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Sleep disorders in shift nurses and their health consequences

Zaburzenia snu u pielęgniarek pracujących w systemie zmianowym i ich konsekwencje zdrowotne

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Abstract

Shift work, especially the night shift, is associated with numerous challenges that can negatively affect the quality of sleep and overall well-being of healthcare workers. This review discusses the causes of these disorders, their impact on the physical and mental health of nurses, and presents strategies for coping. It also highlights the physical factors that contribute to the occurrence of such disorders. The aim is to raise awareness of the impact of shift work on nurses and the prevalence of health disorders among them. The article reviews recent literature from PubMed, Via Medica, the Jagiellonian University Repository and "Psychiatria Polska" based on the search terms *shift work*, *sleep disorders in nurses*, and *the impact of shift work on nurses' health*. While many studies have examined the impact of shift work on the health and social life of nurses, there remains a number of areas that remain unexplored. Shift work has a destructive effect on the mental and physical health of nurses and negatively influences the entire body, resulting in sleep disorders, for example. The article also presents recommendations for preventing sleep disorders resulting from shift work in nurses.

Keywords: circadian sleep rhythm, nurses, shift work, sleep disorders

Streszczenie

Praca zmianowa, zwłaszcza nocna, wiąże się z wieloma wyzwaniami, które mogą negatywnie wpływać na jakość snu i ogólne samopoczucie pracowników służby zdrowia. W niniejszym przeglądzie omówiono przyczyny tych zaburzeń, ich wpływ na zdrowie fizyczne i psychiczne pielęgniarek oraz przedstawiono strategię radzenia sobie z nimi. Podkreślono również czynniki fizyczne, które przyczyniają się do występowania takich zaburzeń. Celem jest zwiększenie świadomości na temat wpływu pracy zmianowej na pielęgniarki i częstotliwości występowania zaburzeń zdrowia wśród nich. W artykule dokonano przeglądu najnowszej literatury z serwisów PubMed, Via Medica, Repozytorium Uniwersytetu Jagiellońskiego oraz czasopisma „Psychiatria Polska” w oparciu o słowa kluczowe: „praca zmianowa”, „zaburzenia snu u pielęgniarek” oraz „wpływ pracy zmianowej na zdrowie pielęgniarek”. Chociaż w wielu badaniach analizowano wpływ pracy zmianowej na zdrowie i życie społeczne pielęgniarek, nadal istnieje szereg obszarów, które pozostają niezbadane. Praca zmianowa ma destrukcyjny wpływ na zdrowie psychiczne i fizyczne pielęgniarek oraz negatywnie oddziałuje na cały organizm, powodując na przykład zaburzenia snu. W artykule przedstawiono również zalecenia dotyczące zapobiegania zaburzeniom snu wynikającym z pracy zmianowej u pielęgniarek.

Słowa kluczowe: rytm dobowy snu, pielęgniarki, praca zmianowa, zaburzenia snu

INTRODUCTION

Sleep is a basic biological need that is an integral part of life, and getting sufficient sleep is essential for ensuring well-being and remaining productive. During sleep, motor activity ceases, conscious awareness of the environment is lost, and reactivity to external stimuli is reduced; however, the nervous system continues to operate and undergoes continuous changes. An important feature of sleep is its reversibility, that is, the ability to return to the waking state, under the influence of adequate external stimuli. Human sleep consists of two phases which occur in cycles: one phase without rapid eye movement sleep (i.e. non-rapid eye movement, NREM) and the other with rapid eye movement (REM). A typical person needs about four to six sleep cycles to rest fully. Sleep structure is influenced by various factors, including genetics and age.

Sleep is regulated by two processes: the homeostatic sleep drive and the circadian rhythm (Bani Issa et al., 2020; van de Langenberg et al., 2023). Under normal conditions, a person is active during the day and sleeps at night. Disruption of this cycle, such as by performing chronic night shift work, causes external desynchronisation, which can result in a range of negative effects across all areas of life, including sleep debt syndrome.

