Sleep Promotion in Occupational Health Settings

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Most adults spend a significant number of their waking hours at work. The work relatedness of employees' sleep is not always obvious to employers, as sleep is usually a private behavior. Yet there is much about how work is organized that influences the opportunity to sleep, the quality of sleep that is achieved, and the risk for sleep disorders. Circadian rhythm disruptions influence sleep when work schedules include very early start times, night shift work, or shift rotation. Reduced sleep opportunity from long working hours, shift overruns and overtime, long commutes, and being called in during time off may cause sleep deprivation. The physical surroundings of the job (light, noise) can increase or inhibit alertness, and over time can alter circadian rhythms. When work is physically or psychologically stressful, it can inhibit sleep by increasing sympathetic nervous system activity that is incompatible with restful sleep. Certain occupational groups (health care, transportation, public safety, food service, mining, construction, executive travel) are at particular risk for impaired sleep because of work stress and the scheduling of work hours. Because nurses care for workers throughout the life span in all health care settings, the nursing curriculum must teach the basics of sleep to entry-level nurses, nurse practitioners, and occupational health nurses (OHNs). (See Chapter 24, Future Directions in Sleep Promotion: Nursing Practice, Research, and Education.) This chapter discusses the work-related impediments to sleep and interventions to improve sleep, with implications for health promotion and occupational health programs in the workplace.

The consequences of acute and chronic sleep deprivation for workers are well documented. Workplace injuries and accidents are more frequent, causing pain and suffering, as well as lost productivity for the worker who is sleep deprived. Frequent or high cost claims can lead to higher costs to the employer for health benefits. Chronic sleep deprivation increases the risk for cardiovascular diseases such as hypertension, stroke, and heart disease, as well as metabolic disorders such as obesity and diabetes. These work-related health hazards can be addressed with active health promotion and occupational health programs and practices that minimize serious adverse outcomes.

Sleep promotion is ideally a shared responsibility of workers, their employers, and health care providers. Workers themselves must consider the priority they place on sleep when competing demands threaten to derail a healthy lifestyle and performance at work. They must also be aware when their sleep is abnormal, seek treatment, and adhere to treatment recommendations if a sleep disorder is detected. Employers who are trying to create a healthy work environment must have a systematic plan at all levels of the organization to recognize sleep-related aspects of the physical work environment, the intensity of workplace stressors, and how work is organized to advantage workers' sleep. They must provide health insurance coverage to ensure that workers receive specialty treatment for their sleep disorder-related symptoms and provide accommodations if chronic sleep disorders continue to impair functioning.

The employee health unit is the best place to coordinate the health promotion activities at work as well as screening, clinical care, referrals, and accommodation. The personnel in the employee health and/or safety departments should conduct exposure assessments of scheduling practices and monitor trends in injuries to inform healthy scheduling practices. When the exposure assessment identifies possible risk factors for sleep deprivation or sleep disorders, the occupational health nurse clinicians must incorporate thorough sleep and occupational exposure histories, provide health education regarding sleep and work, and tailor interventions to improve sleep quantity and quality. The health care providers in the employee health department can also recognize sentinel occupational health events, such as sleep complaints, drowsiness at work, and accidents and injuries which might indicate additional workers at risk for occupational sleep disorders (Figure 22.1). In the ideal situation, all are motivated to create a healthy workplace where workers can be safe and productive and then go home, sleep restfully and long enough, and enjoy a high quality of life. Combined, these concerns clearly have implications for workplace policy development to ensure worker safety and productivity.

WORK-RELATED IMPEDIMENTS TO SLEEP

Both work and nonwork factors influence sleep opportunity and the risk for sleep disorders (see Figure 22.2). The work-related impediments to achieving adequate sleep duration and good sleep quality are described below.

Early Day Shift Start Times

When work is scheduled to begin early in the morning (before 9 AM), workers achieve significantly less sleep, and have reduced alertness and increased sleepiness on the job when compared to those working more normal daytime hours (Ingre, Kecklund, Akerstedt, & Kecklund, 2004; Rosa, Harma, Pulli, Mulder, & Nasman, 1996; Tucker, Smith, Macdonald, & Folkard, 1998). These early shifts are common in transportation, mining, construction, and health care (U.S. Bureau of Labor Statistics, American Time Use Survey, 2010). Even with normal start times at work, commuters in some urban areas leave the house early to "beat the rush" (National Academies, 2006). When work must be scheduled in the early morning, it is beneficial to offer early-shift workers some interspersed later start time shifts to allow them time for recovery sleep. Altering start times to improve sleep may be particularly important for some worker subgroups such as adolescents and young adults, where falling asleep before midnight and arising early in the morning is difficult (see Table 22.1) (Crowley, Acebo & Carskadon, 2007). In contrast, older workers whose circadian cycle has shifted to an early bedtime and wake time may more easily adapt to an early shift (see Table 22.1) (Dilk, Duffy, & Czeisler, 2000).

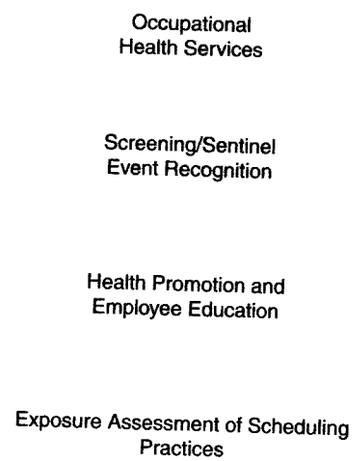

Figure 22.1 ■ Employee health services model to prevent work-related sleep disorders.

