

Analyzing shift work sleep disorder

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A typical work week for many people consists of the traditional Monday through Friday, 9 AM to 5 PM work schedule. The majority of the industrialized world has adopted this schedule, with only a small minority of the workforce in these industrialized nations being involved in some form of shift work. Shift work is defined as a work schedule operating outside of the hours of 6 AM and 6 PM.¹

Many industries are making use of a 24-hour day with shift work schedules that optimize productivity beyond the conventional 9 AM to 5 PM daytime hours. Although the shift work system may maximize the output and efficiency of the business, the same is not necessarily true for the health and well-being of the employees. The negative ramifications of employees working a nonstandard shift can be seen with the industrial accidents at the Chernobyl and the Three Mile Island nuclear facilities.² Both of these accidents occurred in the early morning hours of the night shift.² Whether these incidents were the direct cause of human error or the result of impaired alertness from working irregular hours is not known. Nevertheless, the incidents represent extreme examples of the types of negative effects that shift work can have on safety and performance. The costs and consequences of sleepiness-related work accidents can be profound in a society driven to operate on an around-the-clock basis. This poses the following question: when does sleepiness caused by a chaotic work schedule become unacceptable for the employee, company, or society?

Defining shift work sleep disorder

Sleep disturbances are common among shift workers whose work hours are scheduled during the time that most people are normally sleeping.³ An estimated three-fourths of the shift-working population report sleep disturbances while working an alternate shift schedule.² The ability to adapt to shift work varies on an individual basis,^{3,4} with some shift workers being more susceptible to the negative effects of an erratic sleep-wake schedule than others.^{1,5} A small subset of these shift workers experience difficulty maintaining adequate sleep-wake function while working an alternate shift.⁴ Although

up to 20% of the workforce in industrialized nations is employed in shift-work occupations,⁶ only 5% to 10% of these workers experience sleep deficits significant enough to impair their alertness, physical functioning, and work performance.^{4,5,7,8} Those individuals unable to tolerate the effects of a shift work schedule are diagnosed as having shift work sleep disorder (SWSD).

According to the American Academy of Sleep Medicine's International Classification of Sleep Disorders (ICSD), the diagnosis of SWSD is based on 4 specific criteria, which are listed in Figure 1.^{5,6} Patients with SWSD often present with insomnia and excessive sleepiness despite optimal sleeping conditions and the absence of other sleep disorders.^{5,6} The insomnia (ie, increased difficulty initiating and maintaining sleep) occurs during the major sleep period, while the excessive sleepiness tends to persist during work hours.^{1,5}

In a study by Akerstedt et al,⁹ researchers found that entering shift work from day work can increase the risk of difficulties in falling asleep by as much as 73%, while leaving shift work reduces the odds of this risk (odds ratio = 2.8).³ Increased sleep fragmentation, early final awakenings, and drowsiness in the morning hours characterize the sleep disturbances of individuals with SWSD.⁵ Many shift workers have grown accustomed to feeling sleepy and may not recognize the potential impact that their sleepiness has on subsequent work performance.² The difference, therefore, between what constitutes a normal vs pathologic response to the demands of shift work, remains ill defined.

The existence of many different work schedules makes it difficult to estimate the actual prevalence of clinically significant sleep disturbances.¹⁰ Daytime sleepiness resulting from working atypical schedules is most commonly seen in relation to the night shift and early morning shifts.^{6,8,11} In a

Figure 1 Diagnostic Criteria for Shift Work Sleep Disorder

- 1) There is a complaint of insomnia or excessive sleepiness that is temporally associated with a recurring work schedule that overlaps the usual time for sleep.
- 2) The symptoms are associated with the shift work schedule over the course of at least 1 month.
- 3) Sleep log or actigraphy monitoring (with sleep diaries) for at least 7 days demonstrate disturbed circadian and sleep-time misalignment.
- 4) The sleep disturbance is not better explained by another current sleep disorder, medical or neurological disorder, mental disorder, medication use, or substance use disorder.