The homeostatic process aims to restore equilibrium using appropriate sleep length and quality. Briefly, the sleep drive is increased following shorter periods of sleep, longer periods since the previous rest period, and greater physical activity during the day. This demand for sleep also influences the length and depth of sleep.

The period of wakefulness and sleep is influenced by various types of neurotransmitters, with the main ones being acetylcholine, norepinephrine and serotonin. Acetylcholine increases sensitivity to stimuli and the response through depolarisation of the thalamus, thus allowing the attention mechanism to function properly. Additionally, neurons that produce acetylcholine promote REM sleep and are linked to memory processes. Serotonin regulates brain arousal by controlling the production of acetylcholine and norepinephrine, which promotes deep sleep and inhibits REM sleep. Norepinephrine plays a key role in attention; excessive activity results in poor sleep quality, which is often observed in individuals with substance abuse disorders or chronic anxiety.

High concentrations of these three neurotransmitters put the body into an alert state. However, when acetylcholine levels fall, the body moves into the relaxation phase. As sleep deepens, and moves to the sleep phase, slow-wave NREM sleep is observed. In REM, characterised by delta waves, dreams take place; these typically have a low emotional intensity, due to the reduced concentration of acetylcholine, and are usually not remembered. The REM sleep phase is characterised by a decrease in norepinephrine and serotonin, and an increase in acetylcholine.

Other important neurotransmitters include gamma-aminobutyric acid (GABA), involved in the action of sleep-promoting

drugs, and histamine, which regulates sleep. Melatonin, another neurotransmitter, is secreted by the pineal gland in response to light and plays a key role in managing the biological clock located in the anterior hypothalamus, in the suprachiasmatic nuclei. Orexins also help maintain sleep during the night and wakefulness during the day and adenosine promotes sleepiness (Bani Issa et al., 2020; van de Langenberg et al., 2023).

The role of the circadian rhythm is to orient the human body to the nocturnal phase, i.e. a period of darkness in which to rest, and the activity phase. During the latter, sunlight stimuli are taken up by the retina located in the eyeballs activating the function of the hypothalamus responsible for synchronising the circadian rhythm. All organs have their own circadian rhythms, which they regulate with the help of the suprachiasmatic nucleus located in the hypothalamus. During the dark-sleep period, the hormone melatonin is produced, through the pineal gland, which conditions the transition into the dark-sleep period. The suprachiasmatic nuclei also regulates the activity of the central nervous system.

The body adapts to the 24-hour day cycle through the light environment; however, the proper maintenance of circadian rhythm also depends on social and physical activity, the rhythm of meals and the use of clocks. Any disturbance of the circadian rhythm can greatly affect human function. The introduction of artificial lighting created countless opportunities to disrupt the process of homeostasis and circadian rhythm, and has had a considerable influence on the occurrence of sleep disorders (Bani Issa et al., 2020; van de Langenberg et al., 2023).

SHIFT WORK

For most people, wakefulness and sleep are associated with environmental day and night; however, many modern lifestyle practices, such as shift work and travel across time zones, involve a mismatch between the internal biological clock and externally-imposed sleep and wakefulness rhythms. Both activities require a state of wakefulness during the biological night and sleep during the biological day. Altered light exposure patterns, sleep and wakefulness schedules result in sleep disturbances, attention deficits, health problems, and reduced quality of life (Groves et al., 2020).

In 2015, about 26% of workers in the United States (Feng et al., 2021) and 29.5% of those in Poland (Stryjewski et al., 2016) were employed in shift work. This work practice disproportionately affects health care workers, most of whom work in shifts. In Europe, one in three works on a rotating shift schedule percentage has been reported in Slovakia, and lower percentages in Denmark, France, Belgium and the Netherlands. These disrupted work patterns make daily life more difficult (Lim and Kim, 2025; National Safety Council, 2018).

