

Coping with Night Call: Part I: Understanding the Benefits and Challenges of Traditional Call

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Working all day, being on call all evening and all night, then working the following day is part of the routine of becoming a physician. Residents (and many practicing physicians) typically work every third or fourth night on call for 24-hour to 36-hour shifts. Being on call involves a wide variety of tasks, ranging from working up, admitting, and monitoring patients, to delivering babies, performing surgery, or responding to a pager. In today's managed care environment, patients admitted to the hospital are generally seen as "sicker" and the pressure is greater to "cure and discharge" more quickly than in the past.

Being on call varies in intensity, frequency, and duration, depending on the physician's stage of training, specialty, and practice style. The hours that residents may have for sleep between 12 AM and 6 AM are frequently punctured by interruptions, and a maximum of 2 hours of sleep is common. Residents frequently question the rationale and appropriateness of night call: How can residents be expected to be on call and effectively work for 24 to 36 hours with minimal sleep? However, despite efforts to adapt new standards (as discussed later in this article), being on call every third night is still the routine expectation for residents, and physicians must learn how to cope with being on call effectively.¹

... the last two years have been as tough as my internship and residency, and when I got through with that, I said "I never want to do that again!"

—Dean of the School of Medicine
and Chancellor for Health Affairs,
Duke University, 1994²

Internship is the most stressful year in a physician's medical career^{3,4} because interns work long hours,⁵ have fewer coping resources available,^{3,6} and have less

control over their time.⁷ Several reviews of stress in residents^{8,9} point to being on call^{10,11,12} and the associated sleep deprivation^{13,14} as among, if not the most, stressful component of residency training. Being on call is an ambivalently experienced "good, bad, and ugly" necessity of becoming a physician.

This article is the first of two review articles that address being on call. The focus for this series is to help interns and residents understand and cope with this major source of stress in their careers. Part I of this series focuses on the benefits and challenges of being on call. Understanding these benefits and challenges is necessary for coping with this element of physician training. Part II of this series (to be published in the December 1999 issue of *Hospital Physician*) will recommend tips for coping with being on call.

UNDERSTANDING THE BENEFITS

Increased awareness of why being on call is beneficial can help residents cope with the overall experience. Many of the "Top 10" reasons why night call is beneficial revolve around medical tradition. The wisdom of the elders is assumed to rest within original traditions, and passing tradition from one generation to the next is highly valued in the medical profession. The following 10 reasons for night on call are part of a stress inoculation strategy geared toward providing residents with realistic reassurance, warning signals, and recommendations for preparing psychological antibodies to cope with the stress of night on call.¹⁵

- 1) "Every third night" is a time-honored tradition . . . why change it?

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- 2) Night call is a rite of passage
- 3) Traditional call is academically sound
- 4) Traditional call develops mental and physical endurance
- 5) Most residents cope with call without major emotional or behavioral problems
- 6) Traditional call provides quality and continuity in patient care
- 7) Traditional call benefits resident education and learning
- 8) Night call supports cost containment
- 9) Being a physician is not the only occupation that requires night-shift work . . . but is physician night call different?
- 10) Traditional call is the price of choosing to become a physician (but some complaining is allowed)

“Every Third Night” is a Time-Honored Tradition. . . Why Change It?

Medicine is a higher calling that requires the sacrifice of sleep and working long hours for the care of patients. The original concept of “resident physician” carried with it responsibility for patients 24 hours per day, seven days a week.¹⁶ Before 1990, the on call standard for most medical specialties was a 70- to 100-hour work week with 36- to 40- hour shifts and every third night on call.¹⁷ In the 1980s, a chain of events lead to some questioning of “resident fatigue” as a result of long working hours and night call. A New York malpractice grand jury investigating the emergency room death of Ms. Libby Zion lead to negative publicity and the Bell Commission state health department hearings, which prompted revisions in the New York state medical regulations and the Accreditation Council for Graduate Medical Education (ACGME) guidelines. The outcome of these events was a “new” set of guidelines, which basically limited the work week for residents to no more than 80 hours a week, with 24- to 36-hour shifts; however, the traditional “every third night” on call remained the standard.¹

Despite the Bell Commission Report, night call changed little.¹⁸ There was strong resistance to changing traditional resident working hours: Every witness at the Bell Commission hearings, except one, “opposed the imposition of any quantitative restriction on resident hours.”¹⁷ Nor was night call clearly defined as the problem. Although debate continues to this day, the grand jury in the Zion case cited “resident work load,

fatigue and poor supervision,” whereas the Bell Commission concluded that “inadequate supervision” was the root problem in Zion’s death.

One legal reviewer summarizing the impact of these four events reports “no clear standard(s) emerged . . . there continue(s) to be wide variation in resident work schedules.”¹⁷ The New York standard of an 80-hour work week, a 24-hour shift and every third night on call is not agreed upon nor comprehensively applied in other states. Large segments of the medical establishment, including teaching physicians and residents, opposed changing the “old” standard or adopting the “new” standards.¹⁶ The new ACGME guidelines cover only 75% of residency positions and do not apply to surgery or other specialty programs.

Both the New York and the ACGME standards are “inconsistently applied” with “wide variation” in resident work schedules. Although these guidelines agree to limit call to every third night, New York state regulations allow extensions in the 24-hour shift “if patient care would be compromised,” whereas ACGME guidelines make “no specific limitations on the number of hours worked” during a call shift.¹⁷

Various guidelines blur the call frequency and duration issues by recommending night call “no more often than every third night,” but allowing flexibility for shifts greater than 24 hours or call every fourth night with 36-hour shifts.¹ Although events in the 1980s raised questions and set some limits on resident hours and night call shifts, the night call reality remains every third or fourth night with variations allowed for 24- or 36-hour shifts. Thus, the time-honored tradition of every third night on call is still the expectation for residents. The medical establishment has put forth some good reasons for opposing changes and leaving the traditional night call system intact; these reasons are discussed in subsequent sections.

Night Call Is a Rite of Passage

All healers must complete rigorous apprenticeships and rites of passage for entry into an elite profession.^{19,20} From the Native American sun dance to military boot camp to night call, a rite of passage requiring suffering and self-sacrifice is necessary for transition from novice to expert. Reports that internship with frequent night call is akin to a college fraternity’s Hell Week or hazing are greatly exaggerated according to some sources.^{21,22} Twenty years ago, medicine was perceived as a calling, more akin to the ministry than today’s managed care marketplace. Residents lived at hospitals, were on call 24 hours a day, worked 100-hour weeks, were discouraged or forbidden to marry, and were expected to be

continually available to their patients.^{16,23} There is concern that today's residents who want to limit work hours and night call are becoming soft, self-centered, and self-serving. Surviving night call meets the expectations of physician role models and teachers and is proof of dedication, endurance, and a uniqueness worthy of entry into the healing profession. Night call protects the physician's work ethic and preserves the public's perception that physicians work harder than other professions.

