14

Workplace Strategies to Reduce Risks from Shift Work, Long Work Hours, and Related Fatigue Issues

Claire C. Caruso

Evidence is growing that getting adequate sleep is a basic need for life and health, and is as important as good nutrition and exercise (Luyster, Strollo, Zee, & Walsh, 2012). Healthy sleep is linked to feelings of wellness, good mental health and healthy body weight, improved safety, and the prevention of infections as well as many types of chronic illnesses (Colten & Altevogt, 2006; U.S. Department of Health and Human Services [DHHS], 2010). Three panels of sleep experts reviewed the literature, and all recommended that adults get 7 or more hours sleep each day to maintain their health and safety (Hirshkowitz et al., 2015; Mukherjee et al., 2015; Watson et al., 2015). Healthy People 2020, the science-based, 10-year national objectives for improving the health of all Americans, has three objectives for sleep health for adults: (a) increase the proportion of adults who get 7 or more hours of sleep a day, (b) increase the proportion of adults with sleep apnea symptoms who seek a medical evaluation, and (c) reduce the rate of vehicle crashes due to drowsy driving (U.S. DHHS, 2010).

This chapter gives an overview of strategies that management and safety personnel can integrate into workplace systems to reduce risks from inadequate sleep. Three types of controls are discussed to promote sleep health and an alert workforce: (a) eliminate or reduce the hazard; (b) institute policies,

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programs, and practices; and (c) educate managers and workers. Throughout the chapter, the term *manager* refers to business leaders and safety professionals who are responsible for establishing and maintaining workplace systems, and providing advice and consultation.

Both factors at work and personal factors can lead to difficulties with sleep. The percentage of American civilian workers reporting 6 or fewer hours of sleep per day (a level considered too short by sleep experts) increased from 24% in the 1980s to 30% in the 2000s (Luckhaupt, Tak, & Calvert, 2010). Certain industries show higher rates of workers' reporting they do not sleep long enough: 34% of manufacturing workers, 44% of night-shift workers in any industry, 52% of night shift health care workers, and 70% of night shift transportation workers (Centers for Disease Control and Prevention, 2012). Ricci, Chee, Lorandeau, and Berger (2007) found that 38% of the U.S. workforce had reported having low energy, poor sleep, and fatigue in the previous 2 weeks. These data indicate a large percentage of the U.S. workforce is not getting enough sleep and is fatigued on the job.

Insufficient sleep is associated with a broad range of health and safety risks, including premature death, vehicle crashes, obesity, infections, and a wide range of chronic illnesses, including cardiovascular and gastrointestinal disease, diabetes mellitus, cancer, and disturbances to mood (Durmer & Dinges, 2005; Irwin, 2015; Khanijow, Prakash, Emsellem, Borum, & Doman, 2015; Luyster et al., 2012). In its draft report on carcinogens, the National Toxicology Program (2018) concluded that persistent night-shift work that causes circadian disruption is known to be a human carcinogen. In addition, people who do not get enough sleep can show on brain function tests declines, such as in response rate, thinking, remembering, and concentration, which can affect job performance and increase the risk for making errors on the job (Goel, Rao, Durmer, & Dinges, 2009).

Shift work and long work hours are critical factors that make it difficult for workers to get enough sleep. These demanding schedules can conflict with normal human physiology, which drives people to sleep at night at consistent times day after day and drives them to be awake and active during the daytime. Night-shift and irregular work hours can lead to misalignment of sleep with circadian rhythms, which leads to trouble with falling asleep, more arousals during sleep, and early awakenings, thus leading to poorer sleep quality and shorter sleep duration. Very long shifts and not having enough time off between work shifts can make it impossible for workers to get enough sleep.

