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# Reducing Risks to Women Linked to Shift Work, Long Work Hours, and Related Workplace Sleep and Fatigue Issues

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## Abstract

In the United States, an estimated 12% to 28% of working women are on shift work schedules, and 12% work more than 48 hours per week. Shift work and long work hours are associated with many health and safety risks, including obesity, injuries, and negative reproductive outcomes. Over time, the worker is at risk for developing a wide range of chronic diseases. These work schedules can also strain personal relationships, owing to fatigue and poor mood from sleep deprivation and reduced quality time to spend with family and friends. Worker errors from fatigue can lead to reduced quality of goods and services, negatively impacting the employer. In addition, mistakes by fatigued workers can have far-reaching negative effects on the community, ranging from medical care errors to motor vehicle crashes and industrial disasters that endanger others. To reduce the many risks that are linked to these demanding work hours, the National Institute for Occupational Safety and Health (NIOSH) conducts research, develops guidance and authoritative recommendations, and translates and disseminates scientific information to protect workers, their families, employers, and the community. The key message to reduce these risks is making sleep a priority in the employer's systems for organizing work and in the worker's personal life. The NIOSH website has freely available online training programs with suggestions for workers and their managers to help them better cope with this workplace hazard.


## Introduction

Shift work and long working hours are common in the United States and are recognized hazards that can lead to a wide range of health and safety risks. An estimated 12% to 28% of US women workers are on shift work schedules.[1,2] Shift work refers to work hours outside of the 7:00 a.m. to 6:00 p.m. time period. Shift work is often dictated by society's need for vital services around the clock in public safety, healthcare, utilities, food services, manufacturing, and transportation. Some of these types of jobs are female-dominated, especially in healthcare, which is 80% women.[3] In addition to shift work, many women work long hours. The National Health Interview Survey (NHIS) data from 2010 suggests that over 12% of US working women worked 48 hours or more per week.[2] Other factors that increase risk for sleepiness and fatigue at work are sleep disorders, some medications, and some chronic health problems. The purpose of this article is to give an overview of the risks that are associated with shift work, long work hours, and related workplace fatigue issues and to describe activities by the National Institute for Occupational Safety and Health (NIOSH) to reduce these risks to women and others around them.

## Growing Number of Working Women Reporting Insufficient Sleep

Sleep experts recommend that adults sleep 7 or more hours a day on a regular basis.[4] Although science does not have the full answer about why we sleep, evidence is mounting that critical functions connected with maintaining health and life occur during sleep.[5] Healthy sleep is linked to feelings of wellness, good mental health and body weight, safety, and preventing infections and the development of many types of chronic illnesses. Insufficient sleep, on the other hand, is associated with a broad range of health and safety risks, including premature death, obesity, vehicle crashes, worker errors, and various chronic diseases, including heart disease, diabetes, and cancer.

According to NHIS data between 2004 and 2007, almost 29% of US working women reported sleeping 6 or fewer hours per day.[6] This is an increase from 1985 and 1990, when 24% of working men and women reported short sleep duration. Some types of workers show higher rates of short sleep duration, including 47% of women who usually worked at night.[7]

This trend toward shorter sleep duration could be owing to several factors. Demanding shift work and long hour schedules

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can lead to difficulties with sleep because of the need to sleep at irregular times and at times that are out of phase with normal circadian rhythms. Human physiology strongly drives humans to sleep at night and be active during the daytime. Working at night or at irregular hours, therefore, can cause misalignment of sleep with circadian rhythms, which leads to trouble falling asleep, more arousals during sleep, and early awakenings. In addition, not having enough time off between work shifts does not allow sufficient time to get the 7 to 8 hours of sleep most adults need every day.[4]

Difficult work schedules could be a result of economic pressures that push some women to work second jobs, extra shifts, longer hours, or take on jobs that require a long commute. Women with responsibilities outside the job, such as childcare and caring for an elderly relative, could find it difficult to arrange enough time to rest and recover between shifts. Other domestic chores also take time away from time for sleep.

Women workers and their managers may lack knowledge about the importance of sleep because the topic is rarely covered in their education programs or during healthcare visits.[8] Without this knowledge, women may mistakenly curtail their sleep to fit other activities into their schedules. Managers may unknowingly design work schedules that make it impossible for their workers to get adequate sleep.