Traditional Call is Academically Sound

Medical schools and teaching hospitals believe that traditional call is educationally sound and works for most residents and physicians. As part of medical training, traditional call contributes to producing the best physicians in the world. Proponents of traditional call do not view call-induced sleep deprivation and fatigue as the primary explanatory model for differences in the error rate between residents and experienced physicians. Instead, proponents believe that the higher error rates among residents are a function of their learning curve and inexperience.¹⁷ Proponents of traditional call also note the lack of an empirically based causal relationship between resident fatigue and errors in patient management as a result of night call. Some sleep researchers find "surprisingly few effects from [acute] sleep deprivation . . . [as the] . . . effects are mostly minor and transitory and pose no real long-term threat to health and well being."²⁴

Studies of residents are surprisingly contradictory and confusing regarding whether traditional call systems (ie, 24- and 36-hour shifts) significantly affect a resident's medical cognitive or skill performance. Some studies show small or no differences in neuropsychological performance on standardized tests of motor or cognitive function after acute sleep deprivation between residents just off call and residents who did not spend the night on call.²⁵⁻²⁷ Surgery residents, in particular, seem surprisingly immune to cognitive or performance deficits associated with night-call sleep deprivation.²⁸ Haynes²⁹ retrospectively reviewed 6371 surgeries with 351 postoperative complications and found no statistically significant change in postoperative complications when the surgery was performed by a sleep-deprived resident operating the day after a 24-hour call period. Likewise, Browne³⁰ found that retention and capacity to learn among surgery residents and the medical students on rotation with them "did not appear significantly altered by sleep deprivation (4 hours or less uninterrupted sleep)." Whether sleep deprived or not, participants in this study obtained comparable scores on objective tests measuring short-term (1 week) and

long-term (3 months) retention of newly learned material from six medical journal articles. Other researchers dispute these studies of acute sleep deprivation, claiming that the studies do not account for chronic sleep deprivation, which may be present in all residents regardless of whether they are postcall or rested.¹⁴

Even in the family medicine specialty, changing the traditional call schedules is not strongly supported. Of 137 residency programs, 65 (47%) surveyed perceived "no need" to change the existing call system because the present system was viewed as adequate, and 75% of programs have neither made nor plan to make changes in the traditional call system.³¹

Traditional Call Develops Mental and Physical Endurance

Proponents for traditional call ask, "What (if anything) is wrong with residency overwork?"³² Sleep deprivation prepares residents for the reality of future practice. As noted in the Bell Commission Report, "Performing complex medical decision making and tasks under the stress of extreme fatigue and sleep deprivation are the 'sine qua non' of medical practice during residency and . . . beyond."¹⁸ Residents must be "taught to accept work overload and increasing time pressures as a way of life."²³

Anecdotally, night call develops mental and physical endurance. "Good stress" and accomplishing challenges under the duress of being on call are valuable. One may ask, however, if this endurance-developed emotional muscle allows sensitivity toward others to remain intact or if it creates decerebrate "alligator skin" residents? One end of this endurance continuum is represented by a medical school Dean's complaints about the concept of burnout, describing it as:

a cop out . . . a metaphoric myth . . . a misguided word for fatigue, laziness . . . throwing in the sponge . . . Burnout is not wear-out—it's give up! . . . a quick and easy way to avoid the complexities of practice . . . saying burnout is a slick way of avoiding responsibility . . . or escaping unpleasant realities [of practice] . . . Let's leave flame out to jets, burnout to electricians and get back to work!³³

Although no one denies the character-building quality of night call, perhaps this Dean overstates it. How pervasive and helpful is this "toughen up" attitude in medicine? A resident may find it more helpful to discuss the mental and physical stress of being on call with supportive colleagues, rather than being stoic and "to not cry out, to suffer in silence and to take pride in these attributes . . . [as] . . . expected."²³

Most Residents Cope with Call Without Major Emotional or Behavioral Problems

Conservative estimates suggest that 70% to 95% of interns, residents, and physicians cope effectively with the overall stresses of medical practice, including night call, without obvious emotional or behavioral impairments.^{3,9} This generalization is a primary reference point for those who believe that call is beneficial because it does not harm the majority of its participants. Proponents of call also discount evidence that residents exhibit a higher rate of psychiatric impairment than physicians at other career stages.³⁴ Proponents of traditional call explain the higher prevalence of emotional disorders among residents as a “problem in selection:” either the resident “should have gone into a less demanding specialty” or a resident with “character weakness” or “bad protoplasm” was accidentally selected (personal communication, Dale Alexander, PhD). Attributing resident emotional disorders to personal vulnerabilities or selection mistakes, rather than to the built-in stressful components of medical education (eg, frequent night call shifts), is a viewpoint often expressed by those defending traditional call schedules.

Sleep deprivation affects people differently. Night call-induced sleep deprivation does not appear to permanently or extraordinarily harm most residents. Although short-term subjective mood or attitude may be affected, most residents and physicians cope effectively with call without resorting to substance abuse,^{35,36} developing emotional disorders,^{37–39} or developing obvious impairment. Only 10% of physicians and 5% of residents are reported to be heavy drinkers,^{35,36} and most emergency medicine specialists do not use medications to stay awake or to fall asleep after 24-hour shifts.⁴⁰

The residents affected emotionally or behaviorally by call are often described as having predisposing factors or vulnerability to stress prior to residency; this explanation may be a variation of the bad protoplasm argument. In the opinion of critics of night on call, this position is unfair, inaccurate, and may inadvertently contribute to residents “covering over”⁴¹ or engaging in “mass denial” or a “conspiracy of silence”⁴² about how the stresses of medical training are affecting them.

Traditional Call Provides Quality and Continuity in Patient Care

A resident working 24 to 36 hours can provide continuous care to the same patient for a duration of time that ensures better quality care. Traditional call schedules allow the resident to follow the same patient from

admission to discharge within the same 24- to 36-hour period that the resident is on call. Continuity is crucial for proper management of a patient’s medical and personal issues. The traditional call structure allows the physician to obtain the patient’s initial medical history, perform a physical examination, formulate a differential diagnosis, begin initial treatment, and monitor the patient’s progress throughout a crucial time period to achieve a degree of stabilization. Call continuity minimizes the risks of prematurely transferring a patient’s care to a colleague.

In addition, call continuity allows the resident to be involved with the patient’s family members at a stressful time. The call structure provides an opportunity for the patient and family members to bond professionally with a specific physician during a crucial hospitalization. This involvement may promote a healthy collaborative relationship, involving all parties as partners in the patient’s healing process. Call continuity allows the patient and family to express their concerns or to provide medically relevant information. Call continuity facilitates important and sometimes subtle issues: information relevant to diagnosis and discharge planning, support system issues for helping patients care for themselves, the need to follow up on mild symptoms (eg, mild anemia), and requests by a family member (eg, “Please look into Dad’s mood, he’s really been down lately.”). The benefits of 24- to 36-hour call for the quality and continuity of care of hospital patients may help residents appreciate a positive value of being on call.

