Nurses’ Health in Shift Work
(Praca pielęgniarek w systemie zmianowym a zdrowie)

P Zabielska 1,A,D, M Bażydło 1,F, A Karakiewicz 2,B, E Grochans 3,E, A Jurczak 3,B, I Rotter4,C

Abstract – Nursing belongs to a group of professions with a distinct character of work. It requires special abilities both in the psychological and physical sphere. Most nurses engage in shift work, which entails an on-going adaptation to changing hours of work, including nighttime. Such a system of work hinders family life and it impacts the employee’s health. Shift work may increase the risk of suffering from many conditions and illnesses. It is estimated that only 10% of people on shift work do not experience its adverse effects and approximately 20% must quit due to health problems. A set of non-characteristic health problems resulting from the difficulty to adapt to shift work and late hours in the long run is called shift work intolerance. As a consequence of shift work, workers suffer from biological, health as well as psychosocial effects. In order to avoid adverse effects of shift work and occupational burnout, an appropriate work environment should be created, starting from a nice and friendly atmosphere. Nurses will attend to their duties more optimistically in such conditions and the care provided for patients will be of the highest standard.

Key words – nurses, work.

Streszczenie – Zawód pielęgniarki należy do grupy zawodów o specyficznym charakterze pracy. Wymaga on predyspozycji w sferze psychicznej i fizycznej. Większość pielęgniarek pracuje w systemie pracy zmianowej. Wymaga to ciągłego dopasowywania się do zmienionych godzin pracy, także w nocy. Taki system godzinowy utrudnia życie rodzinne, wpływa na stan zdrowia pracującego. Praca zmianowa może prowadzić do zwiększenia ryzyka występowania wielu dolegliwości i chorób. Oce-nia się, że tylko 10% osób pracujących w systemie pracy zmianowej nie odczuwa złąch skutków tego rodzaju pracy, a około 20% musi z niej zrezygnować z powodów zdrowotnych. Zespół mało charakterystycznych problemów zdrowotnych wynikających z trudności przystosowania się do pracowania w systemie zmianowym i nocnym w dłuższym czasie nazywamy brakiem tolerancji pracy zmianowej. Pracownicy, w związku z wykonywaniem pracy w systemie zmianowym, odczuwają skutki biologiczne, zdrowotne, psychologiczno-socjologiczne. Aby uniknąć negatywnych skutków wynikających z wykonywania pracy w systemie zmianowym oraz wypalenia zawodowego, powinno się tworzyć odpowiednie środowisko pracy, zaczynając od miłej, przyjaznej atmosfery. Dzięki temu pielęgniarki będą bardziej optymistycznie podchodzić do swych obowiązków, a opieka świadczona pacjentom będzie charakte-ryzowała się wysokim poziomem.

Słowa kluczowe – pielęgniarki, praca.

Author Affiliations:
1. Department of Public Health, Pomeranian Medical University in Szczecin
2. Students Research Association, Independent Laboratory of Rehabilitation, Pomeranian Medical University of Szczecin
3. Department of Nursing, Pomeranian Medical University in Szczecin
4. Independent Laboratory of Rehabilitation, Pomeranian Medical University of Szczecin

Authors’ contributions to the article:
A. The idea and the planning of the study
B. Gathering and listing data
C. The data analysis and interpretation
D. Writing the article
E. Critical review of the article
F. Final approval of the article

Correspondence to:
Paulina Zabielska, Żołnierska 48Str., PL-71-210 Szczecin, Poland, e-mail: martab88@o2.pl

Accepted for publication: May 13, 2014.