Figure 1. International Classification of Diseases 9th Revision Clinical Modification, diagnosis code 327.36: circadian rhythm sleep disorder, shift-work type.^{5,6}

review of circadian rhythm sleep disorders, Sack et al¹⁰ determined that a formal diagnosis of SWSD based on ICSD-2 criteria had rarely been used in previous research studies on the topic of shift work. The lack of population-based data based on the ICSD-2 diagnostic criteria makes it difficult to draw definitive conclusions about the characteristic features of SWSD and its associated consequences.^{4,10} Drake and colleagues⁴ estimated that only 10% of

night shift and rotating shift workers in a metropolitan Detroit population had either insomnia or excessive sleepiness that met the ICSD-2 diagnostic criteria for SWSD. Therefore, the true prevalence of this disorder at the present time is unclear, mainly because the percentage of shift workers who seek medical attention for sleep disturbances that adversely impair alertness and work performance is unknown.¹²

Epidemiology

In the May 2004 Current Population Survey, the U.S. Census Bureau conducted a “Work Schedules and Work at Home” supplemental survey to assess the proportion of people that worked nontraditional shifts.¹³ The Current Population Survey is a monthly household survey conducted by the U.S. Census Bureau for the Bureau of Labor Statistics to gather information on national employment and unemployment.²⁰ The May 2004 supplement included questions on flexible work schedules, shift work, reasons for working particular shifts, and the beginning and ending hours of work.²⁰ According to this survey, 14.8% of full-time U.S. wage and salary workers worked an alternate shift outside of the standard 6 AM to 6 PM daytime work hours.¹⁴ This percentage was slightly lower than the 18% of U.S. workers reported as working alternate shifts in May 1991.

In the May 2004 survey, the most prevalent shift was the evening shift, which represented 4.7% of U.S. workers. This percentage was followed by 3.2% of workers on the night shift and 3.1% of workers on employer-arranged irregular schedules. The remaining 2.5% of workers had rotating shift schedules.¹⁴ In terms of gender, more men (16.7%) worked alternate shifts than women (12.4%).¹⁴ Among ethnic groups surveyed, more African Americans were shift workers than were whites, Hispanics or Latinos, or Asians.¹³

Which industries are most affected by shift work sleep disorder? The nature and demands of any industry are key factors in determining whether a particular job requires a shift work schedule. Industries that rely on shift work to improve the efficiency of the production process or to provide services that cannot be confined to the standard 6 AM to 6 PM business hours are impacted most.¹³ Nighttime shifts are more common in the service occupations, which tend to operate around the clock. The protective services—mainly police officers, firefighters, and security guards—represent the occupations with the highest prevalence of shift work, with 50.6% of those workers on an alternate shift.¹⁴ The next most prevalent line of shift work was the food preparation and serving occupations (40.4%), followed by the transportation and long-haul trucking, public utilities, and manufacturing industries (26.2%).¹⁴

The decision to work an alternate shift usually varies on an individual basis. Of those surveyed in May 2004, more than half of the full-time U.S. workers on an alternate shift schedule cited the “nature of the job” as the main reason for working such schedules.¹⁴ For example, jobs in manufacturing and the protective services that

operate on atypical work schedules force potential employees to choose between working an alternate shift or not working at all.¹³

Among workers who chose shift work out of personal preference, as reported in the May 2004 survey, many did so because they wanted a quieter shift with less supervision.¹⁴ Some individuals opted for shift work to obtain better pay, to accommodate familial or childcare obligations, or because no other job was available.²⁰

Among part-time shift workers, the chief reason given for choosing a nonstandard shift was to allow more time for school.¹³ In summary, most workers do not seek out shift work as their first job choice.^{13,14} Rather, the majority of those who work nonstandard schedules do so primarily because it is required of the job.¹⁴