Not getting enough sleep leads to decrements in functioning and performance on the job. As a result, workers may make mistakes at work, at home, or while driving, which put themselves as well as others around them at increased risk for injuries or death. Drowsy drivers as well as their employers have been penalized when a crash has caused a death (*Marthe v. Trotter*, 1999; *State v. Scott Robb*, 2005). Therefore, in addition to possible personal injury, errors because of fatigue can have such devastating consequences as high legal fines, jail time, and lasting mental pain for those involved (Scott et al., 2014).

Immediate risks of inadequate sleep and disruption to circadian rhythms also include poor health behaviors, such as smoking, physical inactivity, and unhealthy eating patterns that lead to obesity. Long-term exposure to sleep deprivation and disruption to circadian rhythms increases risk for developing the range of chronic illnesses previously mentioned. (See National Institute for Occupational Safety and Health [NIOSH et al., 2015] for a review of the health and safety risks associated with shift work, long work hours, why these risks occur, and strategies for managers and workers to reduce these risks.)

Managers and workers share in the responsibility to reduce the risks linked to poor sleep health. Strategies for managers include improving the design of their employees' work schedules, promoting breaks during the work shift, establishing policies and systems at work to promote sleep health and alertness, fostering good coworker and supervisor relationships, and educating their workforce. Strategies for workers include allowing enough time for sleep, adopting good personal practices and behaviors to maximize sleep and alertness, and educating the important people in their lives to reduce conflicting demands from work and personal life. Workers with sleep problems or excessive work-time sleepiness can seek an assessment and treatment from a health care provider.

ELIMINATING OR REDUCING HAZARDOUS SHIFT WORK AND LONG-HOUR SCHEDULES

Night shift is linked to the most health and safety risks, followed by evening shift (Caruso, Lusk, & Gillespie, 2004; Folkard & Lombardi, 2006; NIOSH et al., 2015, Modules 2 and 3). The least risks are associated with day shifts using 8 hours of work per day. Night shifts have most of the work hours between 9:00 p.m. and 8:00 a.m.; evening shifts have most of the work hours between 2:00 p.m. and midnight; and day shifts are scheduled between 7:00 a.m. and 6:00 p.m. (McMenamin, 2007).

If possible, it is best for employers to avoid using night shifts. Some types of work and work settings may not need work carried out during the night. Due to the higher health and safety risks as well as decrements in performance associated with night shifts, managers can choose to schedule all work during the daytime hours if these hours adequately meet the needs of their operation. However, night and evening shifts cannot be avoided for critical services that are needed around the clock, such as police and fire protection, health care, transportation, communications, public utilities, and military service. Other industries require workers around the clock because their production processes and operations need to be continuous to optimize capital investment in machinery, or the manufacturing process cannot be interrupted for production reasons.

When night work is necessary, the following strategies can be used to reduce the risks. Workers will be better able to adjust to work times when they have some ability to control their schedules (Knauth & Hornberger, 2003). With some control, they can take their own physical and mental capacity for work into

account as well as their social and family demands. People with a natural tendency to go to bed late and get up late will tend to have fewer difficulties working night and evening shifts because these work times fit with their natural tendencies. If given the opportunity, they may choose to work those shifts. Some organizations use self-scheduling with guidelines or limits so that workers can choose their schedules but cannot select risky patterns that put them at higher risk for fatigue. A regular, predictable schedule helps workers plan for sleep and personal responsibilities. The inability to plan is one factor that makes emergency, on call, mandatory, and unplanned overtime difficult.

Researchers cannot recommend one design for 24-hour operations that will work well in all work settings. Knauth (1998) estimated that 10,000 work-scheduling patterns are used worldwide. Schedules differ in shift start times and duration, sequence of workdays and days off, pattern of weekends off, and whether the schedule has permanent or rotating shifts. Rotating schedules can differ according to the speed and the direction of the rotation.