I. INTRODUCTION

Nursing belongs to a group of professions with a distinct character of work. It requires special abilities both in the psychological and physical sphere. Nurses often face challenges which are difficult to tackle. Most of them engage in shift work. Such a form of employment characterises 13-14% of European and North American workers [1]. It requires from the persons involved an on-going adaptation to the changing hours of work, including night-time. Such a system of work hinders family and social life and, in particular, it impacts the employee’s health. Shift work, so widespread in the nursing profession, is an obstacle to finding a balance...
between professional and private life [2]. Moreover, it may increase the risk of suffering from many conditions and illnesses. It has not been explained, however, whether shift work is the causal factor. Numerous conditions affecting shift workers are characterised by a complex formation mechanism [3]. It is estimated that only 10% of shift workers do not experience any adverse effects of such work while approximately 20% must forsake it due to health reasons. As many as 70% of people evince a varying degree of intolerance towards shift work [4, 5]. A set of non-characteristic health problems resulting from the difficulty to adapt to shift work and late hours in the long run is called shift work intolerance. Symptoms of workers’ intolerance towards shift work and late hours include:

- sleeping disorders,
- digestive disorders,
- cardiovascular disorders,
- psychoneurotic disorders,
- chronic fatigue,
- social dysfunctions,
- increased use of various stimulants: cigarettes, coffee, medication, alcohol.

Health consequences of shift work are often analysed in three groups, i.e.:

- biological effects
- health effects and
- psycho-social effects [6].

II. BIOLOGICAL EFFECTS

In a normal lifestyle – i.e. in the case of people who are active in the daytime, asleep at night and who eat regular meals, both component parts – the exogenous and the endogenous rhythm – cooperate in harmony and they are synchronised. Thus, for example the levels of glucose, body temperature, levels of noradrenaline and adrenaline in blood increase in the morning and during the day to provide the body with appropriate functioning conditions as well as to enable an optimal alertness and well-being. In the evening, their concentration in blood decreases, body temperature drops as does the secretion activity of the stomach, liver and intestines. Yet, the secretion of some hormones increases, e.g. the growth hormone or melatonin, which prepares the body for sleep, reduces performance and increases fatigue. When the natural activity rhythm is reversed, in the case of night or shift work – the level of synchronisation is not achieved, which entails, for instance, health consequences [3, 7].

In transition from day to night shift, a complete change of the usual lifestyle and work habits takes place. Work rate, reaction time, work accuracy and other indices become unstable with the circadian rhythm [8]. Shift work takes place in hours incompatible with the regular circadian rhythm. Circadian rhythms of different physiological variables adapt to the reversed sleep-wake rhythm with varying intensity and rapidity. A considerable part of research conducted so far concerning the reactions of the circadian system to the reversal of the proper sleep-wake system point to only partial adaptation of the circadian rhythm to changing conditions. The degree of such adaptation depends largely on the type of shift work – a complete reversal of some physiological variables has been confirmed in people who constantly worked on the night shift. In turn, workers engaged in a rotation system have been noted to adapt only partially [3]. Such as state of disturbed rhythm is known as jet lag or shift work disorder. It is characterised by an array of symptoms, e.g. fatigue, inability to concentrate, indisposition, nervousness, difficulty in falling asleep, headaches, gastrointestinal conditions and often by a decline in mental and physical faculties. This state may also occur during flights across different time zones [3].

Based on research by Baker et al., 3 stages have been established that every shift worker must go through. The period of work from 5 to 20 years is referred to as the sensitization phase in which the worker aims to improve both their family and professional life. Subsequently, from 20 to 40 years of service, the worker enters into the accumulation phase where family, social and financial situations are stable. In the third stage, over 40 years of shift work, known as the manifestation phase, health-related problems increase as does dissatisfaction [9]. One of the recommendations prepared during the meetings of the WHO Collaborating Centres’ Network (Beijing 1994) was the following: “Adaptation to unconventional diurnal rhythms varies widely between individuals. Ageing reduces capacity for adaptation and starting to work in three shifts is not recommended for any-one over 45 years of age...”. The individual variety in the ability to adapt to work at night defines the varying tolerance of night and shift work regardless of the worker’s age [10].