Shift systems can include night work, rotating between morning, afternoon and night schedules, or rotating between

12-hour shifts during the day and night. Nurses typically work a 12-hour shift, followed by a 12-hour night shift the next day, and then a 48-hour break. However, this is not always a rule: large staff shortages require changes in work schedules, which can result in higher numbers of working hours in both the morning and night systems (Noh et al., 2020). In Poland, as medical personnel largely work in more than one health care facility, and many medical personnel work on a contractual basis, little accurate data exists on the number of nurses working in shifts; contracted nursing staff may also have a much higher shift workload than those working in a single workplace.

CONSEQUENCES OF SHIFT WORK IN NURSES

Shift workers are known to experience a range of negative consequences associated with their schedule. These include insufficient sleep, excessive sleepiness, fatigue and sleepiness-related accidents, workplace accidents, traffic accidents, decreased productivity, health problems, mental health problems, and decreased quality of life. Given that nurses frequently rotate their 12-hour work shifts, they are particularly at risk of developing sleep disorders. Night work can also cause chronic fatigue, impaired concentration, difficulty falling asleep and various physical dysfunctions due to disruption of the serotonergic, cholinergic and noradrenergic systems (Rosa et al., 2019). Performing shift work can affect all spheres of human life by influencing the diurnal rhythm. The resulting chronic lack of rest is known to impair the mental and physical state, which has been noted in all nurses (Zużewicz et al., 2024). Night work prevents rest during its natural time and, due to the need to properly transfer the medical duties to the next set of shift nurses, this deficit often cannot be made up during the daytime hours. Furthermore, sleeping during the day does not promote recovery to the same extent as sleeping at night, as it disrupts the hormonal regulation system (Szymańska-Czechór and Kędra, 2017). Daytime sleep is therefore generally shallower, with the body entering a state of wakefulness without naturally reducing acetylcholine secretion. Additionally, rest after a night shift is often less effective due to external factors such as external noise; the resulting body stimulation and thalamic activation disrupts the inhibition of the posterior bridge, leading to desynchronisation. As a result, double-shift workers sleep about five to seven hours less per week than single-shift workers (Ulfik et al., 2022).

TOLERANCE TO SHIFT WORK

Some people, including nurses, tolerate shift work quite well and tend not to manifest its associated symptoms. Younger people, for example have been found to tolerate shift work much better than older people. Indeed, an analysis of 60 studies on personal factors affecting shift work

tolerance by Saksivik et al. (2011) found young age to be the factor most predictive of shift work tolerance. However, no studies have been performed on the tolerance of young nurses to shift work; most of the research in this area has not examined the effect individual factors such as age (Zużewicz et al., 2017).

It was also noted that individual chronotype may affect tolerance of changes in circadian rhythm. People who function well at night but do not like to get up early in the morning, tend to tolerate rotating work (Ejebu et al., 2022; Fischer et al., 2016).

Physical condition also plays a role. The additional stress factor of night work can be a major impediment to tolerance among women with a dysregulated endocrine system, as indicated in various studies. Also, tolerance to exertion could moderate the effects of shift work (Jeong et al., 2025; Lim and Kim, 2025): people with low physical capacity may function less effectively during the increased exertion of night work. Unfortunately, no relationship has yet been confirmed between night work tolerance in nurses and their physical body condition (Jeong et al., 2025; Lim and Kim, 2025).

RECOGNISING SHIFT WORK DISORDER

Shift work often results in disturbed sleep and impaired wakefulness. However, the development of severe and chronic symptoms may lead to a diagnosis of shift work disorder, which is classified as a distinct medical condition in the DSM-5. To correctly diagnose a person with this disorder involves taking a history of symptoms, such as insomnia or excessive sleepiness during shift work, where the amount of sleep during the body's natural sleep hours is reduced (Salle et al., 2020). These symptoms must persist for at least three months to diagnose shift work intolerance syndrome (Galecki, 2023).

Among those who work on a rotating basis, 90% report experiencing the adverse effects of this type of work on their bodies. Symptoms most commonly associated with rotating shifts are difficulty in getting a good night's sleep after returning from work, drowsiness during work, chronic fatigue, increased use of tranquilizers and psychoactive substances, mainly alcohol. Sleep disturbances resulting from circadian rhythm disturbances also persist on days off and for several days after the last night shift. Estimates show that shift work disorder can affect up to 30% of shift workers (Mun and Choi, 2020).