The *speed of shift rotation* refers to how rapidly work shift times change. With a *fast rotation*, the person works different shifts within the same week (e.g., a day shift for 2 days followed by an evening shift for the next 2 days, then a night shift for 1 day, and then 2 days off). During a *slow rotation*, the person works each shift for 2 or more weeks (e.g., 2 weeks of day shifts then 2 weeks of evening shifts). A *weekly rotation* involves working, for example, 1 week of days that is followed by 1 week of night shifts. The most difficult speed of rotation is a weekly rotation, so it is best to avoid it (Knauth & Hornberger, 2003; Monk, 2000). Concerning shift rotations, some U.S. researchers suggest slow rotations that change every 2 or more weeks because they give circadian rhythms time to adjust to the new schedule (Smith & Eastman, 2012). Some European researchers recommend the opposite: fast forward rotations (Tucker & Folkard, 2012). They reason that workers spend less time on evening and night shifts, and therefore do not experience long periods of isolation from family. Also, fast rotations do not lead to a long series of workdays misaligned with the sun's light–dark cycle. However, fast rotations do not give time for the circadian rhythms to adjust, so performance may be compromised, which is a real concern in jobs in which fatigue related errors can endanger the worker and others around them.

Another characteristic of shift rotations is the *direction of rotation*, which refers to the order of shifts worked in relation to the time of day. A *forward rotation* refers to moving from day shift to evening shift and then to night shift. A *backward rotation* means moving from night shift to evening shift and then to day shift. Forward rotations (i.e., day shift to evening shift) are easier to adjust to than backward rotations (i.e., evening shift to day shift; Knauth & Hornberger, 2003).

Most people find it difficult to adjust to night work, so experts advise using, with caution, permanent or fixed night shifts (Knauth & Hornberger, 2003). Moreover, researchers recommend that workers with permanent night shifts maintain their nighttime activity pattern on their days off from work to help their circadian system adjust to being active at night and sleeping during

daylight hours (Smith & Eastman, 2012). Because of their social interests, most night workers on their time off return to a daytime activity and nighttime sleep schedule, which leads to a frequent reversal of the sleep–wake schedule that is hard on the body. If having permanent night-shift workers is essential, introduce measures that will maintain worker safety and performance from about 2:00 a.m. to 6:00 a.m. (which is the time with higher risk for sleepiness due to circadian rhythms; Wesensten, Belenky, Thorne, Kautz, & Balkin, 2004). For rotating shifts, reduce the number of consecutive night shifts scheduled to, for example, three night shifts in a row. During the evening and night, workers tolerate shorter shifts (i.e., 8 hours or less) better than longer shifts. People who work shifts that are both long and at night have the highest risks for accidents and injuries (Folkard & Lombardi, 2006).

A long series of consecutive workdays with no days off leads to fatigue, particularly when working long shifts of 12 hours or more. Experts recommend interspersing days off with workdays and avoiding scheduling many workdays together followed by 4 to 7 days off. Workers tend to tolerate five consecutive 8-hour shifts or four 10-hour shifts followed by 1 or 2 full days off. For 12-hour shifts, consider scheduling three consecutive shifts followed by 1 or 2 days off (NIOSH, Rosa, & Colligan, 1997).

Researchers discourage quick changes. Quick shift changes (e.g., an evening shift ending at 11:30 p.m. followed by a day shift beginning at 7:00 a.m. or 8:00 a.m.) give workers little time to sleep. Knauth and Hornberger (2003) recommended at least 11 hours between two work shifts. Furthermore, early start times (6:00 a.m. or earlier) tend to shorten sleep because circadian rhythms promote wakefulness a few hours before the usual bedtime (Rosa, Härtnä, Pulli, Mulder, & Näsman, 1996), thus making it difficult to go to sleep early. It is best to avoid early start time, if possible.