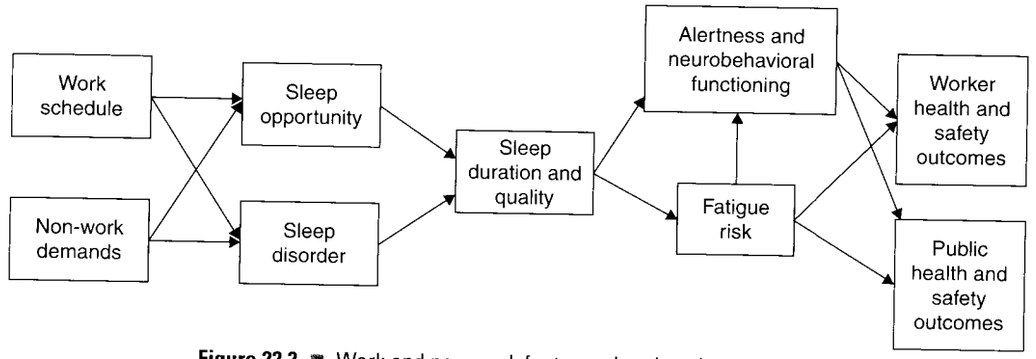

Figure 22.2 ■ Work and non-work factors related to sleep and outcomes.

Shift Length

Extended work hours have become normal practice in some service occupations such as health care, where 12-hour shifts for nurses or 24 hour shifts for physicians are common. Other industries, such as utility companies or those responsible for responding to disasters intermittently have extended hours. Extended work hours reduce the opportunity for sleep, are related to short total sleep time, and result in cumulative sleep deprivation (Ferrie et al., 2007; Geiger-Brown, Rogers, Trinkoff, Bausell, & Scharf, 2010; Lockley et al., 2007).

Table 22.1 ■ *Common Work-Related Circadian Rhythm Sleep Disorders*

Delayed Sleep Phase Disorder
The worker cannot fall asleep at a desired sleep time, often falling asleep after midnight, and then has severe difficulty waking early in the morning to go to work. If sleep is undisturbed, the duration of sleep will be normal. The worker may describe himself as a "night owl." More common in adolescents and young adults, although may begin in childhood and persist into late life.
Advanced Sleep Phase Disorder
The worker gets sleepy several hours before conventional bedtimes of other adults, and wakes spontaneously very early in the morning. If sleep is undisturbed, the duration of sleep will be normal. The worker may describe himself as a "morning person." More common in older adults.
Shift Work Disorder
The worker is unable to sleep or sleeps poorly during the daytime when on the night shift. He is excessively sleepy during the work shift, and may have reduced or unsafe work performance. The duration of sleep will not be normal if sleep is undisturbed, but will be considerably shorter than normal. This occurs even if the worker is in an optimal sleep environment. The worker may describe himself as "unable to adjust to night shift, even though I tried."
Jet Lag Disorder
The worker who travels across time zones will have difficulty falling asleep at the appropriate clock time in the new environment, and may be sleepy during the daytime, with complaints of gastrointestinal upset and malaise. The severity and duration of symptoms depends on the number and direction of time zones crossed (eastward travel is more difficult), as well as individual tolerance to chronobiologic changes. The worker may describe himself as having "jet lag."

Night Shift Work

Shift work is an unavoidable consequence of around-the-clock operations in many industries, and 15%–20% of the working population work some night shift hours (Barger, Lockley, Rajaratnam, & Landrigan, 2009; Morganthaler et al., 2007). Night shift work may be mandated or voluntary, intermittent (as with rotating shifts) or permanent. However it occurs, studies demonstrate that night shift workers achieve about 10 hours less sleep per week than those working on the evening or day shift (Akerstedt, 2003). Being awake during daylight and sleeping in the dark of night is biologically hard-wired into humans, so adaptation to night shift is a continual and hard-fought battle (Akerstedt, 2007). The circadian rhythm regulating sleep becomes disrupted, and sometime desynchronized. Although most workers can adapt biologically to working at night, the circadian system is slow to resynchronize (Barnes, Deacon, Forbes, & Arendt, 1998), and when workers revert back to sleeping at night on days off, adaptation is reversed. (See Chapter 10, Circadian Rhythm Disorders.)

Domestic factors also influence ability to cope with shift work. If the sleep environment were perfect (noiseless, dark), night shift workers would still get less sleep because of the potent circadian influence, but ideal sleep environments are rare. It is common for night shift workers to be awakened by daytime environmental noise, for childcare needs and social obligations, and by daylight exposure encouraging wakefulness (see case example in Table 22.2).

Night shift is associated with a myriad of physical symptoms and disorders. Workers have gastrointestinal complaints ranging from dyspepsia to irritable bowel disorders; depressive symptoms, incipient mood disorders and exacerbation of existing mood disorders (see Chapter 13, Pediatric Sleep Disorders); higher risk for cardiovascular diseases such as hypertension, health disease and stroke and their metabolic precursors; and higher risk for some cancers, most notably breast cancer. Chapter 10, Circadian Rhythm Disorders, provides additional information about the circadian physiologic changes that are relevant to these disease processes.

Table 22.2 ■ *Case Example: Shift Worker*

A night shift worker arrives for her 12-hour shift at 7 PM. She has to fight sleep between 3 and 5 AM when the circadian nadir won't sustain alertness, but by the time she leaves work at 7:30 AM and arrives home at 8 AM, waking pressure from the circadian drive is already beginning to trigger wakefulness. Although she falls asleep easily upon arriving home (due to homeostatic pressure to sleep), by 2 PM there is so much circadian waking pressure that she finds she cannot remain asleep despite not having had enough sleep and desiring more. By 3 o'clock the children are home from school and clamoring for attention, and the worker must start dinner by 4:30 PM in order to feed the family so that the children's evening sports team practices can start on time. She returns to work the next night at 7 PM having had only 5 hours of sleep, and this cycle repeats between each night shift until the weekend when she sleeps 10 hours to "catch up" from chronic partial sleep deprivation. She is unaware that long sleep on the weekend is insufficient to counter the sleep debt that she has accumulated during the week, and does not realize that her early symptoms of hypertension and weight gain might be due, in part, to chronic sleep deprivation.