Treatment involves various measures aimed at improving sleep, such as drug therapy. Most importantly, the patient should try to implement basic sleep hygiene and provide a suitable environment for resting after returning from night shift (Booker et al., 2024). Thus, the bedroom should be darkened and quiet, with the correct humidity and a cool temperature. Often, it is helpful to turn on relaxing music and suggest aromatherapy. In order to improve performance and reduce fatigue, it is recommended to take

dietary supplements containing caffeine and ephedrine. Melatonin taken at doses from 0.5 to 3 mg, if well tolerated, has a beneficial effect on falling asleep after working at night; the drug should be taken one hour before the scheduled bedtime (Jeon et al., 2023; Stryjewski et al., 2016).

A study of 1,076 Norwegian nurses working shifts over a two-year period demonstrated a significant relationship between night work hours and the incidence of sleep disorders. Interestingly, the sleep disorders disappeared when night work hours were reduced or stopped altogether (Piotrkowska et al., 2019).

A study of 200 nurses found 48.7% to suffer from insomnia. This disturbing fact highlights the need for changes in work schedules to make them more beneficial to nurses (Zdanowicz et al., 2020), should certainly be noted by the occupational medicine community.

THE IMPACT OF SHIFT WORK ON THE OCCURRENCE OF OCCUPATIONAL BURNOUT

Shift work involves performing work duties at a time when the body should be resting and recuperating. The resulting sleep and rest deficits affect physical and mental performance.

The body is forced to be in a state of constant readiness, which requires increased mental and physical efficiency. Performing work at night influences the autonomic nervous system (Zużewicz, 2017), resulting in cardiovascular, metabolic, and digestive abnormalities, as well as mental health problems. Moreover, shift work has been associated with an increased risk of cancer linked to changes in the endocrine system (Su et al., 2017). Despite the well-documented detrimental health effects of sleep deprivation, nursing staff often do not spend enough time to recover from the night shift; many also have to engage in household chores, childcare or elderly care duties and simple desire to participate in the diurnal social activities, which reduces the time available for rest and sleep (Yuan et al., 2018). Improper rest after night work results in chronic fatigue, insomnia, irritability and general weakness; it is also associated with a poorer attention span, due to altered norepinephrine levels (Jeon et al., 2023). As a result, the worker experiences reduced professional efficiency and an increased risk of work-related accidents; these are significantly more likely when the break between the night shift and the next shift is only 24 hours. Chronic lack of rest may deteriorate interpersonal contacts in private and professional life, e.g. relationships with supervisors and patients. In fact, prolonged fatigue can lead to occupational burnout, resulting in a reluctance to perform professional duties, dissatisfaction

Diagnostic criteria	International Classification of Sleep Disorders (ICSD-3)	Diurnal rhythm disorder associated with shift work (ICD-10-CM 647.26)	DSM-5
A. Chronic or recurrent pattern of sleep and wakefulness disorders	Change in internal diurnal rhythm, or incompatible sleep and wakefulness schedule	Associated with a cyclical work schedule that interferes with traditional sleeping hours	Changing daily rhythm due to changing working hours
B. Symptoms	Insomnia, excessive sleepiness or both	Report insomnia and/or excessive sleepiness and a reduction in total sleep time	Excessive sleepiness, insomnia, or both
C. Effects of sleep and wakefulness disorders	Cause stress or disruption in important areas of life (social, professional, etc.)	Symptoms affect work life, social life and other important areas of functioning	They cause significant stress and affect social and professional life
D. Duration of symptoms	Chronic or recurrent disturbance of sleep-wake rhythm	Symptoms persist for at least three months and are related to shift work schedules	The disorder must be persistent or recurrent
E. Diagnostics	Sleep and wakefulness monitoring, light exposure measurement (preferred)	Sleep monitoring (sleep diary, actigraphy) for at least 14 days (working days and days off)	No other explanations for sleep disorders (e.g. medical illnesses, medications)
F. Exclusion of other disorders	Sleep disorder is not the result of other sleep disorders, diseases, medications, addictions, bad habits	The disorder cannot be explained by other sleep disorders, medical illnesses, medications, addictions	The disorder cannot be due to other causes (e.g. mental disorders)