ELIMINATING OR REDUCING RISKS LINKED TO EXTENDED WORK SHIFTS

Extended 12-hour shifts, sometimes referred to as *compressed work schedules*, allow workers to put in more hours in fewer days and have more rest days in between: for example, three to four 12-hour shifts with 3 to 4 days off each week. Although 12-hour shift systems are sometimes favored by some workers and managers, studies comparing them with 8-hour systems showed mixed results (i.e., adverse effects, no effects, or positive effects) on sleep, alertness, safety, and health factors (Knauth, 2007). Therefore, extended shifts require special consideration for a worker's needs because of the many hours worked consecutively. Knauth and Hornberger (2003) recommended that the following conditions be met for using extended shifts:

- Work is of a type suitable for long work shifts. Extended shifts may be difficult in jobs with heavy physical demands, dangerous work, fast-paced demands, or high stress.

- Work schedules are designed to minimize the buildup of fatigue.
- Adequate arrangements are in place to cover absentees.
- Overtime is not added. Shift overruns are common in some work settings, can severely reduce the opportunity for sleep, and can lead to drowsy driving.
- Adequate recovery after work is possible.
- Exposure to toxic hazards is limited. Long work hours lengthen the time of exposure to hazards in the work environment and reduce the time to recover. Prolonged exposure to noise, heat, chemicals, and other hazards could exceed established permissible exposure limits or violate other health standards.

  Employers must implement measures to monitor and limit worker exposures to health and physical hazards in the workplace as required by the Occupational Safety and Health Act of 1970. In addition, long shifts are associated with worse sleep as compared with 8-hour shifts (Knauth, 2007) and, as a result, can lead to performance decrements, including increased risk-taking behavior, such as not using personal protective equipment and driving while drowsy (Womack, Hook, Reyna, & Ramos, 2013). Also, longer exposure to physical demands increases risk for musculoskeletal injuries (Caruso & Waters, 2008).
- Sufficient breaks are provided. Folkard and Lombardi (2006) estimated that rest breaks at 2-hour intervals rather than 4- or 6-hour intervals reduce risks for accidents and errors.

USING BREAKS DURING WORK SHIFTS TO REDUCE HEALTH AND SAFETY RISKS

In general, breaks during work shifts help reduce risks. Arlinghaus et al. (2012) showed a clear dose–response relationship between rest breaks and on-the-job injuries: Longer total time on breaks was significantly related to longer time spent on work tasks without having an injury. Lombardi et al. (2014) found that after taking breaks, workers on day shift went longer without an injury than did workers on evening and night shifts. In that study, workers on evening and night shifts had poorer sleep quality and shorter sleep duration than day-shift workers, thus potentially putting them at higher risk for fatigue, errors, and injuries. Therefore, it may be especially helpful for workers on evening and night shifts to have additional breaks or longer time on breaks.

Managers can promote brief 10- to 15-minute rest breaks every 1 hour to 2 hours during work shifts and a longer break for meals. At the beginning of the shift, managers can schedule the breaks along with the other work assignments. During the shift, they can encourage workers to take their breaks and, if necessary, create a system for other workers to cover their duties while on break.

Managers also can plan enriched breaks that include activities, such as exercise or stretching, or novel or amusing diversions. If the work is physical, a break to sit and relax would be appropriate, and for sedentary work, a break to take a walk or exercise would be helpful. Research has not revealed a pattern suggesting how long the alerting effect of a rest break lasts. Several factors influence the alerting effect: how long a person has been awake, the amount of sleep debt, the time of day (circadian effect), and the amount of time spent on a task (particularly monotonous tasks).

REDUCING THE STRAIN OF FREQUENTLY RESPONDING TO E-MAILS AND PHONE CALLS AFTER THE WORK SHIFT

Having to maintain e-mail and phone contact outside of regular work hours can reduce the time available for workers to take care of personal responsibilities and sleep, and thereby increase health and safety risks (Arlinghaus & Nachreiner, 2013). Some workers may interrupt their sleep to respond to calls or participate in meetings over the Internet at night. Workers trying to meet the requests from coworkers or customers around the world may be especially exposed to these demands.