Traditional Call Benefits Resident Education and Learning

Medical education is enhanced by traditional call because this practice provides the resident experience in providing continuous care—from initial work-up through diagnosis and treatment to stabilization and cure. Being on call affords the resident the opportunity to “learn by doing” under intense, challenging circumstances in the hospital environment. Night call allows the resident to learn to independently care for patients, promoting the resident’s self-reliance, level of responsibility, and self-confidence. The resident is often the first physician to see the patient’s initial presenting symptoms, physical examination findings, and laboratory findings. Digesting, synthesizing, and correlating this information into coherent medical decision making for formulating a differential diagnosis and treatment is active learning with real consequences. Sometimes the diagnosis is inaccurate and must be changed, as well as the treatment. The 24- to 36-hour

call process provides an intense learning environment, allowing residents active participation in most or all of the various steps in patient care.

Traditional call also trains residents to simultaneously handle unknown patients, multiple crises, and multiple sick patients, while still studying medicine and taking care of one's own health. Traditional call trains residents for the future task of covering for other physicians, a situation in which they may not know the other physician's patients. According to some physicians, the challenge and intensity of being on call and caring for a patient's medical crisis at 3 AM is more rewarding and provides higher stimulation than working the regular hours of outpatient medicine.

To appreciate this positive value of call, some residents may consider what would be lacking in their medical learning if they did not experience being on call. Most physicians would agree that care is easier for a patient whom the physician initially evaluated, admitted, and wrote up. For example, picking up patients transferred from the on-call resident who admitted them overnight is often mildly anxiety provoking, and the new physician's knowledge of the patient may not be quite as sharp as that of the on-call resident. Likewise, how the disease process progresses or is contained may look very different on the morning after the initial work-up at 2 AM. Also, the physician who takes over for the on-call physician must work hard to develop a new relationship with the patient, which is often less intense or less appreciated than the relationship with the physician who cared for the patient through the most difficult part of the illness.

Night Call Supports Cost Containment

The traditional resident call system contributes to cost containment by cutting medical costs in several ways. Residents are the least expensive physicians in teaching hospitals and are a source of direct and indirect earnings. Substantial costs in hiring additional nurses, technicians, and hospital staff to perform the many tasks residents now perform are averted.⁴³ In New York, implementing the new physician work standards (including reducing call from 36- to 24-hour call schedules) were projected to cost an annual \$358 million (in 1985 dollars), to require an additional 5358 hospital staff and 423 additional emergency room physicians,⁴⁴ and to require difficult and creative scheduling adjustments.⁴⁵

Residents are doing their part to keep health care costs down. One must consider hidden costs of reducing call frequency and the total number of hours a resident works each week: duration of residency may need to be extended in some specialties so that residents can

acquire the necessary clinical skills.¹⁶ Modifying call schedules also has hidden costs in terms of reducing resident electives, decreasing conference attendance, and risking a decrease in the number of outpatient clinic sessions by residents.³⁰ Regardless, many medical educators argue that a resident's long hours and night call shifts are legitimate and necessary to offset the "extra" costs of teaching (ie, time away from one's own patient care responsibilities and subsequent decreases in patient volume and income).³²

Being a Physician Is Not the Only Occupation That Requires Night Shift Work . . . but Is Physician Night Call Different?

Residents account for only a small percentage of the 27% of the United States work force who work nights permanently or on a rotating shift.⁴⁶ Nuclear power plant workers, pilots, air traffic controllers, truck drivers, and security guards are only a few of the occupations that demand night work or rotating shifts. Indeed, more shift work is performed by other health care professionals than by physicians. Approximately 33% of registered nurses in the United States are on rotating shifts similar to residents.⁴⁷ Residents may find consolation in knowing they are not alone while working night shift.

These facts often negate discussions about whether the physician's adaptation to shift work should be perceived as special or different from other occupations. Perhaps physicians should not be treated differently, and perhaps physicians must learn lessons from the extensive literature about the impact of shift work on other occupations. However, the shift work literature and findings about resident on-call scheduling systems have not been integrated. Although a thorough review of this extensive literature exceeds the purpose of this article, relevant findings from the shift work literature are discussed later.

All shift work scheduling needs to account for the body's circadian rhythm, or internal biological clock, which is the pacemaker for regulating cycles of sleep and wakefulness. Examination of how shift work is scheduled is relevant to the discussion of how residents cope with night call and whether their system should be considered different from other shift work systems. In terms of circadian rhythm, the gold standard for shift work is not to change shifts at all. However, most residents do not work fixed shifts but instead work rotating shifts. The two basic types of rotating shifts are:

- **Slowly rotating shift schedules**—the hours of work change regularly but slowly every 2 or 4 weeks,

with time off before the next clockwise or counter-clockwise rotation cycle.⁴⁷ Emergency medicine specialists and many nurses work this slowly rotating shift, which allows for better adjustment of circadian rhythm.

- **Rapidly rotating shift schedules**—the hours of work change rapidly every third or fourth night.⁴⁷ Most resident on-call shifts are every third or fourth night, with little or no time off before resuming day shifts.

In some aspects, resident night-call shifts are different from those of other occupations. Only 10% of registered nurses in the United States rapidly rotate from days to evenings to nights, the type of rotation that is expected of residents.⁴⁷

Industries that use slowly rotating shifts report more productive and satisfied shift workers. Optimal slowly rotating shifts rotate workers forward, or clockwise,⁴⁸ in day shifts, then evenings, then nights, in cycles of 10 or more days each cycle, after a number of days off (ranging from one to 10 days) between cycles.^{49,50} Because of the Zion case and New York state regulations for resident working conditions, some hospitals and residency programs have duplicated slowly rotating shifts through various systems, termed *night float systems* or *night-shift call rotations*.^{31,51–54} Night-shift call rotations are described as a schedule in which “one resident or a group of residents is . . . to be present during most of the evening and night shifts, but is not to [be] scheduled to be present during the day . . . this eliminates the need for daytime residents to remain in the hospital during the evenings and nights.”^{31,51}

However, rapidly rotating night call and widely varying night float systems designed for residents seldom follow the optimal rotating forward/clockwise model, nor do these systems allow sufficient days on or off between different shifts to promote better adaptation. Night float systems also vary greatly across and within different specialties. In New York, 63% of obstetrics and gynecology residency programs utilize different night float systems, but only 10% of obstetrics and gynecology programs from all other states report night float systems.⁵¹ Only 15% of family medicine residency programs³¹ and approximately 30% of internal medicine residency programs⁵⁵ offer versions of night float systems.