### Additional Factors that Can Lead to Sleepiness on the Job

An estimated 50 to 70 million Americans have chronic sleep disorders or intermittent sleep problems, but these are often not recognized, diagnosed, and treated.[8] The most common disorders are insomnia, sleep-disordered breathing (which includes obstructive sleep apnea), restless-legs syndrome, and narcolepsy. These disorders can cause sleepiness and fatigue on the job. 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 and improve quality of life.

In addition to sleep disorders, certain chronic diseases and medications can increase excessive work-time sleepiness and cause difficulties with getting enough good-quality sleep.[9] Sleepiness is a side effect of certain commonly used medications, such as benzodiazepines, narcotic analgesics, some antihistamines, some antidepressants, and some prescription and over-the-counter medications used to treat insomnia. To reduce this problem, the healthcare provider can sometimes adjust the dose or switch to medications that are not sedating.

Pain and other symptoms from several chronic diseases are often more bothersome at night and interfere with getting good-quality sleep.[9] These diseases include asthma, arthritis, chronic obstructive pulmonary disease, chronic fatigue syndrome, and rhinitis. Better symptom control can sometimes also reduce excessive work-time sleepiness and sleep problems.

### Negative Outcomes Associated with Insufficient Sleep, Shift Work, and Long Work Hours

Research indicates that shift work and long work hours increase health and safety risks by disturbing sleep and circadian rhythms and reducing time for family and other personal responsibilities.[10] In addition, long work hours increase exposures to other hazards at work and reduce recovery times. Shift work and long work hours promote stress, fatigue, negative mood, discomfort, physiologic dysfunction, and poor health behaviors (overeating, smoking, and lack of exercise), which in turn could lead to illnesses and injuries for the worker. In addition, the risks can extend to families: for example, from the conflicting demands of work and family. Risks to employers include reduced productivity and increases in worker errors, which reduce the quality of goods and services. Mistakes by fatigued workers can have far-reaching negative effects on the community, ranging from medical care errors to motor vehicle crashes during the commute. Scientific evidence indicates that the characteristics of the worker, demands of the job, and design of the work schedule influence whether these negative outcomes occur.[10]

Many studies report that people on shift work and long work hours frequently experience shorter sleep duration and poorer sleep quality.[11,12] Workers on night shifts and rotating shifts report the most difficulties with sleep. Sleep deprivation can impair job performance and increase risk for workers making errors and having injuries. Errors made by fatigued workers also can endanger others around them, including others on the road during commutes to and from work. An estimated 19% of vehicle crashes are attributed to drowsy driving.[13]

Recent studies indicate that sleep deprivation, long work hours, and shift work are associated with poor health behaviors, including obesity, smoking, and lack of physical activity. Sleep deprivation is associated with changes in hunger hormones, which increase appetite and risk for obesity.[14] Poor food choices available in the workplace at night may also play a role in development of obesity. Shift work and long work hours may make it difficult for women to find the time and energy to exercise regularly. Some studies reported decreases in physical activity of workers on these types of schedules.[15] Frost *et al.* concluded that smoking was generally more frequent among shift workers.[16] Women may be drawn to smoking to relieve the fatigue, sleepiness, and stress linked to demanding work schedules. These negative health behaviors could contribute to the development of several types of chronic illnesses.

Current scientific evidence suggests that shift workers may be at higher risk for several chronic illnesses, including cardiovascular and gastrointestinal disease, psychological disorders, cancer, and diabetes mellitus. Puttonen *et al.* concluded that shift work possibly increases risk for cardiovascular diseases, such as myocardial infarction, chest pain, and high blood pressure.[17] Research findings are stronger for a link between shift work and factors that promote development of cardiovascular disease, such as smoking and metabolic disturbances. Compared with day workers, shift workers more frequently report gastrointestinal (GI) symptoms: abdominal pain, gas, diarrhea, constipation, nausea, vomiting, change in appetite (either increased or decreased), indigestion, and heartburn.[18] Shift workers frequently complain of bad mood, depression, irritability, anxiety, personality changes, and difficulty with personal relationships.[19] A growing number of studies link shift work with an increased risk for type 2 diabetes mellitus.[20]

In 2007, the International Agency for Research on Cancer of the World Health Organization announced that sufficient scientific evidence is available from animal and human studies to label shift work with circadian disruption a ''probable'' carcinogen.[21] Breast cancer has been the most frequently studied type of cancer. According to a 2012 report

by Bonde *et al.,* statistically significant increases in risk for breast cancer were seen for working night shift for 20 years or more, but it is not clear from existing studies whether there is risk for shorter durations.[22] Bonde *et al.* also suggest that ''women with previous or current breast cancer be advised not to work night shifts because of strong experimental evidence demonstrating accelerated tumor growth by suppression of melatonin secretion'' (page 380). Melatonin secretion is suppressed by light when a person works at night.