Tab. 1. A comparison of diagnostic criteria for day and night rhythm disorders associated with shift work based on various classifications

Sleep disorder category	Description
Insomnia disorders	Difficulty initiating or maintaining sleep despite adequate opportunity
Hypersomnolence disorders	Excessive daytime sleepiness despite sufficient nighttime sleep
Sleep-related breathing disorders	Breathing difficulties during sleep, e.g. sleep apnoea
Circadian rhythm sleep-wake disorders	Disruption of the normal sleep-wake cycle, e.g. delayed sleep phase disorder
Sleep-related movement disorders	E.g. restless legs syndrome, bruxism, limb movements during sleep
Parasomnias	Abnormal behaviours during sleep, e.g. night terrors, sleepwalking
Other specified sleep disorders	Sleep disturbances not fitting above categories
Sleep disorders, unspecified	Insufficient information for precise classification

Tab. 2. ICD-11 classification of sleep disorder

with work, and, in extreme cases, the development of depressive symptoms and psychiatric disorders (Leon et al., 2023). A study on Polish oncology nurses found satisfaction with work to decrease with age and the rotation system. Among nurses, lack of job satisfaction can very quickly lead to professional burnout, which has a negative effect on the patients and on the mental and physical health of the nurses (Piotrkowska et al., 2019). It has also been found that nurses experiencing problems resulting from improper use of work schedules demonstrate lower quality nursing care (Fox et al., 2025).

Tab. 1 compares the diagnostic criteria for circadian rhythm disorders associated with shift work across various classifications. Tab. 2 presents the ICD-11 classification of sleep disorder.

IMPACT OF SHIFT WORK ON FAMILY LIFE AND SOCIAL RELATIONS

Work can have a huge impact on family life and relationships. Chronic exhaustion due to lack of sleep can lead to a lack of interest in social gatherings and family activities, and parenting. Rybka and Gładyszewska (2024) report that shift work has a negative impact on family and social life among nurses. Another study found nurses to express a decreased desire to attend gatherings with friends and family (Su et al., 2017).

Shift work may also require nurses to perform duties on Sundays and holidays, when others have time off and can fully indulge in rest (Stryjewski et al., 2016). As such, many years of shift work can result in greater social isolation and fewer family and social contacts, increasing the risk of depressed mood and even depression (Feng et al., 2021; Huang et al., 2021).

EFFECT OF SHIFT WORK ON SYSTEMIC DISORDERS IN THE BODY

Physical activity and lifestyle also affects the digestive system. Rybka and Gładyszewska (2024) found nurses working shifts to be more likely to report complaints associated with abdominal pain, constipation and irritable bowel syndrome. A study by Peplowska et al. (2013) on 725 nurses aged 40–60 years working in a rotation system in Lodz also identified digestive system complaints including abdominal pain, flatulence and diarrhoea; these ailments were less frequent in nurses working in the morning system. The higher incidence of irritable bowel syndrome and abdominal pain after meals may be associated with irregular eating habits and working under constant stress (International Council of Nurses, 2021; Kang et al., 2020; Qanash et al., 2021; Weaver et al., 2023; Wu et al., 2022). Fallis et al. (2021) found shift work to result in elevated blood pressure and heart rate values in a significant number of nurses, suggesting that shift work places a burden on the cardiovascular system. This can be attributed to the stress associated with the need to be constantly at full readiness

to make decisions at the workplace. Lack of recovery after night duty also has a considerable effect on the cardiovascular system.

A study of group of 147 medical workers by Stimpfel et al. (2020) identified a correlation between an increase in waist circumference of workers and night work: the shift worker group had 12% more individuals with obesity compared to those who worked only in the morning. Nighttime eating, lack of motivation for physical activity due to chronic fatigue, and endocrine dysregulation all increase the risk of obesity in nurses. This also places the worker at higher risk of metabolic syndrome (Kalmbach et al., 2018).