In emergency medicine, 12-hour night shifts remain standard and 16- to 24-hour shifts are frequent.^{56,57} However, emergency medicine specialists work fixed or slowly rotating shifts for longer time periods and thus keep the same sleep patterns; this system is not possible for residents or other specialties. Emergency medicine

specialists may be able to provide guidance for residents and other specialists about how to adapt to night shifts.⁵⁷

Traditional Call Is the Price of Choosing to Become a Physician (But Some Complaining Is Allowed)

From the benefit of a retrospective view, some experienced medical authorities and attending physicians ask: Why all this complaining about night call? From the perspective of these sage physicians, residents are aware that being on call is required of a physician, essentially give their informed consent, and voluntarily agree to the terms of their employment, which includes night call and the accompanying stressors.³² Therefore, these experienced physicians do not perceive depriving residents of sleep and free time as wrong. Attending physicians often feel unfairly blamed as the authorities responsible for the existence of night call. When rotating with house staff, attending physicians are sometimes observed wearing *No Whining* buttons.

As a coping device, residents may need to internalize this viewpoint to justify or rationalize call as a good experience. Residents can remind themselves that they chose to be a physician and that the work load, the demands of night call, and sleep deprivation are all part of this choice. Although a resident sacrifices a great deal, the resident also receives a lot in return. As one resident said, “I’m paying a lot now, but things will be different and better in the future.”²³ It is important for residents to remind themselves that being on call is part of the choice that they made when pursuing a career in medicine. Residents should take pride in their choice and the responsibilities and accomplishments that accompany what may at times seem like a Faustian bargain.

Research on the stress hardiness concept (ie, control, commitment, and challenges) and shift work tolerance supports the need for residents to remind themselves that they are in *control* and responsible for the choice that they made as well as their level of *commitment* to the *challenges* in medicine—even when this choice includes night call.^{58–60} Likewise, residents need to beware the risks of being overly stoic, suffering in silence, and not admitting their energy limits nor the need to take care of oneself. Some complaining about call is justifiable. This ventilation may be a healthy means of coping and asking for understanding and support. Most hospital attending physicians have a range of tolerance for resident complaints about call.

UNDERSTANDING THE CHALLENGES

Being on call also has an ugly side. Knowing what to beware of may help residents monitor and compensate

for the negative side effects of being on call. Many of the challenges of call revolve around the principles and physiology of sleep and circadian rhythms, which are violated by night call. The literature on sleep physiology and how circadian rhythms are affected by sleep disruption and sleep deprivation in the nonphysician population is extensive. Although this literature merits attention, a through review exceeds the scope of this article.

One review notes that the "best documented health consequences of night and rotating shift work are disorders of sleep."⁶¹ A 1983 classic review on resident performance and sleep deprivation bemoaned the lack of research literature on this topic specific to physicians and the lack of response to what research did exist. This review also questioned existing justifications for sleep-depriving night-call schedules and suggested reevaluation of night call because of the potentially negative effects.¹³ Since 1983, evidence of mental and physical stress associated with sleep deprivation and night call has been increasing in literature about shift workers and resident physicians. Mounting evidence suggests that there is a progressive intolerance and cost to shift work and being on call. Specific mental and physical problems associated with shift work and being on night call are outlined in the following "Top 10" challenges:

- 1) Chronic sleep deprivation
- 2) Mood changes and emotional disorders
- 3) Physical fatigue
- 4) Mental fatigue
- 5) Emotional fatigue and burnout
- 6) Negative effects on interpersonal relationships
- 7) Negative effects on resident learning
- 8) Negative effects on patient care
- 9) Long-term physical risk factors
- 10) Legal liability

Chronic Sleep Deprivation

A pattern of too little sleep as a result of many sleep disruptions when being on call starts as an acute problem that slowly evolves over time into chronic sleep deprivation for most interns. Two studies reported that on-call sleep was disrupted an average of three times per night and total sleep averaged 3 hours⁶² and that the average amount of sleep during on-call nights was 2.7 hours.¹² Samkoff's¹⁴ review of studies on resident

sleep deprivation report similar total average hours of sleep by residents on call (ranging from 1.8 hours to less than 5 hours) in 10 of the 27 studies that allow for such specific comparisons. Some studies evaluate only the short-term effects of sleep deprivation and do not account for the long-term effects on accumulative, acute sleep disruption episodes (ie, in residents who cycle every third or fourth night for 1 to 3 years or more).

A general model of how sleep disruptions and deprivation associated with night call may affect physicians can be extrapolated from a general text on sleep problems.²⁴ Acute sleep deprivation because of frequent interruptions and repeating every third or fourth night on call accumulates and progressively develops into chronic sleep deprivation and growing sleep debt. This accumulation of sleep deprivation disrupts circadian rhythms that govern normal patterns of bodily function and further contributes to misalignment among residents' normal sleep-wake cycles, daily routines, and internal circadian rhythms. This disruption may eventually contribute to disorders of the sleep-wake cycle, which is associated with the onset and intensity of anxiety and depression. Therefore, the frequent acute sleep disruptions of being on call may evolve into chronic sleep deprivation, and changes in circadian rhythms and sleep patterns may evolve into a vicious cycle.

Daytime sleepers in other professions working slowly rotating night shifts sleep on average only 4.5 hours/day and commonly experience sleep disruptions trying to sleep during the day, which also results in chronic sleep deprivation and sleep debt buildup.⁶³ Even emergency medicine physicians—for whom night shifts are the norm and scheduling is better controlled—appear to have a career pattern of increasing job dissatisfaction and rotating out of night shifts after 10 years. This pattern is attributed largely to the stress of sleep deprivation induced by working the night shift.^{57,64}

Recent research on the effects of sleep deprivation on residents is controversial, inconsistent, and subject to methodologic differences.^{12,14,62} Although many studies demonstrate that well-rested residents outperform sleep-deprived residents on many tasks, other studies do not show this correlation. Whether negative or positive research findings translate into actual job performance is also unclear. This research merits more attention to clarify the findings. Most of the bad news about being on call, however, is the result of the negative biopsychosocial effects of acute or chronic sleep deprivation. As one study notes, "Sleep deprivation . . . [is the] . . . universal stressor . . . likely to weaken coping effectiveness in daily medical life."⁶²

Mood Changes and Emotional Disorders

A physician's mood, affect, and attitude seem most vulnerable to being negatively affected by being on call. Indirect evidence for these effects is from the disproportionate number of mood disturbances and affective disorders among interns and residents compared with physicians in later career stages.⁸ Studies focused on depression rates for interns find that the prevalence ranges from 30%,³⁷ 27%,⁶⁵ and 21%,⁶⁶ to 15% or 50%.⁶⁷ These studies suggest that depression in residents may be attributed to or complicated by inadequate sleep because of frequent call.

More direct evidence of negative mood changes caused by call is demonstrated in Samkoff's¹⁴ review of 10 studies using standardized mood measures to assess the effects of sleep deprivation in residents. All studies found mood to be negatively affected with descriptors of more depression, sadness, anger, irritability, anxiety, tension, and fatigue and less motivation and social affection present as a result of sleep deprivation.