Concerning reproductive outcomes, a review of 11 studies reports that shift work is associated with modest increases in spontaneous abortion, preterm birth, and reduced fertility in women.[23] A few studies examined the influence of shift work on menstrual cycle symptoms. These studies found that shift-working women have more visits to healthcare providers for menstrual complaints, more sick feelings or dysmenorrhea during menstruation, and changes in menstrual cycle length (shorter, longer, or irregular).[24]

Compared with studies of shift work, fewer studies have examined the health and safety risks associated with long work hours, although the number of studies has recently grown. Like shift work, long work hours appear to increase risk for several negative health effects, such as decrease in self-perceived general health quality, increase in risk for hypertension, increase in risk by approximately 40% for coronary heart disease, increase in time to become pregnant, and possible weak relationship with preterm birth.[25–28]

Eight studies with some controls for physical demands showed that long work hours increase the risk for musculoskeletal disorders (MSDs).[29] Women who work long hours may be at higher risk for pain or discomfort in the back, knee, hip, foot, hand, arm, neck, and shoulder. Researchers theorize that long work hours and MSDs could be linked through several mechanisms: (1) longer duration of work causes higher daily exposure to physical demands, such as lifting and working in awkward postures; (2) stress leads to co-contraction of muscles, which increases loading on the spine and the risk for back pain; (3) impaired sleep shifts the immune system balance of T-helper cells toward inflammation; and (4) impaired sleep could lead to poorer coordination and body awareness.

Demanding work hours can negatively impact families. Strains on personal relationships can result from fatigue and poor mood from sleep deprivation and reduced quality time for family and friends. Several studies showed increased risk for work/family conflict and poor work/life balance.[30–32] These strains could increase risk for divorce and difficulties with family life, but only a few studies have shown an increased risk for marital difficulties and divorce for workers on nonstandard work hours.[33–36]

Few studies examined the influence on child rearing. Some studies suggest that mothers' long work hours adversely influence their children's behavior and verbal ability,[37,38] and one study suggested an associated increase in obesity of the children.[39] However, one study reported potential benefits for families: fathers at home in the evenings while their wives worked were more active in their parenting role and built strong, positive relationships with their children.[40]

### Selected Efforts by NIOSH to Reduce Risks

Through its research, guidance and authoritative recommendations, and dissemination of information to protect workers, workers' families, employers, and the community, NIOSH has a long-standing commitment to preventing hazards from these demanding work hours.[41] The NIOSH Program Portfolio, which broadly guides National Occupational Research Agenda (NORA) activities, is organized into 10 NORA Sector Programs that represent industrial sectors and 24 cross-sector programs organized around adverse health outcomes, statutory programs, and global efforts.[42] Work schedule and sleep-related research fits many strategic, intermediate, and activity/output goals in the National Occupational Research Agenda.[43] Several sector goals directly address fatigue or sleep deprivation, including (but not limited to) creating and using data-collection systems for evaluation of sleep deprivation and fatigue as factors in injuries and fatalities; developing effective guidelines to reduce worker fatigue; fostering dissemination and implementation of effective teaching tools and interventions to reduce risks from demanding work schedules; and investigating workplace agents or workplace factors that may be associated with cardiovascular disease, cancer, or adverse reproductive outcomes and determining ways to minimize exposure to such agents.

Work-related sleep and work schedule issues closely fit two of NIOSH's cross-sector programs: Total Worker Health® (TWH)[44] and Work Organization and Stress-Related Disorders (WSD).[45] TWH integrates occupational safety and health protection with health promotion to prevent worker injury and illness and to advance health and well-being. This more comprehensive approach addresses the systems in the workplace for organizing work schedules, as well as personal factors, such as sleep disorders and inadequate sleep practices, that lead to insufficient sleep. Work organization refers to the nature of the work process (the way jobs are designed and performed) and to the organizational practices (e.g., management and production methods and accompanying human resource policies) that influence the design of jobs. Work schedules are a key component of work organization.