To reduce the risks and respect workers' need to relax and sleep when off from work, managers can set a work culture and expectation that after workers complete their shift, they will not carry out work tasks. With some thought and discussion, the work group may develop another way to respond to those requests. Managers can model the appropriate times for responding to e-mails and phone calls by ending e-mails and phone calls after normal business hours.

ADDRESSING PERSONAL FACTORS THAT INCREASE FATIGUE AND SLEEPINESS AT WORK

Several personal factors can lead to problems with sleep and cause sleepiness on the job, and the associated health and safety risks. This section discusses these personal factors: sleep disorders; some chronic illnesses and medications; the necessity to wake up from sleep to help family members; the need to have second jobs; and the forgoing of adequate sleep for entertainment or other social activities or obligations.

An estimated 50 million to 70 million Americans have a sleep disorder that often is not diagnosed and treated (Colten & Altevogt, 2006). The most common disorders are insomnia, sleep-disordered breathing (which includes obstructive sleep apnea), restless-legs syndrome, and narcolepsy (Kryger, Roth, & Dement, 2016). Workers can be made aware of four common symptoms of sleep disorders that occur even when spending 7 to 9 hours in bed: (a) consistently taking more than 30 minutes to fall asleep; (b) awakening several times during sleep or for long periods; (c) having to take frequent naps; and (d) often feeling sleepy, especially at inappropriate times. It may be impossible for a worker to

get adequate sleep until the disorder is treated even if the worker is using the best coping strategies. Persons with untreated sleep disorders can expose themselves and people around them to significant safety risks on the job, at home, and while driving. Many treatment options are available to reduce these symptoms, increase alertness on the job, and improve quality of life. Managers can encourage workers with symptoms to see a sleep disorders specialist. The "Other Resources" section at the end of NIOSH et al. (2015) online training for nurses lists websites to find certified sleep clinics and sleep specialists.

Pain and respiratory symptoms from several chronic diseases are often more bothersome at night and interfere with getting good-quality sleep (Smolensky, Di Milia, Ohayon, & Philip, 2011). These diseases include asthma, arthritis, chronic obstructive pulmonary disease, chronic fatigue syndrome, and rhinitis. Workers can see their health care provider to explore options for better symptom control. Achieving better control of symptoms can also reduce sleep problems and excessive sleepiness on the job.

Sleepiness during work can be an unwanted side effect of certain commonly used medications, including narcotic pain medications, some antihistamines and antidepressants, and some medications used to treat insomnia (Smolensky et al., 2011). If a worker experiences excessive sleepiness or fatigue at work, the worker could see a health care provider to assess that person's medications for side effects. Sometimes the health care provider can adjust the dose or switch to another medication that is not sedating.

Certain personal responsibilities may cut into the time for sleep (McCurry, Song, & Martin, 2015; Mellor & Van Vorst, 2015). Workers who have to help an infant or sick family member at night or during the day may be unable to get enough sleep. Stress due to a family crisis or unstable work situation, such as pending layoffs, can lead to stress and insomnia. Long commutes can cut into time for sleep, especially for workers on long work shifts. Managers can provide counseling and perhaps adjust the work hours to help workers with these stressful but sometimes temporary situations.

Without knowledge about sleep health, some workers may cut into their time for sleep to spend time on entertainment or work at a second job. Managers can identify fatigued workers and explore the reasons they are not getting enough sleep. Managers can educate workers who lack knowledge about sleep health and reinforce the importance of getting enough good-quality sleep to arrive at work fit to carry out their job.

CREATING POLICIES, PROGRAMS, AND PRACTICES TO PROMOTE SLEEP HEALTH AND MINIMIZE FATIGUE

To reduce risks, employers can establish policies, programs, and practices that promote sleep health, minimize buildup of fatigue, and maximize recovery after work. They can target several topics: work hours, what to do when a

worker is too fatigued to work or drive home, services to maintain an alert workforce during emergencies requiring overtime, the use of naps during work breaks, fatigue risk management systems, and the workplace culture.