Stronger evidence for the specific effects of call on a resident's psychological state are found in recent well-designed studies. The specific effects of being on call were evaluated in several ways:

- Comparing the same group of residents when they are on call and when they are not on call⁶²
- Comparing two groups of residents on call with a control group of residents not on call¹¹
- Comparing two types of call scheduling—residents on a rotational overnight call schedule versus residents on a night float system⁵³

Lingenfelter⁶² compared the same 40 residents after being on call for 24 hours that included the night shift and after a day off with 6 hours of uninterrupted sleep. The study found mood status following call decreased significantly for all 40 residents. The study suggests that finding "emotional conditions to worsen after one night on call" suggests that "sleep deprivation weakens (resident) coping effectiveness."

Berkoff¹¹ compared 34 residents on call with 27 residents not on call using multiple psychological mood measures before and after being on call. The study found that on call residents experienced a broader array of negative mood states than simply fatigue. Less sleep was related to increased "state anxiety, levels of perceived stress and negative mood states."¹¹ The good news was that negative mood state changes are "short term and amenable to positive change over the course of two nights off call . . . and one day at home."¹¹ This study is only one sampling of the on-call experience and begs

the question: Over time, what are the erosive effects of call on the resident's mood and psychological state?

Gottlieb⁵³ also found that residents on both regular night call schedules and night float schedules have high levels of depression, hostility, and anxiety, although the night float residents were less sleep deprived. However, the night float residents had "small, but significantly lower depression scores than the overnight call residents."⁵³

Shift work research of non-health care professions finds that men and women working rotating "variable shifts [are] more likely to experience job stress and emotional problems," even when controlling for income, education, and age.⁶¹ Cole's⁶⁸ review of the psychiatric aspects of shift work finds research evidence that supports a relationship between shift work and the potential for emotional disorders in five major areas:

- 1) Psychiatric hospitalization rates
- 2) Substance use
- 3) Anxiety or neuroticism
- 4) Depression
- 5) Circadian rhythm problems

Cole⁶⁸ also reports that admission rates for psychiatric hospitalization are statistically higher for occasional night workers (ie, not permanent night shift workers) and that shift workers have a higher than expected proportion of admittance to psychiatric hospitals in comparison with the general population's rate of admissions.

Substance use rates are higher for shift workers than for day workers; substances used include hypnotics and sedatives, digestive aids, analgesics, sleep medications, tranquilizers, alcohol, and stimulants (except cigarettes and caffeine). Regular intake of these substances was generally "higher among rotating three-shift workers" and "permanent night workers" than among two-shift day workers, evening-only workers, or permanent day workers.⁶⁸ Cole's⁶⁸ review indicates that many studies find increased psychological and somatic complaints among shift workers. Symptoms of anxiety and depression requiring treatment with psychotropic drugs for more than 3 months or hospitalization were five times higher among shift workers rotating through all three shifts, and 15 times higher among permanent night workers.

Cole's⁶⁸ review indicates that few studies formally assessed depression in non-health care shift workers. Other authors⁴⁷ looking at research on nurses and shift work found that elevated depression scores on the Profile of Mood States were higher among nurses working rotating shifts compared with nonrotating day or

night shift nurses. Cole's⁶⁸ review notes that depression is associated with circadian rhythm disruptions; depression can both disrupt circadian rhythms and be affected by them. Cole⁶⁸ cites studies as evidence that "sleep disturbances similar to those seen in major depression can be induced by forcing normal subjects to adopt an abnormal sleep-wake schedule." Circadian rhythm disruptions, producing symptoms similar to symptoms of depression, may provide a better explanatory model for the disproportionate amount of depression among interns and residents than the personal vulnerability or bad protoplasm arguments as previously mentioned.⁴⁷

Physical Fatigue

Physical fatigue is an immediate and repetitive negative effect of being on call. The physical fatigue experienced by residents after being on call is similar to jet lag caused by disruption of circadian rhythms.⁵⁷ Anecdotally, many residents report experiencing more fatigue on the second day after being on call.

A feeling of chronic fatigue is the most often mentioned complaint by the general population of shift workers. Sleepiness and chronic fatigue may affect up to 80% of shift workers.⁶⁹ In a study of 1807 Dutch nurses, fatigue and tiredness caused by physical stress were mentioned most by nurses after the night shift and mentioned least by nurses after the day shift.⁷⁰ Compared with male nurses, female nurses described the physical stress of nursing as more difficult.⁷⁰ Even surgery residents report subjectively experiencing significantly increased fatigue and decreased motivation after being on call.³⁰

What kind of short-term physical effects does being on call cause? Laboratory studies clearly demonstrate that the negative effects of sleep deprivation contribute to measurable physical fatigue in healthy young men. One study measured physical fatigue over a 48-hour period of sleep deprivation through self-selected walking pace, cardiorespiratory functions, and performance on six physical tasks designed to involve all muscle groups.⁷¹ All these factors significantly and progressively decreased over time whereas the perceived amount of exertion necessary to perform these tasks increased.⁷¹

Immune function. Even modest sleep deprivation appears to affect cellular immune function. When 23 medically and psychologically healthy men were partially deprived of sleep between 3 AM and 7 AM, the activity of natural killer cells in the body was significantly reduced in 18 men the next day by an average of 30% from non-sleep deprived baseline measures.⁷² This immediate potential for vulnerability to physical health risks is relevant to residents struggling to stay immune to the diseases they are treating in their patients.

Cardiovascular changes. Cardiovascular changes (ie, increased blood pressure and heart rate) in healthy residents during call shifts have been documented. In one study, 20 interns were monitored by electrocardiograms during a 24-hour call shift.⁷³ These interns showed cardiac rhythm changes, and heart rates ranged from a maximum of 103 to 167 bpm to a minimum of 38 to 61 bpm; most interns had one episode of tachycardia per hour for 57% of their hours on call. Investigators conclude that rapid sinus tachycardia is frequent in on-call interns, and those interns experiencing increased stress and fatigue with call have more atrial and ventricular premature beats per hour and higher grade ventricular ectopy. Being on call does indeed "get your heart racing," perhaps not as much as playing basketball, but enough to add to physical fatigue.

Summary. Physical fatigue, sleepiness, and tiredness from being awake most of the night are common expectations of being on call. Young, healthy residents may rebound from the short-term physical effects of being on call fairly rapidly. But a question remains whether acute fatigue from call goes beyond the short-term physical effects and may, over time, create extra, long-term "wear and tear" on the body.

Mental Fatigue

Anecdotal accounts connect night call to mental fatigue and making mistakes. Residents describe their experience of mental fatigue, dullness, and decreased ability to problem solve while on call, and they attribute this experience to either actually making mistakes or anxiety that they will make a mistake. Making mistakes, paying less attention to a task or conversation, or forgetting to do something when mentally exhausted is a human experience—it happens to everyone. How can the medical community assess how much mental fatigue develops because of sleep deprivation caused by night call?

Medical practice and patient care require mental functioning of a higher order and a higher level of complexity and gravity in decision making than many professions. How much of this complex process becomes mentally dulled from being on call? Mental mistakes (eg, missing potential drug interactions, making an error in a mathematical calculation for a dosage) may be costly and fatal. Although most errors in medicine are not fatal, mistakes are nevertheless disturbing. The amount that being on call contributes to mental fatigue and mistakes is a hotly and legally debated issue. Tracing any deterioration in performance to mental fatigue from being on call is a difficult research challenge.