After a "near miss" safety incident at her job, the employee was referred to employee health per protocol for a urine drug screening. While her urine test was negative for substances, the occupational health nurse specialist conducted a thorough occupational history and sleep history learning that the employee was exposed to multiple 12 hour shifts, often 3 or 4 in a row without a day off. The accident occurred on the 4th straight 12-hour shift. The client's insufficient sleep together with the safety incident prompted a review of scheduling practices at the facility. The worker was referred to a sleep specialist who crafted specific scheduling requirements for the worker upon return to work. Coordination with the employee's primary care practitioner was also initiated. The OHN and nurse practitioner in the employee health unit communicated the work schedule requirements to the supervisor. At the next safety meeting the OHN raised the issue of unsafe scheduling practices. It was decided that night shift workers would be limited to two consecutive 12-hour shifts before a day off. A surveillance program for occupational injuries secondary to repeated 12-hour shifts or overtime was implemented by the occupational health nurse.

Shift Rotation

Rotating shifts (between day and night, or day, evening, and night) are difficult from a circadian perspective. Both the speed and direction of rotation affect sleep duration and quality, although few full time night shift workers (< 3%) ever really show circadian adjustment to their shift (Folkard, 2008). Based on these findings, it is unlikely that rotating shift workers can show circadian adaptation over relatively short periods. However, permanent night workers achieve slightly more sleep than workers who rotate to night shift (Pilcher, Lambert, & Huffcutt, 2000), perhaps because they make accommodations over time to achieve more sleep. Night shift workers often persist in choosing this schedule because of additional shift differential pay that significantly boosts their income (Camerino et al., 2008), the nature of the work itself (fewer "bosses"), or the need to accommodate caregiving responsibilities for a child or an aging parent. The most hazardous aspect of rotating shifts is the "quick return," a pattern where the worker has fewer than 10 hours off between shifts.

Work Stress, Spillover

Many workers spend 40–50 hours a week at their jobs, and some workers spend even more hours at their jobs. At any job there are sources of stress that can carry over into time away from the job as well. As such, there is mounting epidemiologic evidence that physical and mental work demands may be a contributing factor to difficulty falling asleep, awakening in the middle of sleep, and early morning waking, all of which can affect total sleep time (Akerstedt, 2006; Ferrie et al., 2007; Jansson & Linton, 2006). (See Chapter 6, Insomnia.) Physical demands over a long work day can increase adrenergic hormones that prevent sleep (Sonnentag & Zijlstra, 2006). High levels of mental stimulation in a stressful work environment can also impair sleep, especially if the worker anticipates problems during the next work shift (Akerstedt, 2006; Geiger-Brown, et al., 2004; Jansson & Linton, 2006; Sonnentag & Zijlstra, 2006).

In animal models, different forms of stress produced unique sleep architecture changes (Cui, Binglin, Suemaru, & Araki, 2008), with social conflict increasing the amount of NREM sleep, conditioned fear decreasing REM sleep, and novelty stress decreasing both NREM and REM sleep. In a nationally representative survey of more than 1,700 U.S. full-time workers, Knudsen, Ducharme, and Roman (2007) assessed the number of past-month days of difficulty falling asleep, maintaining sleep, and nonrestorative sleep. They found that work overload reduced the quality of sleep in all three aspects, where role conflict was associated with sleep initiation and restorative sleep. Repetitive tasks increased the number of days of difficulty falling asleep and maintaining sleep. Thus, occupational health nurses need to understand not only the type of work that the worker performs, aspects of the work schedule, but also the perceived stressors at work in order to fully appreciate the contribution of work to impaired sleep (Table 22.3).

WORK-RELATED SLEEP DISORDERS

Shift Work Sleep Disorder

Nearly all shift workers have some sleepiness while working the night shift, and most have difficulty achieving adequate sleep during the day although sleep education for shift workers can help to reduce these sleep problems

Table 22.3 ■ *Elements of the Occupational Health/Sleep History*

- Occupation
- Typical work schedule include shift, (day, evening, night) length of shift, and whether employee is required to rotate
- Scheduling policies of employer; ability to request and work desired schedule
- Total numbers of hours worked per shift, week and whether overtime hours are paid or unpaid
- Total commute time, work stressors (pace, conflict, demands, flexibility, decision latitude, support), Family obligation schedule
- Sleep disorder symptoms
- Medical history and medication use

Table 22.4 ■ *Optimizing Sleep When Working the Night Shift*

While at work:

- Drink a caffeinated beverage early in your shift to help maintain alertness during the shift, but avoid caffeine after midnight to reduce fragmented sleep during the daytime after the shift is over.
- Do not succumb to the temptation to eat to remain awake, especially unhealthful snack foods. If you are hungry have a small protein-rich meal early in your shift.
- If you feel drowsy during your shift, go to a more brightly lit area, move around, have a conversation.
- Avoid tasks that require concentration between 3 and 5 AM or "buddy" with a coworker to ensure accuracy and safety.
- Take a nap break if possible; one 20-minute nap may refresh you and can help you to drive home safer. Your employer is obligated to provide and you are entitled to take breaks at work by Federal law. A break is a period of time when others are responsible for your job, not just a time when you get to sit down but are still "on duty." If you choose to nap during your break, make sure that you have a way to wake up at the desired time.
- If you feel too drowsy to drive home at the end of your shift, take a nap, or call a cab or a friend to drive you. Never drive drowsy. It could be fatal to you and to others on the road.
- Before you leave the building to go to your car, put on dark glasses or special blue-light blocking glasses and keep them on until you are ready to get into bed. This may help you to sleep a bit longer by fooling your body to think it is still night.
- Do not stay late after night shift. When your shift ends, leave quickly. Do not stay for meetings, or to work overtime.

