have effects on health and in stress reactions, and success in this domain can have lifelong effects. To illustrate the circumstances that residents face, one resident featured on an ABC News program entitled *Hopkins 24/7,* made this point[32]: "*Obviously, part of the reason we all go to medical school is to take care of people, but after being awake for 56 h or more, all you really care about, I think—or at least all I really cared about was me.*" This search for connections comes at a time when job responsibility leaves little energy for satisfying this developmental phase.[30,31] The social personality of the trainee can be shaped by energy loss and affect current and future interactions with patients and family, and friends.

Mood and psychological health

Small first described features of a stress syndrome as 'common' among graduate physicians.[33] These are: episodic cognitive impairment, chronic anger, pervasive cynicism, and family discord. At the time, these were considered by some to be 'normal' reactions to the demands of residency training,[35] as the biology of sleep loss was less well understood. A recent review also stressed the prevalence of mood disorders including anxiety, depression, obsessive-compulsive trends, hostility, and alcohol and substance abuse.[36] The precise role of sleep loss in this "syndrome" has not been specifically addressed by these psychologically directed surveys. However, a general survey of residents across the nation noted a higher prevalence of self-reported conflict with peers, interpersonal problems and alcohol use associated with longer hours of service[37,38] and mistreatment.[39] There is also the notion that some residents seem to have a "black cloud", meaning that their experiences during residency are more troubled than other residents.[40] In this study, residents with "black cloud" slept less, perceived that they worked harder than average, and had a reputation for having difficult on-call experiences. Residents with "black cloud" appeared to work differently and in the one example given they appeared to work more inefficiently. The assumption was that the resident had some intrinsic feature, even depression, that produced this "black cloud"; however, given the literature on the ability of chronic sleep loss to impact on thinking, efficiency, and mood, it may be that sleep loss or even the individual reaction to sleep loss plays some part in the generation of this "black cloud". Focus groups of physician residents in general reported that sleep loss and fatigue left them vulnerable to loss of self-esteem and contact with not only other residents but with staff as well.[22]

Medical residents and their families

Although most research on postgraduate medical education focuses on student doctors as individuals, residents are embedded in informal social networks of family and friends. Among residents participating in one focus group study, 46 percent were married and 20% had children.[22] Women were more likely than men to be married (52% of female residents in comparison to 38%), but the percentages of male and female residents who were parents was similar (19% men and 21% women). Although no quantitative information was gathered about relationships, residents frequently mentioned romantic partners, other family members, and friends in discussing the impact of sleep loss and fatigue in their personal lives.

These results and prior research on the work–family interface in other professional work settings raise concerns that sleep deprivation and fatigue undermine relationships and constrain the ability to effectively manage tasks of daily life.[41] The effects are similar to the potential effects on personal development in new relationships (as noted above) whereas in this instance there is reduced energy available for relationship maintenance. Residents in focus groups talked about feeling less patient, more moody, less tolerant, more irritable and less interested in spending quality time with their spouses. Even when residents planned shared time with a spouse or partner, sleep deprivation and fatigue often made it difficult for them to participate fully in shared activities. In the words of one female obstetrics resident, "It's hard to be bubbly when you're exhausted." Most residents with children reported that sleep deprivation and fatigue intruded on their performance as parents, since as with spouses, even when they are physically present, exhaustion made it difficult to engage fully in shared activities. Residents reported that relatives and friends personalize changes in residents' behavior, interpreting low levels of engagement from the effects of fatigue as a reflection of the quality of the relationship. Relationships become attenuated under the demands of residency and residents describe shrinking social networks and if married, less marital satisfaction when compared to faculty.[42]

Over a decade ago, the term "disembodied worker" was used to describe employees who as a result of their commitment to paid work became persons with no external obligations.[43] Williams has described "market work", including medicine, to be organized around "the ideal of a worker who works full time and overtime and takes little or no time off for childbearing or child rearing. … This organization of market work continues to be framed around the assumption that ideal workers have access to a flow of family work,"including a supply of meals and clean clothes, household maintenance, and emotional support.[44]"

Not all medical residents have access to the flow of domestic services provided in "traditional" marriages.[34] The number of women in medicine has increased over recent decades, with women now constituting 42% of all medical school graduates, and it is unlikely that many of these women have husbands who are able or willing to provide the domestic and child care services available to Williams' "ideal worker." Furthermore, given patterns of educational similarity between spouses, wives of male residents are also likely to be pursuing careers which constrain time available for domestic responsibilities. The non-student spouses who place their own careers on temporary hold are likely to expect their partners to fulfill expectations of companionate marriage and shared parenthood.[44] Given the current level of public knowledge, it is unlikely that such expectations also incorporate understanding of the emotional detachment that accompanies sleep loss.