Policies can address work hours, such as setting limits on the number of hours worked per 24 hours and per 7-day period. The workplace can establish a minimum of 10 to 11 consecutive hours off from work per day so that workers may obtain 7 to 8 hours of sleep. Restrictions can be set on how much and when overtime can be worked. Managers can identify and modify policies that encourage excessive overtime, and they can establish flexible scheduling options and shorter shifts.

Policies can set procedures for a worker who is too fatigued to work. A policy could specify a backup staffing plan when a worker is unable to continue working. Managers can allow fatigued workers to request and take breaks without repercussions. Employers can establish procedures for meeting the workload when a worker is unable to work by, for example, reducing the amount of work or requesting new staff. Procedures can set forth a signal that team members can use to alert each other, such as the statement "I think this situation is not safe," and specify what follow-up actions to take.

Some workers may want to continue working when they are fatigued and may not recognize that their performance is poor. Managers can establish procedures when a fatigued worker insists on continuing work. For example, they can tell excessively fatigued workers to take the rest of the shift off to get sleep. See Part 1, Module 3, of NIOSH et al. (2015) for signs of fatigue.

Several studies report that shift work and long work hours increase the risk for drowsy driving crashes and near misses (Barger et al., 2005; Scott et al., 2007; Swanson, Drake, & Arnedt, 2012). Managers can institute several types of organizational strategies to reduce this risk. They can develop education campaigns to warn both workers and managers about drowsy driving, and that give strategies to improve alertness while driving. To develop education campaigns, managers can take content from the Module 11 in NIOSH et al. (2015) and the drowsy driving website (National Sleep Foundation, 2018). Procedures can help managers identify workers at risk and possible action steps, such as arranging transportation home for workers who are excessively fatigued after a work shift by calling a family member or taxi. Some worksites could consider arranging for rooms located close to the facility where tired workers can sleep instead of driving home.

Policies can protect a worker's time for sleep and recovery from work. For example, employers can have night and evening shift workers list the times they are not to be called. Managers can then restrict communications to workers during those times to avoid waking them when they need to sleep. Likewise, managers can schedule training, meetings, counseling, and social programs for night and evening workers at times that do not interfere with their time for sleep. Managers can protect days off so night and evening workers can recover.

To promote alertness on the job and reduce fatigue, employers can consider a policy and procedure for using naps during work breaks. The Standards of Practice Committee of the American Academy of Sleep Medicine recommends planned naps before and during the night shift for persons' having difficulty with shift work (Morgenthaler et al., 2007). The committee stated that naps are a generally accepted strategy to counteract work-time sleepiness and increase alertness on the job. The brain benefits from a brief period of actual sleep—a nap, not just a quiet period—to recover from fatigue and help restore alertness. A worker might take a short nap (about 15- to 30-minutes long) during rest breaks. A longer nap of 1 hr 30 min may be more useful to increase alertness when working long shifts of 12 hours or more during emergencies because the long nap will reduce the buildup of pressure for the body to fall asleep. Many U.S. workplaces, however, have cultural barriers to using naps on the job. Discussions may be needed to help managers and workers understand the benefits of using naps at work, and lift these barriers. To make use of naps, managers will set procedures for scheduling naps and waking workers from a nap (e.g., by an alarm or a designated person). In addition, managers will consider the level of staffing required to maintain the work while a worker is napping. Another critical element is creating a good napping environment near the work area. Furthermore, managers will build in time to allow for worker grogginess after wakening (i.e., sleep inertia) to pass before the worker carries out critical tasks. See Module 7 of NIOSH et al. (2015) online training for more information.