Types of shift work

There is no ideal shift, among shift work schedules, in terms of reducing the impact on sleep. Each type of nonstandard shift will alter sleep and sleep habits in different ways. The variability in sleepiness experienced by shift workers is directly related to the duration and quality of sleep obtained before the last shift.⁴ Certain shift work

Table 1
Shift Work of U.S. Full-Time Wage and Salary Workers by Race, May 1991 and May 2004

Race/Ethnicity	Working an Alternate Shift, %	
	May 1991	May 2004
Asian	Not available	15.7
Black/African American	23.3	20.8
Hispanic/ Latino	19.2	16.0
White	17.2	13.7

Table 1. Adapted from Workers on Flexible and Shift Schedules in May 2004. United States Department of Labor, Bureau of Labor Statistics.¹⁴



schedules, such as the afternoon and evening shifts, generally allow more time for sleep than other schedules.¹⁵ Sleep disturbances are most apparent on review of the following 3 work schedules: night shift, evening shift, and rotating shifts.

Night Shift

A typical night shift begins around 9 PM and ends at 8 AM. Night shift workers sleep during the day, at a time when most other people are awake. Daytime sleep tends to be shorter, about 5 to 6 hours in total duration, and lighter than nighttime sleep because of outside environmental noise that makes it difficult to initiate and maintain sleep.⁷ It has been estimated that permanent night shift workers sleep 1 to 4 hours less than daytime workers.⁸

Changes in sleep architecture documented on electroencephalograms during daytime sleep have shown that most of the sleep loss involves a decrease in stage 2 and rapid eye movement (REM) sleep, with no effect on stage 3 or slow-wave sleep.¹⁵ Night shift workers often take late afternoon or early evening naps to combat the effects of inadequate sleep.¹ The end result is insufficient sleep during the daytime to overcome the nighttime sleepiness and fatigue endured on the next shift. The effects of sleep loss accumulate over time, and the impairments that are caused do not improve over a series of successive night shifts.^{2,15} The resulting sleep debt experienced by night workers is greater than that of daytime, evening, or rotating shift workers.⁵

Evening shift

Commonly referred to as the “second shift,” the evening shift generally starts at 2 PM and ends at 12 AM. As a result of arriving home late, the bed-times of these workers tend to be delayed. These workers spend more time in bed and report a greater total amount of sleep compared to individuals who work regular daytime shifts.⁴ In addition, napping is less common amongst this shift work population given that morning wake-up times occur later in the day.¹⁵

Previous research has shown that evening workers obtain approximately 7.6 hours of sleep per day compared to the 6.8 hours obtained by those on daytime work schedules.⁴ Workers on the evening shift obtain the most sleep of all alternate shift workers and are least likely to experience a sleep debt.⁴

Rotating shift

Workers on rotating shift schedules sleep the least of all alternate shift workers. With shifts that are constantly changing, rotating shift workers never experience a set work schedule and often find it difficult to get adequate rest.

Two crucial factors affect the ability of a worker to adapt to a rotating shift—the speed and the direction of the rotation.¹⁵ Speed refers to the number of day, evening, or night shifts that are worked consecutively before a scheduled shift change takes place.² Fast rotations, in which shifts change every few days, result in a greater loss of sleep and prevent workers from acclimating to set work times.⁷ Rapid rotations are also associated with a reduction in total sleep time.^{2,5} Work hours on longer rotations that change every 3 to 4 weeks provide more time for workers to adapt to a particular work schedule.⁷ The direction of a rotation can be either forward or backward. Forward rotations operate in a clockwise

manner, with workers changing from day to evening to night shift. Backward rotations run counterclockwise, with shifts alternating from day to night to evening.²

In an effort to adapt to this counterclockwise schedule, workers try to go to bed earlier and earlier, which leave them very little free time to fulfill social and familial obligations. The timing of the shift changeover represents another area of concern, as a quick shift changeover may result in only 8 hours in between shifts, further curtailing the opportunity to sleep and the subsequent total duration of sleep.¹⁵