The NIOSH Research to Practice (r2p) initiative focuses on reducing or eliminating occupational illness and injury by increasing the transfer and translation of knowledge, interventions, and technologies into highly effective prevention practices and products into the workplace.[46] NIOSH scientists are developing and evaluating tailored training programs for managers and workers in aviation, emergency response, manufacturing, mining, nursing, and retail. These programs are designed to inform audiences about (1) the importance of sleep; (2) the risks linked to insufficient sleep, shift work, and long work hours; and (3) strategies to reduce the risks, including both suggestions for managers to implement in the workplace and suggestions for the workers to implement in their personal lives, such as good sleep practices. NIOSH developed a comprehensive online training program: ''NIOSH training for nurses on shift work and long work hours.''[47] Other types of workers and managers with a health science background may also find the training helpful. This interactive, multimedia training program is available for desktop and mobile devices and takes about 3 hours to complete. A 30-minute interactive online training program was released for emergency responders and their managers who deploy to disaster sites caused by weather, earthquakes, and other catastrophic events.[48] NIOSH is developing a series of short webinars to educate workers and managers in

manufacturing and retail about sleep. A training program for pilots of small aircraft is under development.

NIOSH funds the collection of occupational safety and health data for the Quality of Worklife Questionnaire (QWL) and a supplement for the NHIS. The QWL is a module in the General Social Survey (GSS).[49] The GSS is a biannual, nationally representative, personal-interview survey of US households conducted by the National Opinion Research Center (NORC). The 76 items in QWL include work hours, workload, worker autonomy, layoffs and job security, job satisfaction, stress, worker well-being, and health outcomes, including sleep problems. Data are available to interested researchers through NORC.[50] NIOSH funded a 2010 Occupational Health Supplement for the NHIS; the data are available through NHIS.[51] The NIOSH Supplement included items about common workplace exposures and common work-related health conditions, including a question about usual shift worked. The core NHIS includes a question about total hours worked per week and several questions about sleep. The next occupational health supplement will be collected in 2015.

NIOSH studies are examining shift work and adverse reproductive outcome among female nurses: specifically, the association between work schedule and risk of spontaneous abortion, preterm birth, and menstrual function. NIOSH researchers are collaborating with the Harvard Nurses' Health Studies II and III, both of which are large, ongoing prospective studies of nurses.[52] Results from the Nurses' Health Study II showed that shift work, particularly working the night shift, had a statistically significant increased risk of several reproductive outcomes, including spontaneous abortion, early preterm birth, and menstrual cycle irregularities.[53–55] In addition, results show independent effects on reproductive outcomes from long working hours.[53,54]

## Conclusions

Substantial scientific evidence shows that insufficient sleep can lead to far-reaching negative health and safety risks to sleep-deprived persons and can also endanger others around them. Employers, managers, and workers share in the responsibility of adopting strategies to reduce these risks. The key strategy to reduce these risks is making sleep a priority in the employer's systems for organizing work and in the worker's personal life.

To promote progress, education and training programs for managers and workers would help increase their appreciation and knowledge about the demands of shift work, long work hours, and related sleep and fatigue issues. Strategies for managers and employers include improving the design of their work schedules, promoting frequent breaks during the work shift, fostering good coworker and supervisor relationships, and establishing policies and systems that reduce the risk for fatigue and related health problems. In addition, workplaces can conduct periodic assessments to examine the influence of work schedules on factors on and off the job, including performance, alertness, sleep, unintentional injury, worker errors, near misses, illnesses, and off-the-job responsibilities. An anonymous, no-blame reporting system can collect reports on incidents and near misses. Strategies for workers include allowing enough time for sleep and adopting good practices and behaviors to maximize sleep and alertness. Workers with sleep problems or excessive worktime sleepiness can seek an assessment and treatment. Workers also will benefit from educating their families about their special needs to gain their support and reduce conflicts between work and home demands.

For more information on this topic, including strategies for managers and workers to improve sleep and alertness, see the NIOSH web page on work schedules.[41] As new training programs and other resources become available, they will be listed on that website.

## Author Disclosure Statement

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