When you get home from night shift:

- When you get home, go right to bed. There is a short window of sleep opportunity before your circadian clock will stimulate you to wake up, even if you have not had enough sleep, so do not waste it doing chores, shopping, or socializing.
- Make your bedroom very dark and quiet. This means investing in good quality blackout shades, disconnecting the phone, using a white noise machine or fan, (or earplugs and eye mask) and communicating to others your strong need to not be disturbed.
- If you did not get enough sleep when you first got home, try to nap before returning to work.
- Do not attempt to provide childcare or eldercare during your sleep period. You will need to find other alternatives (e.g., daycare) while on night shift in order to achieve sufficient sleep to be a safe driver, worker, and parent. Your child will not nap long enough for you to get enough sleep.
- If you are on permanent night shift, and if it is possible for you to keep the same wake/sleep schedule on the weekend and days off, that is ideal. If you cannot do this (most people cannot) at least keep an intermediate position by staying up until 3 AM and sleeping until noon on days off.
- Because night shift workers are chronically sleep deprived, try to do as little night shift as possible (days per week, weeks per year, years per career), and take opportunities to catch up on sleep whenever you can.
- If you have a chronic health condition such as diabetes, epilepsy, heart disease, cancer, or are pregnant, avoid the night shift as it may further impair your health.

(Table 22.4). Workers experiencing extreme shift work symptoms (sleepiness during the shift and daytime insomnia) may have a genetic inability to adjust to shift work, shift work sleep disorder (SWSD) (Table 22.1) (see Chapter 10, Circadian Rhythm Disorders) (Viola et al., 2007), although the boundaries of the disorder are not extremely clear. Few workers seek treatment for shift work complaints, as many think that excessive difficulty sleeping during daytime hours or remaining alert at night is a normal part of shift work and are not aware that there are treatments available for this physiologically based disorder. Sack et al., (2007) reviewed literature describing risk factors for SWSD and concluded that older workers may have more shift work intolerance; women may get less sleep than men due to social obligations and thus have greater sleepiness on the job; and workers who are exposed to bright light in the early morning can have maladaptive phase shifting that reduce their ability to sleep in the daytime. However, not all of these risk factors were supported by robust evidence. The prevalence of SWSD has only been estimated in one population based sample (Drake, Roehr, Richardson, Walsh, & Roth, 2004), where in a random telephone sample, 32% of night shift workers, and 26% of rotating shift workers had either insomnia or excessive sleepiness that was job related.

Table 22.5 ■ *Sleep Impairment and Disability*

The Americans with Disabilities Act (ADA), was designed to protect disabled workers from discrimination by ensuring that their disabilities were accommodated by the employer. Workers with sleep disorders have pursued legal remedies when their sleep disorder has not been accommodated, or when they were dismissed after disclosing a sleep disorder. Sleep is one of the "major life functions" that is part of the disability definition. However, courts have generally sided with employers, such that workers with significant sleep deprivation (5 hours per night) were found able, since "most people" could function adequately on little sleep.

Reasonable accommodations for shift work sleep disorder include the following.

- Reduce night shift participation.
- Allow planned naps during the night shift.
- Allow use of stimulant medication to preserve alertness.
- Increase ambient light in the work environment.

The ability of an employer to provide Americans with Disabilities Act (ADA) accommodation to a worker with SWSD depends on production schedules, available personnel, and budget. Occupational health departments should be instrumental in detecting workers with this disorder and working with the employer to tailor the job to improve the workers' health and safety as well as on-the-job performance (Table 22.5) (Moran, 2007; Morin, 2006).

Sleep Apnea

Sleep deprivation associated with shift work can lead to the development of sleep-disordered breathing through its direct effect on airway patency during sleep. (See Chapter 8, Sleep-Related Breathing Disorders.) Sleep deprived adults with mild or moderate sleep apnea have an increase in abnormal respiratory events and episodes of oxygen desaturation, but even adults with no sleep apnea have an increase in the percentage of time snoring, which could increase daytime sleepiness (Stoohs & Dement, 1993). This problem is compounded by weight gain as night shift workers snack during their shift to preserve alertness (Waterhouse, Buckley, Edwards, & Reilly, 2003), and over years of shift rotation, this can result in a higher body mass index (and increase the risk for obstructive sleep apnea) when compared to straight day shift workers (Parkes, 2002). Night shift workers with obstructive sleep apnea have higher apnea/hypopnea index scores when working the night shift, compared to when they work day shift (Laudencka, Klawe, Tafil-Klawe, & Zlomanczuk, 2007).

INTERVENTIONS TO REDUCE WORK-RELATED SLEEP PROBLEMS

Because work-related sleep problems are due to both individual and organizational factors, a robust worksite health promotion program designed around a thorough exposure assessment can influence employees' individual behavior toward a healthier lifestyle. Employers must integrate screening/surveillance, sentinel event recognition, and clinical interventions into a comprehensive approach to preventing work-related sleep disorders (Table 22.6). In this section, solutions at both levels of intervention that have been used in the past to promote sleep among workers are addressed. It is in the interest of the employer to maintain employee's health at a high level in order to ensure worker safety and productivity.