Samkoff's¹⁴ review of research on resident performance after the residents were on call the previous night found 10 studies that showed decreases in performance on 11 of 19 short psychomotor tests, and eight studies that showed no decrease in performance on 13 of 19 other psychomotor tasks. Greater clarity is needed regarding when and how call produces mental fatigue that contributes negatively to resident performance, medical decision making, and cognitive or manual dexterity tasks.

The consensus about this acute negative effect of sleep deprivation from being on call is that performance on tests and tasks requiring prolonged vigilance tends to deteriorate, but not on brief psychomotor tests or tasks requiring manual dexterity, reaction times, and short-term recall. Mental tasks that require vigilance and prolonged concentration or that are dull and repetitive are adversely affected by sleep deprivation. Thus, the evidence is mixed regarding whether mental fatigue caused by being on call contributes to a measurable deterioration in cognitive performance.

The nursing literature reviewed by Alward and Monk⁴⁷ confirms the normal circadian mental slump between 4 AM to 6 AM in six studies, which shows mental lapses in attention to vigilance. This review noted that, "For most categories of accidents and errors, rotating nightshift nurses fared worse than permanent nightshift nurses . . . [and] [r]otating nightshift nurses had twice the amount of errors and accidents at work" than other shifts.⁴⁷ Some evidence suggests that male rotating nurses experience the mental stress of nursing as more fatiguing than female nurses, who experience the emotional stress as more fatiguing.⁷⁰

The literature that attributes mistakes in medicine to mental fatigue is limited. The lack of clarity directly connecting being on call with mental fatigue and mistakes may be because "good data, even crude data, on the nature and extent of errors in health care delivery does not exist."⁷⁴ Two books on errors⁷⁴ and accidents⁷⁵ in medicine allude to mental fatigue and night call as contributing to errors, but do not report direct, empirical, supporting evidence.

Van Cott⁷⁴ indicates that the "probability of errors [in health care]. . . tends to increase with high workloads and long rotating shifts," adding that "stress and fatigue . . . degrade the performance of . . . interns and other hospital staff." After reviewing the causes of human error in medicine, Van Cott⁷⁴ concludes that "in truth, errors people make are traceable to extrinsic factors that set individuals up to fail, rather than intrinsic reasons, such as forgetting or inattention." This conclusion suggests that extrinsic factors, such as tradi-

tional call with sleep deprivation, contribute more to setting up residents to fail or be error prone than intrinsic medical knowledge deficits caused by residents' "bad protoplasm" that predisposes them to errors.

Emotional Fatigue and Burnout

Some physicians use the bad protoplasm argument to deny or explain away the emotional fatigue and stress of being on call. This insensitive position suggests that only physicians who suffer personal vulnerabilities or who have "inadequate protoplasm" demonstrate difficulty coping with the stress of call. In addition, this argument ignores the fact that many physicians are potentially at risk for what is termed *burnout syndrome*.⁷⁶⁻⁷⁹ Professional burnout is defined as:

- **Emotional exhaustion** in caring for patients, in which empathy is replaced by a less caring and emotionally distancing approach
- **Depersonalization**, or treating patients in a more callous manner
- **Reduced sense of personal accomplishment**, or feeling less daily satisfaction from medical practice

Burnout is not a "cop-out," but a psychologically defined and measurable syndrome found in sufficient prevalence among physicians to merit attention. Studies directly linking call to burnout and its associated emotional exhaustion are not available. However, studies of burnout with samples of family medicine residents⁸⁰ and physicians⁸¹ and pediatric attending physicians⁸² reveal that the group averages met burnout criteria at the moderate level. Lemkau's⁸⁰ survey found family medicine residents from four programs have average burnout scores, indicating elevations in emotional exhaustion, depersonalization, and lack a sense of personal accomplishment equivalently high for men and women in each of 3 years of residency. A small subgroup of residents with second thoughts about choosing medicine or their specialty showed even higher scores on depersonalization and emotional exhaustion.⁸⁰ Moderate levels of burnout in attending physicians are associated with "working more hours . . . seeing more hospitalized patients" and "excessive clinical workload hours."⁸¹ Likewise, 58% of attending physicians in health maintenance organizations who reported high scores on the emotional exhaustion dimension of burnout related this to high "workload/scheduling" and low "input/influence."⁸³ Fields⁸⁴ found that, although 50% of pediatric critical care attending physicians could be classified as "at risk for burnout" (36%) or "burned out" (14%), no direct

association linked their burnout levels with call schedule or specific working conditions.

A study of burnout among Finnish shift work nurses indicates that emotional exhaustion was the most elevated scale for all points of assessment; averages peaked to burnout levels once a month with equal frequency among men and women on both two- and three-shift schedules.⁸⁵ Three-shift nurses working three successive nights in one 3-week period reported significantly more stress symptoms and less enjoyment of their work than nurses with no overnight shift, but only showed a tendency toward higher burnout than two-shift nurses. Although burnout is a highly suspected outcome of night-call shifts, the evidence with health care professionals and residents is indirect and limited.

A review of 100 empirical studies of the symptoms of professional burnout in non-physician samples finds that burnout is significantly associated with negative attitudes as well as emotional, physical, behavioral, and interpersonal symptoms.⁸⁶ Burnout was most commonly associated with emotional depletion and depression, in addition to guilt, helplessness, irritability, and anxiety. Also associated were the following factors:

- Higher consumption of caffeine, legal drugs, tranquilizers, and alcohol
- Increased performance problems
- Making more serious mistakes on the job
- Increased neglect of duties and tardiness among nurses
- Increased negative attitudes toward work and clients
- Poor physical health in general, including more headaches, gastrointestinal problems, backaches, sleep disturbance, and more colds and flu

Negative Effects on Interpersonal Relationships

The rapidly rotating on-call schedule can directly and indirectly affect a resident's interpersonal relationships with patients, colleagues, significant others, family, and friends. Inadequate sleep and burnout potential stemming from frequent call may contribute to a host of interpersonal changes in a resident's relationship to others. Kahill's⁸⁶ review indicates that burnout may negatively change interpersonal and communication styles with patients, colleagues, friends and family members. The depersonalization that accompanies burnout may manifest as an "unfeeling and impersonal . . . stereotypic" style of patient care treatment.⁸⁶ The resident may have difficulty concentrating on conversations and may develop

defensive avoidance or escape from contact with patients and others. Burnout also alters telephone behavior, contributing to "not answering the phone . . . hanging up on calls" or resisting meeting with patients.⁸⁶

Specific empirical evidence is lacking for a direct relationship between night call and interpersonal changes in patient care. Observational evidence and anecdotal self-reports regarding how night call compromises good interpersonal skills are plentiful. In discussing what is stressful about internship, Ford⁸⁷ observes that inadequate sleep and the need for sleep interferes with [interns'] interpersonal relationships and [their] lack of an adequate support system.¹¹ Observing a resident after call may reveal that the resident is sleep-deprived and paying more attention to accomplishing tasks, perhaps at the cost of ignoring how they are treating others. One may need to be forgiving of the resident's increased irritability or abruptness. Television dramatization of a post-call resident falling asleep during sex may be presented as fiction, but anecdotally reflects reality.