Among the biological consequences of shift work, we must mention the necessity to perform professional duties at hours when the intensity of physiological processes is lower and when mental capacity is the lowest. This is a major concern in terms of work safety. More mistakes are reported at night-time, which can be linked to
the deterioration of mental capacity. In the case of a regular lifestyle night is reserved for sleep. A considerable number of workers’ mistakes related to technological processes are reported at night. Generally, these processes require good sense, precision and rapid reactions. The deterioration of an individual’s effectiveness may bring about major catastrophic events in industry. It was in the night that nuclear plant disasters happened (Three Miles Island, Chernobyl). Within the 24-hour period, there is another period when the psychophysical capacity sinks – in the early afternoon. This is traditionally referred to as postprandial somnolence, although it also affects people who have not eaten lunch [10]. During night shifts incidents attributed to a “human error” take place relatively more frequently than during day shifts. The analysis of accidents among shift workers demonstrates that the risk of causing accidents or injuries during consecutive nights in shift work is approximately 6% higher during the second night, 17% higher in the third night and as much as 36% higher in the fourth consecutive night [11].

Feskanich et al. have demonstrated in their research a link between working on night shifts and fractures of the hip and wrist among nurses in the postmenopausal period. The results suggest that women working on night shifts for 20 years and longer run a much higher risk of hip and wrist fracture than women who have never worked in such a system. The risk is highest among women with a lower BMI index ( < 24 ) who have never used hormone replacement therapy [12].

III. HEALTH EFFECTS

In order for our body to function properly, appropriate sleep time and quality is necessary. Low sleep quality or insufficient sleep may cause various conditions and states, e.g. attention disorders, thought disorders, spatial orientation and memory disorders, bad mood, decline in the ability to cope with stress, conflicts with the environment, sight disorders and disorders of the immunological system [13]. Shift workers are often affected by sleeping disorders including insomnia (disturbance in maintaining sleep, difficulty in falling asleep, early morning awakening), excessive drowsiness with bouts of daytime sleepiness, wakefulness and sleep rhythm disorders, night fears, somnambulism, nightmares or sleep apnoea. The above-mentioned conditions require treatment [14].

It might be suggested that the fatigue of a shift worker towards the end of his or her shift (especially night shift) may relate to both sleep deficit and the increased effort resulting from work at night. It is estimated that the sleep of a shift worker is approximately 5-7 hours shorter per week than the sleep of a worker who is active exclusively during the day. Sleep disorders may lead to chronic fatigue, and chronic sleep deprivation may reduce life expectancy [3]. Problems related to drowsiness at work may have an influence on the higher rates of occupational burnout and poor sleep quality may cause injuries [15]. Sleep quality depends on the conditions in which sleep takes place. Electrical light and noise, even if they do not cause awakening, undoubtedly influence sleep characteristics, alter sleep cycles and the subsequent sleep phases [11]. Shift work lowers sleep quality and reduces its duration [16]. Shift work and night work disturbs the biological rhythm and it desynchronises various tasks of the body, which leads to disturbed digestive and metabolic processes. They lead to changes in the plasma lipid profile and to carbohydrate intolerance. Among shift workers, there are higher rates of obesity, and consequently, lipid disorders. We should recognise the contribution of this type of work to the emergence of a metabolic syndrome being one of the factors predisposing people to cardiovascular diseases [17]. Melatonin levels in the body sink in the case of shift work and a lack of a light-dark cycle. The lower production of melatonin may increase the risk of stroke, since its deficit may trigger hypercoagulation. In addition, melatonin is an antioxidant and its ability to lower blood pressure has been demonstrated [18].