When overtime cannot be avoided, employers can consider providing services that reduce nonwork demands on workers so they can devote their time off to rest and sleep. Services that might be helpful include providing comfortable uniforms, laundry service for work clothes, and on-site child care. Managers can ask workers for input on what other services might be helpful. They also can work with food vendors to make healthy drinks and nutritious food available at the worksite. Sugar-rich foods, such as candy bars and donuts, can increase sleepiness, so managers can check that the foods offered in vending machines include high-fiber, good-fat, and protein-rich options (Anderson & Horne, 2006; Lowden et al., 2004). Employers also can establish procedures to avoid pressuring workers to work extra shifts. Longer shifts and shift work are associated with increased errors, which can adversely affect work products and services, and fatigued workers have made tragic errors that have led to deaths (*State v. Scott Robb*, 2005).

For workers on shift work and who long work hours, employers can encourage those workers to get regular health examinations because these work schedules are associated with a somewhat higher risk for cardiovascular, gastrointestinal, musculoskeletal, and psychological disorders; cancer; diabetes; and adverse reproductive outcomes (NIOSH et al., 2015). Employers and managers also can encourage workers with symptoms to see their health care provider promptly.

Good supervisor and coworker support can reduce some of the risks associated with shift work and long work hours (Pisarski, Lawrence, Bohle, & Brook, 2008), possibly because the positive atmosphere reduces job stress that leads

to poor sleep. Therefore, managers can build a good psychological work environment that has the following characteristics:

- Managers and workers always communicate in a respectful manner and are not exposed to threats, bullying, or violence.
- Managers give workers significant control in decision making, make their roles clear, minimize time pressures, and provide the resources to get their jobs done.
- Managers provide positive feedback for a job well done.

IMPLEMENTING A FATIGUE RISK MANAGEMENT SYSTEM

Managers can establish a *fatigue risk management system*, which is a comprehensive, several-part approach that is science based and data driven, and that promotes continuous improvement (for more information, see Lennan et al., 2012). Some parts of a fatigue risk management system can be integrated into existing health and safety systems, such as incident reports.

The first part is to set up fatigue management policies, such as those discussed previously. The second part involves identifying aspects of the operation that will be vulnerable to mistakes by tired workers; collecting information about fatigue in the workforce; analyzing its risk; and instituting controls to reduce the risk, such as routinely double-checking critical tasks.

The third part is to create an anonymous, no-blame reporting system to collect the following information from workers about their incidents and near misses: the time of the incident; shift details (e.g., start time, number of hours into the shift when incident occurred); number of prior consecutive work shifts and time of those shifts; number of hours awake before the incident; number of hours of sleep in each of the previous 3 days; and normal or unusual circumstances, such as overtime because of weather emergency. Analyses of several incident reports may reveal organizational factors that managers can modify to reduce risks.

The fourth part incorporates fatigue-related factors into incident investigations to determine if fatigue was a causal factor. Data to collect include information about the worker, the work schedule, and any medical conditions or medications. See Lerman et al. (2012) for two checklists and a discussion about the types of data to consider collecting.

The fifth part is to train and provide education to workers and managers so they will understand the challenges of working shift work or long work hours, and understand the resources available to help them better cope. Training should include basic information about sleep, circadian rhythms, and fatigue; good practices to improve sleep at home and alertness on the job; and sleep disorders and the importance of identifying and treating them. Managers can schedule all staff to take this training and schedule updates periodically. The training can be part of new employee orientation. See NIOSH's (2018)

work schedule topic page for links to several online training programs that are tailored for several types of workers.

The sixth part addresses sleep disorders. Workers with sleep disorders, some chronic illnesses, and certain medications may be at higher risk for work-time sleepiness and fatigue issues (Smolensky et al., 2011). Managers can encourage workers with excessive sleepiness or trouble with sleep to see their health care provider or a sleep disorders specialist for an assessment and treatment.