Individual Level Interventions

Even though much of sleep is affected by how work is organized, there are individual factors that strongly influence the worker's duration and quality of sleep. In order to improve sleep, there are lifestyle and drug therapies that can be used to induce and sustain sleep, or preserve alertness at work. Worksite health promotion programs educate employees to important lifestyle modifications included scheduling of bedtime, regulating and timing caffeine, obtaining appropriate child care when the worker needs to sleep without interruption, and improving the sleep environment. In this section, we describe these individual level interventions.

Sleep Timing

Because night shift workers usually revert to a day shift sleep pattern on their nights off,

Table 22.6 ■ *Elements of a Comprehensive Occupational Health Program to Prevent Sleep Disorders*

Employer	Worker/Staff	Supervisor/Nurse Manager	Occupational Health Nurse
Develop a Policy on Work Schedules	Participate in development of policies/know and understand policy	Participate in supervisor training/provide feedback on scheduling issues to management	Conduct an exposure assessment of all job titles for scheduling practices, overtime use, vacancy rates, participate in evaluation and feedback relating to schedule policy
Provide on-site or contractual, occupational health services	Report to occupational health services when feeling drowsy on the job, for insomnia, and after all injuries and accidents	Refer drowsy employees and those who sustain injuries or accidents to the employee health unit	Establish a protocol for sentinel occupational health events (SEIH) when employees with drowsiness, insomnia, and accidents/injuries come to the employee health unit. Utilize the SEOH to assess workers in similar job titles and work units for occupational sleep disorders.
Provide education and tools to implement policy to workers and supervisors	Participate in regular and periodic sleep hygiene education; communicate sleep hygiene practices and work schedule to primary care clinician	Utilize work scheduling tools such as software; participate in exposure assessment	Assist with development and teaching of sleep hygiene/health promotion classes to workers; monitoring participation rates of employees and units; provide feedback on participation to managers
Monitor and evaluate policy implementation/seek feedback from workers and supervisors	Provide feedback to supervisor on scheduling policies; go to employee health unit for health concerns related to sleep	Participate in evaluation of work schedule policies; provide feedback to managers; refer workers with sleep and safety issues to Employee Health unit	Take work and work schedule histories on admissions to employee health unit for occupational injuries and accidents; conduct surveillance on injuries and accidents related to sleep/fatigue/work schedule
Accommodate workers with occupational sleep disorders in jobs that will not exacerbate their symptoms	Follow recommendations for sleep hygiene and accommodations on the job	Evaluate job performance of employee	Monitor symptoms and health of workers on accommodations or light duty post diagnosis of work-related sleep disorder. Recommend follow-up and communication with primary care provider.

their circadian systems can become dysregulated, creating poor sleep throughout the work schedule cycle. Eastman's extensive laboratory research on timing sleep to produce alertness during the night demonstrates that it is possible to improve nighttime performance in carefully controlled conditions by phase-advancing the sleepiest portion of the night shift. Her most recent study recommends that night shift workers adopt a compromise sleep position by remaining awake into the early morning hours (go to bed at 3 AM) on nights off and then sleep during part of the day (arise at 12 noon) to partially phase shift their circadian system towards nightshift alertness (Smith, Fogg, & Eastman, 2009). Night shift workers should use blue-light blocking glasses in the morning to dampen the circadian upswing from bright morning light (Sasseville, Benhaberou-Brun, Fontaine, Charon, & Hebert, 2009) (Table 22.4). Employees with work-related travel that requires flights across time zones should have individualized sleep plans developed in conjunction with the employee health unit to ensure that they are alert and productive during their business, as well as protecting their health from adverse health consequences from circadian disruption.

Drug Therapy

There are several drugs that can be prescribed to promote either sleep or alertness for workers with SWSD (Schwartz & Roth, 2006). Hypnotics and melatonin can be tailored to induce sleep, sustain sleep, or assist patients to quickly return to sleep when sleep is interrupted based on the pharmacokinetics of the specific drug (Aeschbach et al., 2009). Stimulants such as Modafinil can be used to sustain alertness during the work shift, as in the "go" pills used in military settings (Czeisler et al., 2005; Czeisler, Walsh, Wesnes, Arora, & Roth, 2009; Moran, 2007), although they should not be a replacement for spending adequate time in bed. (See Chapter 9, Narcolepsy.) Drugs are often prescribed as a first-line therapy by primary care providers without a full diagnostic assessment for sleep disorders. This can increase sleepiness at work if an older hypnotic is prescribed for a worker with an undiagnosed sleep disorder such as sleep apnea. Patients seen by sleep specialists are often those who were unresponsive to medication from primary care settings.

Organizational Level Interventions

Fitness-for-Duty Testing

The science of occupational fitness-for-duty testing to detect sleep deprivation in workers is in its infancy. There are instruments of high quality that are used in research settings to detect fatigue and microsleeps (unintended and uncontrollable episodes of sleep lasting up to 30 seconds) in ambulatory research conditions (e.g., Perclos to detect eye blink activity in truckers, psychomotor vigilance testing (PVT) to detect lapses in reaction to a visual stimulus), but these are not appropriate for "real time" testing of employees in actual work situations. Because detection is not feasible, a better approach is to reduce the work-related inhibitors of sleep by making sure that work schedules allow sufficient sleep opportunity. Software is commercially available and in common use in some settings to flag fatigue-inducing schedules in workers (Moore-Ede et al., 2004). In this section, we will review organizational measures to reduce the impact of work on sleep duration and quality.