Disturbance of the circadian rhythm resulting from shift work may lead to higher rates of dyspepsia, lack of appetite, heartburn and stomach ache. It is not fully known whether shift work has a considerable influence on the rates of duodenal and gastric ulcer [19]. Studies show that conditions of the gastrointestinal tract affect 25-75% of shift workers but only 10-25% of day workers [3]. The most frequent disorders are: constipation, diarrhoea, appetite disturbance – its decrease or increase at various times of the day, deregulation of bowel movement times, and heterogeneous abdominal pain. Gradually, inflammations in the upper gastrointestinal tract may appear as well as the inflammatory bowel disease. Unhygienic and irregular meals sometimes disturb the homeostasis of the gastrointestinal tract mainly between the protective and aggressive factors in the duodenum and stomach environment, which may cause ulcer disease to develop [3]. Another crucial problem is the higher risk of carcinogenesis in the large intestine among night workers [20]. Studies by other authors have confirmed that sleep disorders and chronic fatigue are crucial factors facilitating the development of cardiovascular diseases. From the
analysis of examinations “cohort, Nurses’ Health Study, (NHS)”, whose participants were women involved in health care (71,617 women), a conclusion may be drawn that people sleeping 5 hours or less per day indeed run a higher risk of coronary heart disease [17]. The studies by Vinkuna et al. have demonstrated that three factors, usually concurrent, truly exert a negative influence on the development of coronary heart disease: noise, physical effort, and shift work [21].

Researchers have repeatedly approached the relationship between shift work and an increased risk of developing cancer. The results of studies are divergent and ambiguous. It is certain that the lifestyle of shift workers contributes to the risk of developing cancer – an irregular and inappropriate diet, a lack of physical activity, poor sleep quality, smoking, and melatonin deficiency are crucial contributors to such increased risk.

Peplonska B. et al. demonstrate that working on night shifts eight or more times per month may disturb melatonin synthesis [22]. A relation between shift work and the risk of developing lung cancer has been observed for women working on night shifts 15 years and longer. That relation held for small-cell lung cancer. A crucial fact is that the increased risk applied to smokers [23]. The consequences of shift work, i.e. an inappropriate lifestyle, melatonin deficiency, disturbance of the circadian rhythm, the secretion of cortisol and estradiol may be risk factors for the development of breast cancer [24].

Shift work influences the development of type 2 diabetes among women – the longer the period of involvement in shift work, the greater the risk of developing the disease. According to research, body mass is an indirect risk factor for diabetes [25].

Costa G. has analysed the influence of shift work on the female reproductive functions. The conclusion is that shift workers are more frequently affected by an irregular menstrual cycle, menstrual cramps, and a higher frequency of miscarriage. Anomalies of the foetus, premature birth, and low birth weight might also occur [26].

Another health hazard related to shift work among nurses are disorders of the musculoskeletal system. Conditions and ailments affecting the musculoskeletal system are at present one of the most crucial causes of incapacity for work as well as the limitation of work and non-work activity. These conditions are widespread and affect about 90% of individuals above 50 years of age. Apart from unpleasant and persistent pains and a decrease in professional activity, disorders of the locomotor system generate large socio-economic costs resulting from treatment, rehabilitation, sick leaves and disability pensions. Diseases occurring as a result of work, known as occupational diseases, are included in “item 19 on the list of occupational diseases attached to the decree of the Council of Ministers dated 30 July 2002”. The cause of chronic occupational diseases of the locomotor system might be the manner of conducting work, and especially excessive overload of a part of this system (joints, periarticular tissues, bones). Overload of the locomotor system is a name for a set of phenomena when mechanical work exceeds the functional performance of dynamic-static parts or their physical resistance. If the working place is not properly adjusted in terms of ergonomics to performing professional tasks or the technology of the production process engenders an overload of the locomotor system, such a method of work may entail various health hazards. Overload can affect ligaments, muscles and their attachments, tendon sheaths, the meniscus, bursae, bone tissue, and articular capsules [27, 28]. The manual lifting and transferring of patients has the greatest influence on the occurrence of locomotor system disorders among nurses. The body weight of every patient, except children, exceeds the allowed standards for lifting by nurses approved by relevant orders [28].

It has been noted that one of the most serious type of conditions mentioned with reference to the nursing profession are those of the musculoskeletal system. In literature of the subject, nursing is listed second after industry in terms of the amount of physical load and work-related symptoms of musculoskeletal disorders [29].

The following are the basic factors causing the overload of the locomotor system:

- monotonous movement,
- forced body position,
- excessive physical effort,
- static and dynamic load on muscles,
- repetitive microtraumas of the body,
- repetitive tasks,
- work monototypicality,
- tasks carried out in haste,
- noise [30].