Pathophysiology

Misalignment between the endogenous circadian rhythm and the external 24-hour environment forms the basis for SWSD.¹⁶ The circadian rhythm functions to promote wakefulness during the day and the consolidation of sleep during the night.³ For shift workers, the main sleep period occurs during the day. Thus, an individual who works the night shift is doing so when his or her circadian rhythm is promoting sleep and sleeps when the circadian rhythm is promoting wakefulness.¹⁷

The inability to align the endogenous circadian rhythm with the sleep-wake schedule demanded of the occupation can result in insomnia, disturbed sleep, and fatigue as shift workers continually attempt to sleep when the circadian propensity for sleeping is low.^{3,16} This can eventually lead to sleep deprivation if daytime sleep over a series of shifts is fragmented.^{5,15} The homeostatic drive, which is responsible for the increased tendency to fall asleep the longer an individual is awake, increases as a consequence of the lack of sleep achieved earlier in the daytime. This makes a person feel more tired and drowsy over the course of the night, with the greatest sleepiness occurring in the early morning

hours.⁵ Symptoms of excessive sleepiness and insomnia can persist as long as the shift work and abnormal sleep-wake patterns persist.

The job-driven schedule of the shift worker also can affect the exposure to environmental time cues that entrain the circadian clock to the 24-hour day.⁵ Time cues, such as natural sunlight, are out of phase with the shift worker's altered sleep-wake times.¹⁸ The effect of light on the circadian rhythm partially depends on the time of exposure. Light exposure in the early morning hours can advance the circadian rhythm or move the circadian clock to an earlier time, while exposure to light earlier in the night can delay the circadian rhythm and move it to a later time.⁸

The adjustment of the circadian rhythm to several consecutive days of night work is countered by a light pattern in opposition to the nighttime work hours.¹⁵ The inability to limit light exposure to appropriate times of the day explains why most shift workers show very marginal adjustments to the shifted sleep-wake schedule caused by their specific work shifts.⁴

Risk factors

There are individual differences in the susceptibility to the adverse effects of shift work. Previous research has shown that shift workers on the same schedule will differ in the degree of sleepiness and insomnia experienced.⁴ An individual's inherent vulnerability to the sleep-wake disturbances caused by an irregular work schedule is influenced by several predisposing factors that increase the risk for the development of SWSD.

Age is an important predictor of shift work intolerance.⁵ Older shift workers, compared to their younger counterparts, are less likely to adapt to abrupt changes in shifts and take more time to physically recover after working several days on the night shift.¹⁸ In

addition, "morning-type" individuals, who awaken in the early morning and go to bed in the early evening, as well as those with rigid sleep patterns adjust poorly to shift work secondary to the inability to delay their circadian sleep-wake rhythm.¹⁵ After a night shift, morning-type individuals generally obtain less total daytime sleep.⁶ The timing of morning light exposure also plays a key role in circadian adaptation to shift work.¹¹

Daylight exposure in the early morning hours, whether during the commute home from work or while running morning errands, can inhibit the resetting of the circadian rhythm to match the daytime sleep schedules of night workers.¹⁰ Furthermore, the type and duration of the shift may impair a worker's ability to adjust to a non-daytime schedule. Rapid rotations and counterclockwise rotations are less-tolerated work shifts due to their adverse impacts on the quality, duration, and total amount of sleep.^{5,7} The presence of co-morbid sleep disorders and psychiatric conditions may exacerbate the sleep disturbances experienced on atypical work schedules and worsen the severity of SWSD.^{6,11}

Women are more likely than men to experience the adverse effects of shift work. Female shift workers have the tendency to sleep less and feel more drowsy and fatigued than their male counterparts.¹⁸ This tendency may be explained by the fact that most household tasks and familial duties tend to be the responsibility of the woman.

For a woman employed in a shift work occupation, the time available to sleep after the shift is affected by the time that must be allotted to domestic and childcare duties.¹¹ This is especially problematic in single parent households in which the familial responsibilities cannot be equally divided between 2 people.