Married to Their Careers: Career and Family Dilemmas in Doctors' Lives is a book that discusses the interpersonal risks associated with the demands of medicine.²³ Frequent night call leads to mismatches with the normal activity schedules of children, spouses, and friends. Interpersonal stress and strain are observed as common dilemmas for interns and residents. An intern trying to balance frequent call with time for developing a relationship toward marriage was observed struggling with this dilemma. Sometimes marriage happens at the cost of losing one's residency position. This balancing dilemma is often painful personally and interpersonally for the resident in a dual-career marriage who wants to be a more involved mother or father than rotating call schedules allow.

Research among nonphysicians indicates that rotating shift work interferes in family lives, especially with the time available to spend with spouses and children; this work also interferes with the shift worker's ability to fulfill roles as a spouse and parent.^{61,88} A critical review of the effects of various types of shift work on social and family life of nonphysicians provides information for physicians to consider.⁸⁸ The relative advantages and disadvantages of fixed evening shifts (3 PM or 4 PM to 11 PM or 12 AM) and fixed night shift (11 PM or 12 AM to 7 AM or 8 AM) are compared with several rotating shifts considered together.

Rotating shift workers experience "the best advantages and worst disadvantages" of other shift schedules.⁸⁸ Although rotating shifts appear to allow greater free time and flexibility, "effective use of this time . . . may be severely curtailed by the negative carryover effects and

strains that go with variable rotating shifts." For example, having the next day off during daylight hours for free time may sound good, but it may not feel good if the person is sleep deprived or unable to nap during the day. In addition to the higher incidence of somatic and psychological symptoms previously discussed,^{61,68} rotating shift workers get less overall sleep than other shift types.⁶⁹ Feelings of general malaise and lethargy may reduce a resident's ability to use this free time productively.

Nurses on fixed evening and night shifts actually "spent more time with their family than nurses on rotating shifts."⁷⁴⁷ Rotating shifts are a major problem for parents of young children. Finding child care providers who work the same rotating shift schedules is difficult. This problem is intensified in single-parent or dual-career households. Even with two parents in the household, employment options can be severely limited because of the need to be available for child care on an irregular basis. Regular family patterns and rituals are complicated, and mealtime, intimacy time, communication time, or joint activities change. Rotating shifts often extend into weekends on an irregular cycle that compromises family participation in recreational and social activities. When the night shift rotation begins, greater strain occurs with other family members whose own life styles must accommodate the spouse or parent's switch to daytime sleeping. Studies are needed on the effect of rotating shifts or other shift schedules on more objective indicators of family and social adjustment (eg, divorce rates, frequency of participation in marital counseling, children's academic performance, children's behavior problems).

In one study the perceptions and feelings of the partners of shift workers were surveyed.⁸⁹ The survey shows that, although 65% of the partners report adapting to their spouses shift rotations, 70% attribute higher conflict with their partner to shift work, 55% feel their intimate relationship suffers, and more than 50% report a general disruption in relationships, including a detrimental effect on joint social life and poor contact with children.⁸⁹ Many routine activities are altered by night shift work, including sharing meals and time for immediate family or relatives. The "most significant disruption to partners lives occurred during the nightshift period," which contributed to the most "dysfunction with the family."⁸⁹ Some evidence suggests higher divorce rates for rotating and night shift workers.⁶³

Negative Effects on Resident Learning

Night call may negatively effect resident learning during the night on call and the next day. Alertness needed for learning and memory retention may be

impaired by night call because of disruption of normal circadian rhythm patterns. Circadian rhythm patterns for low vigilance are the same in the laboratory as natural settings. For example, in a study of memory retention by night nurses, their ability to retain the contents of a training film at 4 AM was only half as good as when the film was shown at 8:30 AM.⁴⁹ In addition, alertness for learning or listening is often compromised the day after call. Based on the more than 20 years' experience of the author of this article, motivated but fatigued residents after call are often observed falling asleep or developing significant head-nod frequency, even during stimulating curriculum, patient discussions, or patient contacts facilitated by others.

Long-term consequences for resident learning may occur if sleep debt and sleep deprivation are developing because of circadian rhythm desynchronization. Common sense and the principles of adult education suggest that optimal learning is facilitated by an environment in which learners are physically rested and psychologically alert. However, when medical education is metaphorically described as a "neglectful and abusive family system,"⁹⁰ clearly some educators do not perceive medical education as an optimal learning environment.

Negative Effects on Patient Care

The practice of medicine has been called "an error-ridden activity."⁹¹ Human errors in health care are estimated at 100,000 per year.⁷⁴ Mistakes in medicine are inevitable, and the causes may be numerous throughout a physician's career span. Mistakes may be caused by fatigue, inattentiveness, too large of a patient load, or hurriedness. The result may be a missed diagnosis, prescription errors, and failure to monitor a patient closely enough, to name a only a few. Most mistakes are not life-threatening and may be unnoticed. However, some mistakes cause harm.

Efforts to link higher rates of physician mistakes in patient care to night call are contradictory, but often supported. When 254 internal medicine residents were asked to assess their own reasons for medical mistakes in patient care, 41% attributed the mistake to fatigue, whereas 51% said they had too many other tasks.⁹² Although this self-reported data does not directly attribute mistakes to night call or sleep deprivation, the major contributor to fatigue is night call. Hillson's⁹³ retrospective review of medical records for 22,000 patients admitted throughout an 8-year period by on-call, first-year internal medicine residents showed that their admissions after 12 AM were "associated with the highest rates of mortality," whereas daytime admissions had

the lowest rate of mortality. Although it is "clear that mortality is higher among patients admitted at night, when interns may be sleep deprived and relatively unsupervised," the authors of this article recommend that this analysis be interpreted with caution because factors such as case mix may contribute.