Occupational Screening for Sleep Disorders

In safety-sensitive industries, fatigue and sleepiness at work greatly increase the risk for accidents, injuries, and errors. Occupational screening for sleep disorders has become a standard method for managing fatigue risk in the transportation industry (Hartenbaum et al., 2006), but this is rare in other industries (Linnan et al., 2008). In one study in which a large scale occupational sleep disorders screening program was introduced into industrial work settings (power plants, medical fabrication plants, heavy machinery repair), there was a 30% reduction of injury rates among excessively sleepy workers (Melamed & Oskenberg, 2002). A benefit of occupational screening is that patients without daytime symptoms often have occult sleep disorders, but generally do not seek medical attention. Lavie (2002) proposes that rather than waiting for symptomatic patients to be referred, screening programs should be used to identify individuals with sleep-disordered breathing at the youngest age possible (similar to hypertension and diabetes screening) to prevent cardiovascular morbidity and mortality. Also, some portion of the high fatigue seen in shift workers, often discounted as an unavoidable reaction to shift work, may actually be due to the presence of a treatable primary sleep disorder, such as sleep apnea or narcolepsy (Hossain, Reinish, Kayumov, Bhuiya, & Shapiro, 2003).

Screening for sleep disorders in occupational settings has several limitations. Most screening instruments are highly sensitive, but lack specificity (Hartenbaum et al., 2006). Thus employers will be faced with difficult decisions about when to follow up positive screening results with sleep specialist consultations and expensive polysomnograms. However, failing to heed the screening test result must be balanced with a risk of employing a person with a sleep disorder and then assigning him to a shift rotation schedule that will exacerbate his underlying condition and possibly cause an unsafe work environment for himself and others as well as reduced productivity and increasing the latent conditions for worker errors to occur.

Comprehensive Occupational Health Programs

Table 22.6 summarizes the elements of a comprehensive occupational health program to prevent sleep disorders. While these elements

may vary in order or intensity depending on the workplace, the basic outline begins with policies that cover scheduling practices. From there, occupational health services may or may not be provided on site, but linking safety systems, scheduling policies, and occupational health services is critical to preventing illness and injury secondary to scheduling practices. In many workplaces, a health and safety committee with multidisciplinary representation will coordinate evaluation of system level data with the employee health unit. Figure 22.1 displays a comprehensive model of occupational health services designed to prevent work-related sleep disorders and their health and work consequences.

The foundation (as depicted in Figure 22.1) is a thorough assessment of scheduling practices by department and job title typically conducted by the safety professional and the occupational health nurse. In addition to an assessment of scheduling practices, trends in occupational accidents and injuries can be examined simultaneously to benchmark their association with scheduling practices. Next, employee health promotion and education programs are vital to address employee lifestyle and sleep hygiene behaviors which impact work and health but largely occur on personal time. Occupational sleep disorders and their sequelae will go largely undetected without basic screening and surveillance during preplacement and routine encounters with workers in the employee health clinic. The practice of recognizing sentinel occupational events is related to screening and provides early clinical care to the affected worker. It also facilitates investigation of whether coworkers in similar jobs are experiencing risks for work-related sleep disorders. Sleep complaints, drowsiness on the job, and all injuries and accidents should be considered sentinel occupational events requiring further investigation at the population level. Finally, the clinical services for occupationally induced sleep disorder must include a thorough exposure and occupational health history, appropriate referrals and case management, and job accommodation upon return to work (Greenburg & Roger, 2006; McPhaul, 2002; Olson et al., 2005; Silverstein, 2005).

Sleep Hygiene, Shift Work, and Long Work Hours Education for Workers

Many workers have no orientation about steps that they can take to improve sleep duration and quality while working night shift, early morning start time, and long work hours. Sleep hygiene education is one of the most widely delivered basic treatments given to patients with sleep disorders in sleep medicine settings, and should be routinely incorporated into employee orientations (Harvey, 2000).

Napping at Work. Napping during the work shift is controversial in many industries, and for some workers it is grounds for dismissal. Yet, unplanned naps do occur when sleep pressure overwhelms the worker's drive for alertness. Certainly a planned nap under controlled circumstances is preferred to "falling asleep at the switch." Both laboratory and workplace studies have confirmed (by EEG) that a brief 15–20 minute nap during a work shift confers additional alertness, especially for workers with partial sleep deprivation or those working in monotonous tasks (Driskell & Mullen, 2005). A nap of 20 minutes reduces the risk for sleep inertia (grogginess upon waking), and the ideal time to take a nap is at the circadian nadirs (2–4 PM, 2–4 AM). Among 12-hour night shift workers, reaction times were quicker after a 20-minute nap was taken between 1 and 3 AM (Purnell, Feyer, & Herbison, 2002). However, only half of workers reported falling asleep during the scheduled nap period; the most common complaint was excessive noise, suggesting that creating appropriate conditions for napping may improve the outcome. Knowledge transfer of the benefits of napping have been slow, and this evidence-based information will only be applied when the specific constraints and incentives in individual worksites to overcome concerns from employers about "sleeping on the job" rather than "napping at the break" (Anthony & Anthony, 2005).

Ensuring Reasonable Work Schedules

Whether workers "self-schedule" or are assigned their work hours, having adequate sleep opportunity is critical, and work schedules are often

at odds with this. Fatigue risk software has been used since the mid-1990s to evaluate day-by-day fatigue and error risks related to job schedules in UK safety-sensitive industries such as rail, bus, chemical, nuclear and offshore operations (Folkard & Lombardi, 2006; Folkard, Robertson, & Spencer, 2007), and military, rail and airline applications in the United States (Hursh et al., 2004). Several software packages are available, and differ slightly in the prediction formulas and covariates entered into the models; however, there is general agreement that key elements must be present in order to predict fatigue risk. These are (1) a cumulative component where patterns of work on previous shifts influence the current shift, (2) timing of work including start time, shift length, and time of day throughout the shift, and (3) the nature of the work (job intensity) as well as patterns of breaks taken during the shift (Folkard & Lombardi, 2006). This approach was successful in a study where managers and dispatchers were trained scheduling methods to reduce driver fatigue using fatigue risk management software. This led to significant reduction in fatigue risk scores, fewer accidents, and lower insurance premiums 9 months after the intervention (Moore-Ede et al., 2004).