Clinical evaluation

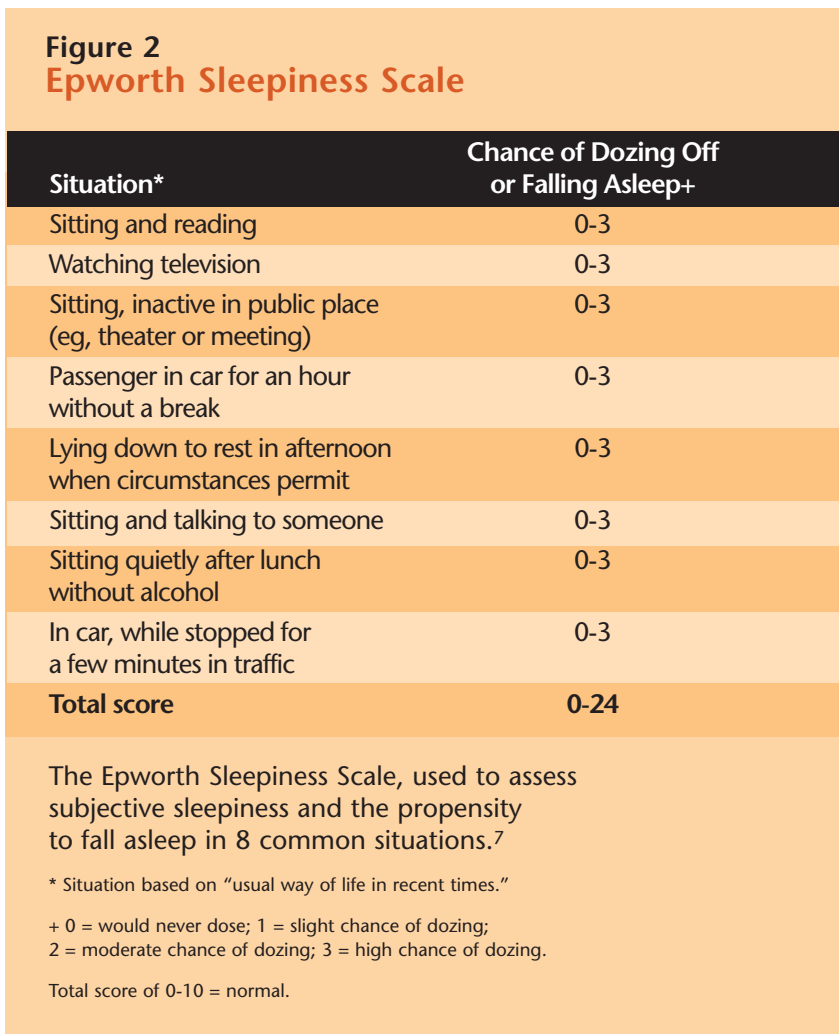
A comprehensive approach to the clinical assessment of SWSD is required to understand how several complex factors such as sleep-wake cycle disturbances and social obligations interact to perpetuate this disorder. The diagnosis of SWSD depends on establishing the relationship between patients' sleep problems and their work schedule.

The sleepiness experienced by the shift worker with SWSD can be directly related to his or her work schedule and is not a sleep disorder of excessive sleepiness that is always present.² Studies have shown that the sleepiness of SWSD improves substantially after a patient leaves a shift work schedule.³ A key component of the diagnosis of this condition is a detailed history that focuses on the sleep and work schedules of the patient. In many cases, history alone can be diagnostic of the disorder.