Smith-Coggins⁹⁴ finds that emergency room attending physicians working night shifts are "slower intubating a mannequin" and "more likely to commit errors as their shift progressed" than when they work day shifts. Evidence that patient care may be negatively effected by night call also comes from nursing research. Nurses on rotating night shifts report twice as many errors related to sleepiness than nurses who only work day or evening shifts.⁹⁵ In fact, most minor hospital accidents reported by nurses throughout a 5-year period occurred between 12 AM and 6 AM.⁹⁶

Effects of burnout and inadequate sleep. Potentially negative interpersonal changes in patient care caused by burnout and inadequate sleep are previously mentioned and are also applicable in this discussion. Many mental health clinicians who work with residents and inpatient attending physicians believe that interpersonal skills toward patients and colleagues can deteriorate because of night call and as chronic sleep deprivation progressively develops. Patient-centered care concepts may be disregarded during call. Emotional exhaustion and depersonalization may develop and amplify because of call. This change may lead to dehumanizing and "hardening" attitudes and behavior toward patients, not only as the night progresses but also with sleep interruptions during call, and then may continue on as a postcall "hang over" with outpatients the next one or two days. Although these attitudes and behavior may be temporary, there is a risk that they may become entrenched as chronic sleep deprivation progressively develops. Studies that show a resident's humanistic values and attitudes decrease as they progress through residency unfortunately support concerns that interpersonal dimensions of patient-centered care may suffer from call.⁹⁷ Mizrahi⁹⁷ concludes that the "educational experience is structured to militate against the development of humanistic doctor-patient relationships . . . The novices [physicians in training] are systematically dehumanized, which only fosters the deterioration of the doctor-patient relationship rather than allowing it to develop into something positive."

Long-Term Physical Risk Factors

Literature on shift work among nonphysicians suggests that, as a result of rotating shift work, long-term health consequences and risks occur, especially sleep

and digestive disorders. Some research suggests that people may not appreciate the physical exertion of shift work because they habituate and adapt to it. When Spelten⁹⁸ retrospectively reviewed the physical effects on shift workers years after leaving shift work, shift workers quantified it as "worse than they realized at the time" on measures of general health and chronic fatigue.⁹⁸

"Shift work intolerance," including subjective health complaints, fatigue, and a lower level of general well-being, tends to increase throughout time and with age.⁹⁹ Increased gastrointestinal problems, immune system dysfunction, infertility,¹⁰⁰ and chronic hypertension¹⁰¹ have been described as long-term physical risks of shift work. Some researchers equate the increased risk of cardiovascular mortality of rotating shift work to smoking a pack of cigarettes per day.^{56,102}

Female nurses who work rotating shifts for 6 years or more are 70% more likely to have heart attacks (when other risk factors are controlled for).¹⁰³ The short-term cardiovascular effects of being on call for residents were mentioned previously, but what are the long-term effects for residents after rotating shifts for 3 or 4 years? Would their future risk for heart attacks be similar to that of the nurses studied? More research is needed to clarify these issues.

Other physical risk factors related to sleep deprivation resulting from rotating shift work include the following:⁶¹

- Sleep disorders⁶¹
- Digestive disorders, including disrupted eating habits, poorer diet, higher prevalence of gastric and peptic ulcers, gastritis, and constipation⁶¹
- Chronic health problems⁶¹
- Subjectively lower levels of general well-being¹⁰⁰
- Higher use of sleeping pills and tranquilizers⁶¹
- Heavier alcohol use⁶¹
- Increased use of indigestion aids⁶¹

Although drug use may be no higher in physicians than the general population, Zun⁴⁰ reports that 25% of emergency medicine diplomats and 15% of first-year postresidency emergency medicine physicians "took medications to sleep or stay awake" to adjust to 24-hour rotating shifts.

Additional physical risk factors attributable to night call include higher risk for needle stick accidents and higher rates of automobile accidents. Automobile accident rates for residents after call has not been studied, but anecdotal accounts of postcall accidents are numerous. Research indicates that shift workers are at

increased risk of accidents driving to and from work¹⁰⁴ and 15% of shift workers report falling asleep while behind the wheel of a car at least once every 3 months.²⁴ Richardson¹⁰⁵ found that 21.7% of rotating shift workers report at least one automobile accident the previous year compared with only 7.2% of nonrotating shift workers. The study concluded that “shiftworkers as a population are at greater risk for accidents.”¹⁰⁵ The study also associates this finding with shift workers’ higher self-report of circadian rhythm problems, chronic sleep disruption, poorer sleep quality, excessive fatigue or sleepiness during waking hours, and a higher use of alcohol in general and to promote sleep. The evidence that long-term physical risk factors are attributable to shift work exists for nonphysicians and is clearly suspected to accompany traditional night call for residents. Residents have good reason to question if, over time, night call may be hazardous to their physical health.

Legal Liability

Regardless of the continued controversy^{106,107} the Zion case demonstrates that resident fatigue caused by extended 36-hour call schedules is a legal liability issue.¹⁷ The facts of this case indicate that a clinical error occurred. This error was attributed to “over tired” residents failing to review the *Physician’s Desk Reference*, resulting in a lethal drug interaction between phenelzine sulfate and meperidine hydrochloride. According to one physician-lawyer, legal liability continues to spill over from this case.¹⁷ Hospitals and residency programs “that continue to have extended call hours may be liable”¹⁷ for failure to adhere to new standards (ie, New York state’s and ACGME’s). Malpractice suits scrutinize errors and will continue to determine if the errors can be attributed to resident fatigue because of extended call. An injured patient may think that she or he has a “strong case for negligence if a resident, working beyond a designated call schedule, commits even an excusable error.”¹⁷ In addition, “juries may find it easier to blame error on exhaustion” than trying to understand the medical complications and problems that the resident was confronting.¹⁷ Regardless of the reasonableness of errors, complications, or misdiagnosis, the common knowledge or common sense doctrine that exhausted residents function poorly may allow juries to find them liable.

Legal liability issues may continue to amplify the benefits and challenges of night call. Placing the focus on external legalities and regulations now governing physician call schedules only adds to the ambivalence that many residents feel about rotating night call.

Another liability issue may eventually creep into the problem of resident fatigue due to night call.¹⁰⁵ If it is

ever determined that medical residents—like other shift workers and truck drivers—are at increased risk for automobile accidents after all-night shifts, then liability or insurance rates may increase. What if, in this ever increasingly litigious world, automobile insurance companies or plaintiffs in automobile wrecks with residents begin to exploit the same legal arguments of resident fatigue from the Zion case? For residents, defensive driving may take on new meaning.

Financial Exploitation

The authors of this article would be remiss if one more aspect of the resident experience of night call were not added to the discussion. The senior author, a medical educator for 23 years, has not experienced a single professional year without at least one intern dividing her or his salary by the total weekly hours worked and announcing the hourly wage with indignant disbelief. This example voices the concern that many residents not only feel overworked by on-call shifts but also financially exploited by hospitals, rather than idealistically contributing to lower costs for patient care.

SUMMARY

A medical education experience such as night call must demonstrate that it can live up to the ethical dictum, *Above all do no harm*. Much of the accumulated evidence from studies of the traditional call schedule of 36 hours suggests that night call “may do harm”,¹⁴ not only to the quality of patient care but also to the residents. Residents have good reason to expect caring medical educators to provide research-proven or practical coping tips for surviving the traditional night call system. The more attention, care, and effort that is paid to helping residents find effective ways to cope with the challenges of night call, the better the chances are that this care will be passed on to patients and translate into other caring benefits for the health care system. Part II of this series (to be published in the December 1999 issue of *Hospital Physician*) will provide readers with tips for coping with night call. HP

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