A study of menstrual cycle disorders in shift nurses by Groves et al. (2020) found the length of time worked in the rotation system was positively associated with the risk of disorders associated with menstrual cycle irregularity and its duration. These may lower the chance of getting pregnant and increase the occurrence of gynaecological diseases resulting from hormonal disorders.

RECOMMENDATIONS

Recent years have seen a considerable growth in the body of evidence concerning the effect of shift work on workplace safety, the mechanisms of sleep, and the internal diurnal clock (2017 Nobel Prize). This has led to growing demands to prevent problems caused by shift work before they develop (Wu et al., 2022).

Recommendations to improve the health of shift workers:

1. US: Educational programs in hospitals (e.g. “Healthy Nurse, Healthy Nation”) teach nurses to manage sleep, stress and diurnal rhythms.
2. Sweden: Mandatory training in shift ergonomics and sleep hygiene for medical staff.
3. Australia: Introduction of e-learning modules on the effects of night work on mental and physical health.
4. Germany: Certified courses on chronobiology and shift planning to minimise sleep disturbance (Härmä et al., 2022).

The literature includes a number of recommendations for nursing in particular. Firstly, sleep hygiene training should be included as a mandatory part of professional education (Rainbow et al., 2024), and relaxation workshops and mindfulness training should be organised as ongoing activities in the workplace (Härmä et al., 2022). In addition, managers could be trained on how to plan shifts according to biological rhythms (e.g. clockwise shift rotation) and educational materials such as brochures, podcasts and webinars about the impact of shift work on health could be made available (Härmä et al., 2022).

Furthermore, nurses could be encouraged to use relaxation techniques such as meditation and 4-7-8 breathing before bed (Lie et al., 2024) and introducing strategic naps (20–30 minutes) before the night shift (Patterson et al., 2019). They could also reduce their exposure to blue light after the night shift with the use of light-blocking glasses or screen-filtering apps

(Albakri et al., 2024). Indeed, light therapy could be used to support the diurnal rhythm, especially after night duty (Albakri et al., 2024).

On a wider scale, psychological support systems could be implemented for nursing staff based on those used in Scandinavian countries (Waage et al., 2023), and the topic of shift work could be included in nursing curricula and specialisation courses (Mohedat et al., 2023). Finally, greater efforts could be made to promote international standards for the health of health care workers, such as those given by the World Health Organization and International Council of Nurses (Weaver et al., 2023).

Shift work is a central part of nursing. As a result, nurses are particularly susceptible to circadian rhythm disruptions and the resulting hormonal imbalances, leading to chronic fatigue syndrome and, eventually, professional burnout. Research on sleep disorders has covered both its medical and psychological aspects, with most focusing on disorders caused by sleep deprivation, particularly chronic fatigue and insomnia; however, studies on nurses tend to focus on those who work long hours without considering how long they've been working shifts. Additionally, little attention has been given to methods for combating sleep disorders and reducing the complications of long-term rotating shifts, which should be addressed in future research.

CONCLUSIONS

The nursing profession is vulnerable to sleep disorders resulting from night work. More specifically, rotational shift work has a destructive effect on the quality of life of nurses and their relationships with their relatives; it also causes a significant decrease in job satisfaction, potentially resulting in professional burnout. The literature identifies very few strategies for improving the quality of sleep in nurses performing shift work, and the prevalence of such treatments, including cognitive-behavioural therapy, among nurses is unknown. Finally, it would be worth investigating how quickly the onset of sleep problems and other health effects develops in nurses from the time they start working shifts. Also, the prevalence of endocrine disorders related to shift work in nurses and their effect on fertility are unknown. Therefore, there is a need for further research in this area with the aim enhanced prevention of shift work disorders in nurses.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organisations which might negatively affect the content of this publication and/or claim authorship rights to this publication.

Author contribution

Analysis and interpretation of data: MR, HR. Writing of manuscript: PŁM. Final approval of manuscript: AP.

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