EDUCATING THE WORKFORCE

Lack of knowledge about sleep health is widespread across the United States (Colten & Altevogt, 2006). Sleep health is usually not taught in schools, in education and training programs for health care providers, or during health care visits, so the workplace can be a source of sleep health information. Managers can promote education and training programs and materials on topics discussed in the preceding section. The NIOSH (2018) work schedule topic page has many free resources produced by NIOSH as well as other organizations to educate workers and managers. Included are links to several online training programs and how to find a certified sleep center.

Managers and health and safety professionals can use events across the year to give short messages about sleep. For example, during the fall, health care professionals can recommend that workers make an effort to get enough good-quality sleep after receiving the flu vaccine. Several studies found that compared with participants with sleep disturbances or short sleep duration, participants who had adequate sleep after vaccination showed a higher level of antibodies that will protect them from getting the flu (Irwin, 2015). If a worker is sick with a contagious disease, managers can recommend that the worker stay home and sleep more. Getting plenty of sleep can help the person recover because sleep and the immune system work together to attack disease-causing agents. Managers also can point out to the worker that when he or she is sick, the worker will likely be more sleepy due to the disease and possibly the medications. Consequently, the worker will be at higher risk for making a mistake; therefore, it is best not to operate dangerous equipment or make critical decisions until the sleepiness has subsided.

About a week and half before the 1-hour daylight saving time changes in the fall and spring, managers can educate workers about strategies to improve their sleep and alertness, and protect themselves from the somewhat higher safety risks that occur during those weeks. The 1-hour change in time can disrupt some workers' sleep and functioning for several days. Managers can give suggestions on how to better cope with the time change. See Caruso (2016) for information that managers can share. In addition, managers can point out that others around them on the roads and at work may be having more difficulty, so workers need to be more vigilant at work, at home, and while driving.

Several other types of occasions during the year give opportunities to insert brief messages about sleep health. If the workplace holds health fairs, organizers

can invite a sleep disorders specialist to distribute information about sleep and sleep disorders. During vacation season, people sometimes drive long distances to their vacation site and back home. Managers can relay that these types of long trips are a known risk factor for drowsy driving crashes and suggest that workers plan the drive wisely to protect themselves and their passengers (National Sleep Foundation, 2018).

Health and safety professionals can develop a business case for setting up systems to promote sleep health and an alert healthy workforce. Managers can gather data on sick leave, productivity, health care and workers' compensation costs, and recruitment and retention. Also, health and safety professionals can consider other positive effects: For example, alert workers are able to interact better with their customers and the public, which possibly will have positive effects on the business's image and its public relations.

Managers and health and safety professionals can promote other good health behaviors that will improve sleep and reduce fatigue. They can encourage exercise because exercising every day can improve sleep. A poll by the National Sleep Foundation (2013) found that people who exercised vigorously tended to report the best sleep; however, walking as little as 10 minutes a day helped. If the job is sedentary, managers can encourage workers to periodically get up and walk. People who sit fewer than 8 hours a day reported better sleep. People who smoke or use tobacco products have shorter sleep and sleep that is more disturbed, so employers can encourage ending the use of tobacco products (National Heart, Lung, and Blood Institute, 2011).

CONCLUSION

Sleep health is a key factor to promote a high-functioning and healthy workforce. The design of the work schedules, the culture in the workplace, and the policies, procedures, and practices all have a critical influence on sleep health and the ability of workers to be alert on the job. Overly demanding work schedules and job stress will make it difficult for workers to get enough sleep.

Health and safety professionals and managers can use the range of strategies discussed in this chapter to make their workplace a good source of sleep health information and to set up systems at work that promote sleep health. A healthy, alert, high-functioning workforce will be in everyone's interests: the manager, worker, and consumers of the organization's goods and services.

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EDITED BY

Heidi L. Hudson, Jeannie A. S. Nigam, Steven L. Sauter, L. Casey Chosewood, Anita L. Schill, and John Howard

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PALM BEACH STATE COLLEGE
Palm Beach State College
Library Learning Resource Center
4200 Congress Avenue
Lake Worth, FL 33461

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