Most patients with SWSD present with persistent complaints of poor sleep quality or unrefreshing sleep.^{3,8} In taking a sleep history, it is necessary to obtain information regarding the extent of the sleep disturbance. Crucial aspects of this history include the frequency of disrupted sleep, the number of interruptions affecting the major sleep period, and the amount of sleep achieved in a 24-hour period.¹⁹

Given that sleep is often curtailed by 1 to 4 hours in the shift worker compared to the daytime worker,⁸ an estimation of the total sleep time will provide further insight into the sleep debt incurred by the shift worker.⁴ Seven to 8 hours of sleep is needed daily to optimally function, so any decrease in the total sleep time can inadvertently lead to a sleep-deprived individual who is less alert and has difficulties staying awake in circumstances that require full attention to detail.⁵

The degree of sleepiness experienced by a patient must be carefully addressed. The Epworth Sleepiness



Scale (ESS), shown in Figure 2, is based on a standardized questionnaire that assesses subjective sleepiness and the propensity to fall asleep in 8 common situations.⁷ A score of 10 or higher indicates clinically significant sleepiness.⁵

Environmental time constraints and job-specific factors are relevant to the patient's sleep history because both have the potential to impact sleep and exacerbate sleep disturbances.¹⁹ Everyday domestic duties—such as after-school activities, meals with family, and various appointments—can impinge on the time available for a shift worker to sleep. As a result, sleep is sacrificed for the sake of daily routine activities. The excessive sleepiness resulting from this sacrifice can interfere

with the ability to fulfill these obligations. The work history should reflect specific components of the job-driven schedule that affect the patient's sleep quality and duration, including the type of shift work, the length of the shift, the amount of time off between shifts, and the number of successive shifts worked before a day off, especially if the patient is assigned to a rotating shift schedule.¹⁵

Other essential parts of the work history include any overtime worked, the regularity and predictability of the work schedule, the ability to rest during work breaks, and whether the individual works a second job. Sleep quality during days off may be the most important factor in maintaining the

overall well-being of the shift worker. Health issues such as the patient's eating habits and timing relative to sleep, daily exercise, and nicotine use should be addressed in the evaluation. A thorough physical examination for obesity and other cardiovascular, gastrointestinal, or psychological manifestations of SWSD is also important in the work-up of this disorder.⁵

Shift workers who have a sleep disorder independent of their occupation must be distinguished from those in whom shift work is the underlying factor responsible for their sleep disturbance.⁴ To effectively diagnose SWSD, it is essential to rule out other primary sleep disorders that present with excessive sleepiness, such as obstructive sleep apnea or narcolepsy. A thorough sleep history can reveal whether environmental disturbances, such as outdoor noise or social and familial obligations, are contributing to behaviorally-induced insufficient sleep.⁶ In addition, coexisting medical and psychiatric conditions need to be excluded.¹⁸

Psychiatric conditions—namely, anxiety and depression—may mimic and intensify symptoms of insomnia and excessive sleepiness while further impinging on the amount of restorative sleep obtained. Substance abuse must also be taken into consideration. Drug and alcohol addiction may arise as individuals attempt to self-treat the stress of sleep disturbances and hide the emotional strain of missed social interactions caused by the restraints of a shift work schedule.⁶

There is no formal screening process for the identification of sleep disorders in the workplace.¹⁷ The practice parameters for the assessment of SWSD were developed in 2007 by the American Academy of Sleep Medicine to guide the diagnostic process.¹² In addition to a thorough sleep history, the use of sleep



logs and actigraphy are indicated for patients suspected of having SWSD to document and confirm the temporal pattern of sleep disturbance associated with the atypical work shift.^{1,5} Sleep logs or diaries are subjective records of a patient's sleep-wake pattern over a 1-week period. Patients are expected to record daily bedtimes, wake times, and time spent napping. Caffeine consumption, bedtime activities, and the use of any sleep-aid medications can also be charted.⁷

On review of a patient's sleep log, it is possible for the physician to discern discrepancies in the regularity, duration, and timing of the major sleep periods—both during the work week and on days off.⁵ Although there is no “standardized” sleep diary, these logs are important in establishing a disrupted sleep-wake cycle and the degree of sleep limitation caused by the shift work schedule.^{1,10} Ideally, the logs should be

completed before the patient's initial medical evaluation.¹⁹

Data from sleep logs can be supplemented by data from an actigraph unit. An actigraph is a wrist-worn device that records arm movement or activity over an extended period of time.¹⁹ Sleep-wake patterns are interpreted based on the pattern of wrist movement over a 24-hour period, with the absence of any movement representing periods of sleep.⁷ With the use of computer software, the actigraph results are translated into a display of activity vs time, from which the total sleep time and wake time can be estimated.^{7,19}