A nurse’s working place should be properly prepared and equipped to enable nursing procedures. Of great importance is various equipment improving and facilitating work such as lifting devices and orthopaedic beds. According to research by Tinubu et al., 84.4% nurses found that they experienced pain and discomfort of the musculoskeletal system during work (work-related musculoskeletal disorders). WMSDs affected in 44.1% the lower
back, in 28% the neck and in 22.4% the knees. From all the examined who experienced WMSDs, only 30.3% sought treatment. Nurses at work often adopted a forced body position for a longer period of time (55.1%), they had to provide care on duty to an excessive number of patients (44.9%) and they were overburdened during lifting or transferring of lying patients (50.8%), thus risking exposure to WMSDs. In order to improve nursing activities and reduce the risk of developing WMSDs, the surveyed nurses proposed three strategies: assistance in lifting and transferring patients, making equipment available (50.4%); change of body positions adopted by nurses and patients (40.3%), and a modification of nursing procedures so as to prevent renewed injuries [31]. Rates of WMSDs among nurses changed from study to study, but they were always high regardless of the part of body. Fabunmi et al. indicate that within 12 months of work, musculoskeletal ailments may occur in 90.7% nurses [31]. However, Josephson who conducted studies in the United States recorded 72.5% musculoskeletal disorders.

**IV. PSYCHOLOGICAL AND SOCIAL EFFECTS**

Stress experienced in the work environment related to a specific type and organisation of work as well as interpersonal contacts related not only to providing care for the ill but also therapeutically influencing their psychological state may well lead to health consequences among nurses. A close confrontation and interaction with suffering, death and continuing stress may become apparent mostly when the nurse or doctor cannot cope with their own negative fatigue, burden or emotions. They become emotionally exhausted. They begin to defend themselves from this condition by defining limits and, often, by treating patients as objects. What can be observed then is a phenomenon known as depersonalisation. Also, a lack of professional satisfaction appears which entails a decreasing involvement in work, which in turn leads to occupational burnout [32].

Unfavourable environmental conditions have a major influence on generating stress and they include: difficult work conditions, overburdening, time pressure, and shift work. Interpersonal relations are also quite difficult when the social policy is defective, lacking social support is coupled with a non-conducive organisational structure or emotional sphere [33]. The intensity of the psychological burden faced by nurses decreases the quality of medical care provided and contributes to occupational stress [34]. The burnout syndrome pertains to various reactions: lower motivation and lower willingness to act, loss of concern and care about other people, a lower morale, an excessive withdrawal in the face of problems. Occupational burnout may come in two forms. The first one is general socio-cultural stress experienced as a sort of existential disillusionment. The second one is occupational stress related to specific work conditions and to facing responsibility or danger [35].

The social effects pertain to the non-occupational life of workers engaged in shift and night-time work. Carrying out work at a time when others are asleep, which makes it necessary to sleep during the day, is undoubtedly a major problem for a person active in family and social life. Unfortunately, shift or night-time work constitutes an obstacle to family and social relationships. The time spent on rest after a night shift usually means less time for family or friends. This may lead to weakening relationships with the close ones, which in turn can potentially cause addictions [36].

A plan for the management of the risk of fatigue should be based on light and darkness control, which can ensure health, productivity and safety [37]. The key factor of circadian system regulation is exposure to or avoidance of bright light at specific times of the “biological night” [38]. It is essential that shift workers be made aware what risks they are exposed to in connection with this type of work. Preventive programmes should be created and implemented in work establishments so as to deepen the employees’ awareness and to increase the level of individual knowledge [39-44]. Work overload may in consequence lead a nurse to abandon her profession or continue exercising it – which may result in occupational burnout. In order not to allow such a situation, an appropriate work environment should be created, starting from a nice and friendly atmosphere to proper equipment facilitating work and enhancing the quality of work. Thanks to this, nurses will approach their duties more optimistically and the patients will enjoy care of the highest standard.

**V. REFERENCES**