Resident physicians are aware of their expectation as spouses.[45] In the focus groups,[22] many residents admitted cutting corners on household responsibilities, doing only what was necessary "to get by." In another study, residents report a sense of time urgency in their hours away from the hospital,[46] paralleling the "time famine" characteristic of dual-earner families, especially shift workers.[47]

Gender structures residents' responses to performance of activities of daily life. Married male residents are more likely than other residents to rely on their wives for performing (or at least managing) these aspects of domestic production, a result consistent with other research on the household division of labor,[48] and females express more ambivalence about not completing household tasks that are often considered women's responsibility and constitute a significant dimension of gender expectation.[49] For both male and female residents, failure to participate in housework and child care are likely to result in reduced marital satisfaction,[48] thus undermining an important source of support. This feature of resident training is not well identified by educational leadership in the US,[2,50] but is one known motivation for efforts towards collective bargaining for resident physicians.[51]

Regulatory and educational countermeasures

The regulation of work hours falls under the jurisdiction of the Accreditation Council for Graduate Medical Education (ACGME) and its member organizations. In the US, no federal work hour standards are currently in place; rather, under the auspices of the ACGME, the individual Residency Review Committees for the accredited medical specialties have the responsibility of developing individual specialty-specific standards for resident work hours. Voluntary adherence as suggested by ACGME in the early 1990s produced little change. In a 1999 review of residency training standards, the ACGME cited 28 of 92 internal medicine residency programs (30%), and 25 of 69 general surgery training programs (36%) across the US for significant

violations of the organization's voluntary restrictions on work-hours.[52,53]

The ACGME regulations effective July 1, 2003, state that "residents must not be scheduled for more than 80 duty hours per week averaged over a 4-week period, with the provision that individual programs may apply for an increase of this limit of up to 10%, if they can provide a sound educational rationale";[23–26,52,54] thus, residency program directors, hospital administrators, and department chairs are externally motivated to institute educational programs in order to maintain accreditation by the ACGME. Further, the regulations stipulate that program directors, faculty, and resident colleagues actively seek to identify and intervene in instances where residents exhibit signs of fatigue. "To prepare them for this, program directors, faculty and residents must demonstrate exposure to an educational session about the effects of sleep loss on performance and well-being, and how to recognize fatigue and apply countermeasures." This is intended to encourage awareness and a climate where residents recognize their own limits and request to be relieved when limits are exceeded. Programs across all disciplines are instructed to institute the necessary "system" changes to allow tired residents to request to be relieved.[54] The ACGME requirements are increasing attention of training programs to the issue of fatigue mainly because they have 'teeth,' i.e., residency programs not complying with these requirements may lose their accreditation.

It will be a challenge to gear curriculum to varied interests of the faculty, program administrators, and others responsible for fiscal oversight of a fatigue management program.[55] If curriculum for these important stakeholders is missing, the effort to recognize and appropriately respond to sleep loss and fatigue in resident physicians is likely to fail. As an example, the Bell Commission Regulations in New York State resulted in widespread violations of the duty hour regulations.[56,57] Though there are undoubtedly multiple explanations, the lack of a commonly accepted knowledge base for *all* stakeholders, not just residents, on the effects of sleep loss and fatigue was notable by the commentary about the rules. Fortunately there are precedents set by aviation that countermeasures if instituted at all levels of a program are effective in reducing error. Recent evidence shows that less fatiguing schedules reduce patient error, with the implication that it also may improve patient safety.[58] As was found in aviation studies, errors of commission are documented in settings of fatigue, and potential countermeasures include not only by reducing continuous hours of service, but also by information technology. Errors of omission may represent a greater number of errors overall than errors of commission.[5] It is argued that the value of fatigue countermeasures in residency may accomplish goals of improved patient outcomes, reduced exposure to liability, and decreased cost. Empirical evidence of this effect are needed. It may also be the right thing to do for housestaff.

Sleepiness and fatigue in training is a human resource issue, affecting workplace harmony, resident satisfaction, and resident health. Residents could be supported to acquire best habits that increase vigilance that are learned and supported during the formative years of residency training. These habits may also enhance current and future job satisfaction and possibly lifelong learning potential. The optimum effective approach to patient safety related to resident physician sleep loss and fatigue is congruent with the culture of the hospital. As the hospital is a 24-7 operation, patient safety strategies that value teamwork and cross-discipline collaboration should be encouraged. This may result in greater satisfaction for residents, hospitals, and patients.[59] The Association of American Medical Colleges (AAMC) states: "Given the uncommon stresses inherent in fulfilling the demands of their training program, residents must be allowed sufficient opportunities to meet personal and family obligations, to pursue recreational activities, *and to obtain adequate rest* (italics added)."[60] The AAMC statement addresses both undergraduate as well as graduate medical training. Empirical studies assessing the effects of sleep loss and fatigue along the continuum physician education are needed.

Final remarks

A comprehensive approach consisting of the following four components is recommended to effect change: education, alertness strategies, scheduling policies, and healthy sleep habits. Education is the foundation for any change in fatigue-related risks. Basic knowledge of sleep medicine is crucial to understanding the physiologic factors that underlie fatigue and the risks involved in performing under sub-optimal conditions and for addressing widely held myths about sleep that abound among residents. During the medical training period, residents receive little training in sleep and sleep loss, chronobiology, and sleep disorders.[22] Without such knowledge, physicians are unlikely to personalize the need for change. Educational modules developed for other 24/7 professionals, like those in aviation or military operations, could be used as

models to promote systemic changes in process and attitudes. We believe that such educational interventions, particularly as it includes family outreach, could be successful in identifying and intervening with residents at this crucial time in their professional training.

Practice points

1. Explain the importance of sleep and the risks of sleepiness to all post-graduate trainees (as well as other shift-workers) working with you in your medical practice.
2. Establish a rapport with graduate training program directors and institutional leaders to counter attitudes and scheduling issues that promote sleep loss.
3. Be the resource for rehabilitative approaches to individuals who are identified as potentially impaired from fatigue or sleepiness.

Research agenda

1. Create educational interventions to reduce the impact of sleepiness and fatigue on the learning objectives for postgraduate training.
2. Test the impact of changes in schedules and/or attitudes on professionalism and social life as well as patient care in medical practice after residency.

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