Most employers look at the issue of worker fatigue as inevitable and are unaware of the science that supports using fatigue risk tools to examine current scheduling practices to improve outcomes. Employers also believe that workers want to compress work schedules to "get it over with" so that they can have larger blocks of time off. This was recently contradicted in a study of police officers, where a healthier pattern of rotating shifts was tried. At the beginning of the study, officers were unhappy with having fewer days off per month with the healthy shift pattern, but at the end of the study they were more satisfied with their work schedules because they now had at least 16 hours off between shifts despite fewer days off per month (Kecklund, Ericksen, & Akerstedt, 2008). In general, evening shift workers have the longest and best quality sleep of 8-hour shift workers (Akerstedt, 2003).

Modifying Ambient Light on the Night Shift

Many work environments are dimly lit and without any circadian variation in light levels. Environmental modifications are an inexpensive way for employers to improve alertness in workers. Bright light has been shown to improve alertness in night shift workers, through both direct alerting effects (Campbell, 1995), and through suppression of melatonin production (Santhi, Aeschbach, Horowitz, & Czeisler, 2008). Exposure to blue-light phase shifts the circadian rhythm if the retina is exposed during specific sensitive periods in the circadian cycle (Cajochen et al., 2005). There have been studies using a variety of light "doses" and timing to improve alertness in night shift workers, and many have shown benefit (Boivin, Tremblay, & James, 2007; Shechter, James, & Boivin, 2008). Light has also been used to reduce decrements in alertness during the postprandial dip in dayshift workers (Hayashi, Masuda, & Hori, 2003). Amber glasses are also helpful to block blue-wavelength light from reaching the non-rod non-cone receptors in the retina, to prevent the circadian day from being triggered in night shift workers upon their departure from work.

GAPS IN SCIENCE AND IMPLICATION FOR FUTURE RESEARCH

Despite extensive research that documents the importance of sleep for workers, the consequences of their not receiving sufficient sleep, and remedies to reverse this trend, there are still gaps in the research literature. These gaps have prevented strong policy development leaving many safety sensitive industries without regulation and guidance. Areas of needed research are described:

- Most of the sleep deprivation laboratory studies that have shown performance decrements have used healthy young adults with no "work" during waking hours, and no social responsibilities during leisure hours. The effect of occupationally produced sleep deprivation needs to be studied in actual worker populations such as adolescent workers still in school, young parents with children, pregnant women, older workers with chronic

diseases and risk factors for chronic diseases, workers providing caregiving to elders, and aging workers. These special populations may need protections in the workplace to prevent illness and injury due to sleep deprivation.

- The science of screening for sleep disorders in occupational settings warrants additional research. Currently the questionnaires that can flag workers with a suspicion for sleep disorders lack specificity, and can be costly to companies that must follow through with confirmatory evaluations. Creating better user-friendly risk profiles can help companies to maintain productivity by locating and assisting workers with latent sleep disorders.
- There are no readily available "fitness for duty" tests to screen workers in real time for potential sleep deprivation-related safety hazards despite years of neurobehavioral research.
- Workplace health promotion efforts are effective in reducing back pain, diet, exercise and smoking cessation but have bypassed sleep as a key factor to promote worker health. There is adequate science to support a variety of workplace interventions, and these need to be combined into comprehensive programs that target the myriad of factors that reduce sleep in workers. Outcomes should include both proximal (sleepiness, fatigue), intermediate (injury, acute illness), and distal (chronic disease) events. This will require interdisciplinary collaboration and skill at translational science.
- The policy debate between external regulation and self-regulation for industries with sleep-destructive organization of work should be addressed. Lee (2006), writing about regulation of resident work hours, posits that only Federal legislation will be effective in curtailing dangerous hours of work. He carefully describes the failure of regulation efforts by States and by self-regulating accreditation bodies (e.g., ACGME), as well as the undesirability of allowing tort law to shape hours of work. Only the federal government has the strong national interest to promulgate regulation, and the financial and personnel resources to implement regulation across State boundaries.

Employers are required to provide a "safe and healthful workplace, free from recognized hazards." The association between work schedules, work stress, sleep disorders, and cardiovascular health outcomes creates an important hazard for consideration by the U.S Occupational Safety and Health Administration (OSHA). Dangerous work schedules should become an OSHA issue. The possibility of compensable claims via workers compensation should also be a focus of policy development. This will likely vary by State, but the stronger the evidence and more precise the screening and diagnostic tools, the higher the likelihood that occupationally induced sleep disorders will be compensable under most workers compensation schemes. Finally, in safety sensitive industries such as Health care, work schedules are coming under increasing scrutiny in terms of patient safety. Long hours for residents and nurses may be jeopardizing patient health and safety in acute care hospitals and possibly other Health care settings. It is clear, however, that these policy implications hinge on strong scientific evidence of the association between work schedules, job stress, and adverse health outcomes.

SUMMARY

The work relatedness of sleep is clear, and the responsibility to improve the duration and quality of sleep must be shared by the worker, the employer, and clinicians who are informed about sleep. Companies who require workers to be productive and safe need to consider all aspects of the employment situation to ensure that sleep deprivation is not compromising the health of their valuable workforce or their productivity. Similarly, workers themselves must make time for sleep, select a schedule that permits adequate sleep, seek treatment for sleep disorders, and adhere to treatment recommendations. Occupational health providers are in a prime position to improve the health of a large swath of the population by employing population-based principles to ensure that work-related sleep deprivation is reduced or eliminated, and that employees receive education and treatment to improve sleep quantity and quality. For nurses as employees, this will protect their health, and possibly the safety of the patients that they serve. For occupational health nurses, this will add a new emphasis area to their practice, and allow them to use their current skills in an area that will reap great reward towards improving the health of their worker population.

