

S0022-3999(99)00073-2

## EDITORIAL

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# CONSIDERATIONS AND POSSIBLE CONSEQUENCES OF SHIFT WORK

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Shift work can be defined as a work schedule where at least 50% of work is required to be done outside of the hours of 8:00 A.M. to 5:00 P.M. [1], which engages approximately 25% of the work force in many Western societies [2, 3]. Working outside the “normal” hours either by extended days or shift rotation has a historical background and has increased since the invention of electricity and the industrial revolution. It is an ubiquitous feature of present-day working, social, and family life.

Shift work involves professionals in emergency health care, public safety (law enforcement, fire), transportation (aviation, rail, etc.), night service workers (restaurants, shopping, entertainment, etc.), military operations personnel, and many industrial plant employees. Apart from providing and maintaining the obvious demands of industrial growth, shift work also improves employment opportunities and income, facilitates flexibility for couples *vis-à-vis* childcare and domestic life, satisfies individual preferences due to variations in lifestyle, and is often associated with a relaxed hierarchy in the workplace and may ameliorate time pressures. Family advantages are sometimes perceived but individual preference is often a major motivating factor [4].

Many view shift work as driving society to overcome the challenges of the need for constant growth and prosperity. However, the diverse, complex, and profound implications of shift work have been only relatively recently acknowledged. The need for better strategies in shift-work design and management of this complex biopsychosocial phenomenon is increasingly appreciated.

The shift worker’s inability to adapt to shift-work schedules can lead to loss or impairment of physical, psychological, and social well being with impact on physiologic rhythms, sleep patterns, health, social interactions, family life, job performance, and safety [5]. The possible factors that contribute to relative or absolute intolerance of shift work schedules are complex and interrelated and include host variables, among them innate circadian rhythms and social and environmental variables including type and duration of shift and work [6]. People of certain personality types or those having certain circadian patterns may be more suited to shift work than

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others [5]. Even a seemingly simple factor such as travel time to and from the workplace has an effect on shift-work tolerance. Age is a further important factor [7].

Circadian regulation and brain restitution (by sleep) are among the crucial factors by which the interindividual variability to tolerance to shift work occurs [8]. On the other hand, shift workers can use different coping mechanisms by trying to schedule their lives, and especially their sleeping habits, to function at unusual hours [8]. Current conceptual models propose that the impact of shift work increases with exposure; that is, at some point, the worker is said to reach a tolerance limit beyond which shift work is no longer safe [9].

The most direct and consistent effect of carrying out shift work is the impairment of the quality and quantity of sleep at unusual hours during workdays and non-workdays, and this sleep debt appears to have a cumulative effect on the individual's tolerance [10, 11]. The factors affecting sleep variables may include circadian tendency to wakefulness, hunger, increased urine output, and some environmental influences such as noise, light, and social/domestic factors such as child care, family harmony, carrying out chores/errands, social/educational activities, and switching shifts and unpredictability of the shift schedule [10].

Circadian desynchronization may occur with rapidly rotating shift schedules, rapid time-zone changes, or unorganized sleep-wake cycles [12], which displaces sleep to the rising phase of the circadian rhythm. Similarly, if wakefulness is displaced to the circadian trough, where the sleep-promoting properties of the circadian rhythm are at their maximum, decreased vigilance and psychomotor performance, increased fatigue, and errors during a biological low time will occur [13].

Adverse effects of shift work can manifest themselves in the short term as sleep disturbances, shift-lag syndrome, fatigue, errors, accidents, and psychosomatic troubles [14]. In the long term, there is an increased risk for chronic fatigue, gastrointestinal problems, depression, and cardiovascular diseases [14, 15]. Older workers seem less able to adjust to shift work due to cumulative effect of sleep debt and gradual circadian desynchronization [9, 15, 16], and female shift workers may find that there is an impact on menstrual cycles [14].

The impact of shift-work disorders is often ignored by the individual or society in terms of its clinical and socioeconomic ramifications. This leads to underappreciation and undertreatment of the symptoms, thus making these disorders a serious health concern [17]. Also, there are no legal restrictions on shift work in North America [18]. However, the hidden cost of treating sleep-wake disorders, accidental injuries (on and off the job), increased number of sick days, and decreased work productivity warrants proper investigations to provide information and recommendations for shift workers to effectively manage a lifestyle that incorporates their variable work-rest routine.

Three main factors influence the ability to predict adjustment to shift work: rigidity/flexibility of sleeping habits; ability/inability to overcome drowsiness and morningness/eveningness; or individual traits of circadian rhythms or phase positions [15, 19]. A high interindividual variability has been recorded in both short-term adjustment and long-term tolerance to shift work. Often, management and/or medical staff view employee complaints of shift-work intolerance with skepticism [20]. The phenomenon of biological intolerance is real and it has only been during the past decade that shift-work intolerance has been demonstrated to have a chronobiologic basis. It seems that persons who possess a weak circadian time structure, or low-

amplitude bioperiodicities, are more prone to shift-work intolerance, and those endowed with strong or high-amplitude time structure are least prone to shift-work intolerance [20].

Impediments or limitations to management of shift-work disorder may include lack of awareness and education among shift workers and others involved in scheduling shift work, inappropriate sleep hygiene and self-treatment, and an unsympathetic legislative environment to provide mandatory worker education on shift work. There is a lack of awareness of sleep and circadian disorders among general physicians. Comorbid conditions, like obesity, depression, medical illnesses, and underlying sleep disorders, are important in shift-work management. There is a significant role for sleep medicine specialists and psychiatrists to play in the arena of advocacy for patients who are shift workers.

Shift workers differ from day workers in symptomatology and health claims in: feelings of support from management, friends, and family; safety attitudes and practices; meal habits; and alcohol and tobacco use [20]. The purpose of education in this field is to decrease physiological, psychological, and social implications related to shift work and ultimately to improve individual tolerance. Intervention strategies for promoting healthy shift work has begun in four major areas: work schedule design; napping; natural biological therapies; and drugs [7, 22–24]. Workers' education on sleep hygiene, stress management, physical activity, ambient temperature, nutrition, and individual behaviors are also of recent research interest [7, 24].

A "tailor-made" shift system utilizing circadian principles should be a compromise between the employer's goals, the wishes of the employees, and ergonomic recommendations for the design of the shift systems, which may not correspond with the traditional ones [25]. If a high acceptance of a new shift system is to be reached, a participatory process of design and implementation is as important as the characteristics of the new shift system itself. Carefully planned naps at appropriate times and duration can also help shift workers maintain normal rhythms. Natural biological therapies include sleep restriction, chronotherapy, and light therapy [26]. Sleep restriction promotes sleep within a set timeframe. Chronotherapy aims at resetting the biological clock by delaying or advancing the sleep time without deprivation, and artificial light therapy resynchronizes the biological clock by sleep-phase delay or advance. Melatonin is a mild sleep-inducing hormone and a potent chronobiotic, which is secreted during darkness and can be used to alter the sleep phase [27].

Although further investigation is required to improve our current understanding of shift work, we now have a knowledge base on which to validate the broad-spectrum socioeconomic implications of shift work and to encourage all concerned parties to meet and overcome the challenges of shift work by revising recruitment policy of shift workers, providing continuing education for better coping strategies, regular check-up for shift-work intolerance, and finally facilitating recovery from any clinical adversity directly or indirectly caused by shift work [28].

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