Actigraphy is most useful in assessing sleep duration, including the lengths of any supplemental naps.¹⁷ The objective sleep-wake data recorded by the actigraph can then be compared to the sleep logs maintained by the patient. Agreement with the sleep logs enables the correct interpretation of the actigraphic data.²⁰

Polysomnography is not routinely indicated in the clinical evaluation of SWSD.¹² Much of the research on shift work involves sleep-wake data collected over several weeks and months, making polysomnography impractical for field studies on sleep and subsequent performance in shift workers.¹⁴ When the etiology of the sleep disturbance remains unclear or if the history suggests a co-morbid sleep disorder, such as sleep apnea, then polysomnography can be used to exclude other potential causes of excessive sleepiness.³

If polysomnography is performed, the study should occur during the shift work sleep schedule to which the patient is accustomed.⁶ Polysomnographic findings in shift workers typically demonstrate prolonged sleep onset, decreased total sleep time, and fragmented sleep, with repeated arousals and awakenings.⁶

There is currently insufficient evidence to recommend the use of circadian phase markers in the standard assessment of SWSD.¹⁶ Dim-light melatonin onset (DLMO), which occurs 2 to 3 hours before typical bedtime, and the minimum of the core body temperature, occurring 2 to 3 hours before awakening from nocturnal sleep, are 2 markers to use in determining the misalignment of the circadian rhythm with habitual sleep time.⁶

Studies of DLMO have yielded inconsistent results regarding circadian adaptation among shift workers,¹² and limited data on circadian phase shifting exists for core body temperature minimum (CBTmin).⁷ Furthermore, to our knowledge the diagnostic accuracy of these markers for routine use and clinical application has not been evaluated in formal clinical trials.¹² Therefore, their use remains impractical.

Information gained from the use of the recommended practice parameters is helpful in determining whether the impact of shift work on an individual's health and well-being, familial situation, and workplace safety is significant. If so, recommending removal from this type of work schedule may be warranted. A clinician must weigh the intensity of the sleepiness and fatigue against the level of alertness required for the job. In circumstances in which excessive sleepiness poses a risk to job performance or to personal and public safety, early clinical intervention is necessary. If appropriate or feasible, the idea of returning to a daytime job should be addressed with the patient.⁵

Short-term and long-term consequences

The medical and social impacts of the sleep debt associated with the abnormal sleep-wake patterns of a shift work schedule have consequences that cannot be overlooked or underestimated. In contrast to daytime workers, the majority of shift workers experience sleepiness in direct relation to their irregular work hours.⁵ The primary consequences of the resulting sleep deprivation are incremental decreases in individual alertness, cognition, and reaction time.²

As sleep-deprived workers continue to perform routine work tasks while fighting the biologic drive for sleep, they may fail to recognize the warning signs of fatigue, which can have grave consequences.² The theta-wave activity characteristic of stage 1 sleep has been documented in several electroencephalography studies of truck drivers and power station operators working the night shift.² Study participants were aware of their sleepiness but were unaware of having momentarily fallen asleep.² These brief sleep intrusions substantially impair psychomotor performance and manual dexterity and



increase both the risk and incidence of errors, injuries, and accidents.¹⁷

Higher injury rates have been noted on the job during the late night and early morning hours, with the risk of injury being the greatest on the night shift.¹⁷ This risk increases not only on the night shift, but also over the number of successive nights worked, as well.⁵