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SLEEP DISORDERS and SLEEP PROMOTION in NURSING PRACTICE

Editors
Nancy S. Redeker, PhD, RN, FAHA, FAAN
Geoffry Phillips McEnany, PhD, PMHCNS, BC

Here is the first comprehensive, evidence-based resource for nurses on the prevention and treatment of sleep disorders, along with the promotion of healthy sleep habits. Focused on individuals and families across the life span and in multiple health care settings, the volume presents core knowledge, latest scientific findings, and clinical guidance for assessment and intervention.

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Nancy Schmieder Redeker, PhD, RN, FAHA, FAAN, is a professor and Associate Dean of Scholarly Affairs at Yale University School of Nursing. Her research focuses on sleep and sleep disorders and their consequences among adults who have chronic comorbid medical conditions. Her work has included studies of sleep disorders and their consequences among patients who have cardiovascular disorders, including heart failure and ischemic heart disease and investigations of sleep in adult acute and critical care settings. She is currently conducting studies of the efficacy and effectiveness of behavioral treatments for comorbid insomnia in people with chronic medical conditions. Dr. Redeker's research projects have extensively used multimodal sleep measurement methods, including polysomnography, wrist actigraphy, and self-report. She has published over 100 peer-reviewed papers, abstracts, and book chapters on sleep and related topics, and her work has been funded by the National Institutes of Health, the American Heart Association, the American Association of Critical Care Nurses, and the American Nurses Foundation. Dr. Redeker has taught extensively at the BSN, MSN, and doctoral levels, mentored many students and clinicians in sleep and the conduct of research, and provided numerous continuing education presentations to interdisciplinary audiences on sleep-related topics. She is a Fellow of the American Academy of Nursing and the American Heart Association, Editor of *Heart & Lung: The Journal of Acute and Critical Care*, and the President of the Eastern Nursing Research Society. She previously served on the faculties of the College of Nursing, Rutgers–The State University of New Jersey, and The School of Nursing of the University of Medicine and Dentistry of New Jersey. She earned an AB in Sociology from Rutgers University, BSN and MSN from Seton Hall University, a PhD in Nursing Research and Theory Development from New York University, and completed a research fellowship in sleep disorders at New York University School of Medicine.

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Sleep Disorders and Sleep Promotion in Nursing Practice

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To Jim Redeker, husband, partner, and best friend who accepts my long hours of work on this and other projects with good humor and love.

To Lois W. Schmieder, RN, who taught me what it means to be a nurse.

—Nancy Lou Schmieder Redeker

To Brian Phillips McEnany and Karen McEnany Farrington for their powerful presence in my life that is always loving and unconditionally supportive. They are treasured and celebrated examples of the richness of family.

—Geoffry Phillips McEnany

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Preface

The science of sleep and sleep disorders treatment has come of age, as demonstrated by inclusion of sleep-related goals in *Healthy People* 2020, released as our book goes to press. These goals build on incredible advances in basic, clinical, and community-based science addressing sleep and sleep disorders, including the notable contributions of nurse scientists (many of whom are contributors to this book), to this interdisciplinary field. There is no doubt that sleep contributes positively to health and well-being, and sleep disorders contribute to morbidity, mortality, and decrements in functional capacities, and quality of life; and there is powerful evidence of the efficacy of sleep promotion strategies. We wrote *Sleep Disorders and Sleep Promotion in Nursing Practice* to provide a reference for nurse educators, advanced practice nurses, and other nursing leaders on sleep and sleep disorders; to integrate the science of sleep into nursing practice, education, and research; and to facilitate the uptake and translation of evidence-based assessment and treatment of sleep into community-based and clinical settings where nurses practice.

Our focus is based on the need for nurses to have a strong grasp of the essence of sleep, sleep disorders, and practical strategies to integrate this information. We expect this book to be a critical resource for faculty teaching in prelicensure nursing programs, master's, and practice and research doctoral levels. We also expect that our book will serve as a seminal reference for advanced practice nurses across a variety of specialties.

As documented in a recent report commissioned by the Institute of Medicine (Colten & Altevogt, 2006), there is a tremendous gap between the strength of the evidence about sleep and sleep disorders and its dissemination, translation, and uptake into community and clinical settings—a problem partially explained by the lack of knowledge about sleep and sleep disorders among health care providers, including *nurses*. Although deficiencies in content and clinical experiences related to sleep and sleep disorders in formal nursing and medical educational programs and postgraduate continuing education have been well documented, there have been few systematic attempts to address this problem in *nursing education*. Even when nurses are knowledgeable about sleep, limited time and resources in clinical settings are major barriers to improving access to sleep promotion and sleep disorders treatment. Our book will address these important gaps.

Sleep Disorders and Sleep Promotion in Nursing Practice is written from a nursing perspective and incorporates interdisciplinary research, as befits this expansive field. It is based on our (NSR, GPM) extensive experiences in sleep research, practice, and nursing education. As veteran nurse educators, we understand the incredible demands for time in the nursing curriculum and the need for faculty expertise. We agree with Virginia Henderson (1955), who identified sleep and rest as one of the 14 basic "human needs," and Florence Nightingale who noted the importance of sleep to human health and healing (1860) that *sleep promotion is a fundamental element of nursing practice*. By virtue of our broad focus on health promotion, disease prevention, expertise in lifestyle, and behavioral change coupled with biobehavioral perspectives, nurses are well suited to promote sleep and assist individuals, families, groups, and