In addition, the more complex the workload is in terms of task intensity, duration, and attention to detail, the greater the decline in performance and productivity as sleep-deprived workers spend more time to complete individual tasks.¹⁹ Safety is further jeopardized during the commute home, with shift workers being at an increased risk for motor vehicle accidents, especially after the night shift.⁵

The disruption to familial, social, and personal life represents a major area of concern for individuals with SWSD. A shift work schedule interferes with activities occurring during the day, such as child care and team sports. With most shift workers sleeping during the day, they tend to miss out on important family activities and social gatherings or are often too tired to attend.⁵

Some shift workers would rather sacrifice sleep to spend valuable time with family and friends than deal with the guilt of missing familial interactions or the stress of failing to accomplish necessary errands, chores, or other domestic responsibilities.⁵ The attempt to find balance between work and personal time often conflicts with the opportunity to sleep, further exacerbating the chronic sleepiness and sleep deprivation endured by the shift worker.⁵ This ultimately has a negative impact on an individual's quality of life.⁵

Those with SWSD exhibit higher rates of absenteeism from work, reduced work satisfaction, depression, and irritability compared to other workers.^{5,10} They may also experience social isolation and marital disconnect,



as well as lower morale and decreased overall well-being.^{4,5} Higher divorce rates have been noted in shift workers, and greater behavioral problems and school performance difficulties have been reported in their children.⁵ In attempts to manage sleep disturbances on their own, shift workers may develop maladaptive behaviors, such as drug and alcohol dependency, to counter the effects of sleep deprivation.⁶

The job-related and social demands that affect the sleep schedules of shift workers have been linked to several health problems. In a study of more than 25,000 full-time workers, obesity, high triglyceride levels, and low high-density lipoprotein levels were among the metabolic consequences that were more prevalent in shift workers than in daytime workers.¹³ In addition, increased risks of cardiovascular disease, impaired glucose metabolism, and miscarriage have been associated with shift work.¹¹ Greater gastrointestinal

disturbances, like peptic ulcers, diarrhea, and constipation, have also been reported in shift workers.³

Although these co-morbidities do not necessarily occur in all individuals with SWSD, they do illustrate how multiple factors contribute to the perpetuation of the sleep disturbances. The excessive sleepiness and insomnia characterizing SWSD persist as long as the shift work continues, and the tendency for workers to revert to a daytime schedule on days off and during vacations is counter-productive to their overall physical and mental health.¹⁸

Future considerations

To achieve optimal performance at work, an individual must maintain a high level of alertness to function efficiently and productively. If workers perform poorly due to lack of sleep, the likelihood of making errors leading to injuries and accidents rises substantially.^{5,17}

With many service and industrial occupations operating around the clock, it is unlikely that shift work schedules will disappear from the work place. Thus, efforts to minimize the short-term and long-term adverse effects of shift work are of great importance. An individualized approach to the care of patients with SWSD is key to facilitating the realignment of the circadian clock with the worker's sleep-wake schedule. This realignment is crucial to improving the symptoms of sleepiness and fatigue.

With the use of alternate shifts being determined by the demands of the job industry, employers must assume responsibility for safeguarding the well-being of the employees assigned to shift work. Through a collaborative effort between employer and employee, a work schedule that incorporates several short breaks into the shift, fewer successive shift changes, and shorter shift lengths may be developed and implemented. Such changes could potentially minimize sleep deficits and preserve the sleep quality and sleep duration of shift workers.³

The role of the physician is crucial, as well. Correctly diagnosing SWSD according to the formal ICSD-2 criteria not only benefits patients but draws attention to the prevalence of this disorder and highlights the pathologic response associated with the stress of irregular sleep schedules. Accurate diagnoses will also aid in future research on the reliability of current practice parameters.

With our 24-hour society continuing to expand and develop, more positions in the job market will likely open for the hire of new shift workers. As additional occupations extend their hours to accommodate the schedules of evening, nighttime, and rotating shift workers, physicians are likely to see more patients presenting with SWSD. The main challenge will be to

recognize and treat this disorder in a society geared toward around-the-clock production and services.

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