

Evaluation of work conditions of nurses employed in a shift system in hospital wards during the COVID-19 pandemic

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Received 25 May 2022

Accepted 22 November 2022

Abstract.

BACKGROUND: Nurses work in a shift system that determines the provision of round-the-clock care of a patient in hospital conditions; however, it entails health consequences.

OBJECTIVE: The aim of the study was the evaluation of work conditions of nurses engaged in shift work in hospital wards during the COVID-19 pandemic.

METHODS: The study was conducted in 2020, and included 108 nurses working in a shift system in hospital wards. The research method was a diagnostic survey, using an author-constructed questionnaire.

RESULTS: 88.9% of nurses reported a negative effect of shift work on their physical health: 'musculoskeletal pain', 'elevated arterial blood pressure', and 'hormonal disorders' - 54.5% of respondents used pharmacological treatment. The causes of physical disorders were: 'microclimate', 'physical effort', 'noise', and 'forced body position'. Shift work exerted a negative effect on psychological health of the majority of respondents (75.0%): 'deconcentration', 'sleep disorders', 'feeling of occupational burnout' - treatment in 38.9% of respondents. Psychological health disorders were caused by: 'circadian rhythms disturbance by shift work', 'chronic stresses', and 'conflicts at work'. 69.7% of respondents reported that their shift work was disturbed by organizational factors, including: a 'badly planned work schedule', 'enhanced pace of work due to staff shortage', 'ambiguous division of duties, rights, responsibilities', 'shortages of equipment at the workplace'.

CONCLUSION: The examined nurses experienced a negative effect of shift work on their physical and psychological health which, for some of them, was the cause of pharmacological treatment. Many organizational factors hindered the work of nurses in a shift system in hospital wards.

Keywords: Shift work of nurses, physical health, psychological health, occupational burnout, health consequences shift work

1. Introduction

Work conditions are a set of factors which occur in the work environment and result from the work process at a given workplace. The conditioning of work

in various situations may be noxious, or create risk for the health of employees. According to Kosińska and Kułagowska, the shaping of proper work conditions provides adequate occupational safety and work hygiene. It includes many elements related with the work process [1].

Studies conducted by researchers from Poland, Canada, and the USA showed that working time is one of the important elements of the work environment, and its distribution should be consistent with

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current regulations. Despite observance of working time standards shift work may have a negative effect on human health. Work in a shift system is associated with disorders in daily life of an employee, e.g. sleep, leisure, or mode of nutrition. Apart from this, it may exert a negative effect on the functioning of the nervous, gastrointestinal and hormonal systems, motor organs, and may also disrupt family and social relationships [2–4].

Steege et al. and Banakhar emphasize that nurses and midwives in order to provide round-the-clock care of a patient treated in inpatient care must work in a shift system, and these are often 12-hour shifts negatively affecting their health [5, 6].

In researchers' opinions (Kecklund and Axelsson, as well as Zisapel), shift work of nurses, especially at night, causes disruption of the physiological processes of the body, and disturb homeostasis, which leads to disturbance of the circadian rhythm, sleep disorders, and suppression of melatonin secretion due to artificial light at night. It also leads to disorders in the functioning of the gastrointestinal system [7, 8].

Italian researchers (Ferri, Guadi, Marcheselli et al.) confirmed that shift work of nurses leads to the intensification of fatigue, decrease in concentration and efficiency, as well as development of many diseases. Also, nurses' fatigue with shift work carries the risk of undesirable events and medical errors in patient care [9]. According to researchers from the United Kingdom an important aspect in the improvement of the quality of work of nurses in a shift system is the correct organization of shift duties, e.g. compliance with the weekly, monthly norm, prevention of working overtime, and observance of the work schedule [10].

According to Turkish researchers (Potas, Koçtürk, Toygar) nurses taking care of patients with COVID-19 experience sleep disorders, anxiety, physical and psychological fatigue, however, this study did not take the shift work system into consideration [11].

In the opinion of Duński and his team from Iran, nurses, while taking care of patients severely ill with COVID-19, experience strong psychological stress, followed by physical load. A review of early relevant literature showed that the researchers also did not consider shift work of nurses [12].

A group of researchers from Turkey, based on a study conducted during 2020/2021 at the University Hospital of Istanbul among medical staff taking care of patients with COVID-19, confirmed an increase in absenteeism and loss of manpower. The researchers did not take shift work into account [13].

Therefore, it was considered important to recognize the opinions of nurses employed in a shift system in hospital wards concerning factors which hinder their work.

2. Objective

The aim of the study was to evaluate work conditions of nurses employed in a shift system in hospital wards during the COVID-19 pandemic.

3. Materials and method

3.1. Population and research project

The study was conducted within the Student's Scientific Circle at the University of Economics and Innovation in Lublin (WSEI), Poland, from 2 January - 28 February 2020. The research project was submitted to the Dean's Office at the WSEI by the co-author of the research work – member of the Student's Scientific Circle at the WSEI in Lublin (Catalogue No. 33787/2017), and consent for the study was obtained from the Dean of the WSEI in Lublin. Considering the beginning of the COVID-19 pandemic in China the study was carried out through the social networking site using the Google Forum, and the social media. The study included 108 nurses. The largest number of respondents were aged 31–40 (33.3%), the number of females participating in the study was considerably higher than that of males - 88.9% and 11.1%, respectively. In the study group the number of urban inhabitants was three times higher than that of rural inhabitants – 75.0% and 25.0%, respectively. The largest number of nurses participating in the study had higher Master's degree education (41.7%). A half of the nurses in the study had work experience in a shift system from 16 - 25 years (50.0%).

3.2. Selection of the study group

Nurses for the study were selected at random. The criterion of selection was employment of nurses in hospitals, where adults were hospitalized. The place of work were hospital wards of conservative or surgical profile during the COVID-19 pandemic. For the study were qualified exclusively nurses working 12 hour day and night shifts. The criterion of exclusion was working in a single-shift system (in inpatient and outpatient care). Apart from this, nurses who retired

or discontinued practice of the nursing profession, despite their previous work in a shift system before COVID-19 pandemic were excluded from the study.

3.3. Method and research tool

The research method was a diagnostic survey, and the research tool an author constructed questionnaire designed specifically for the purpose of the presented study. The questionnaire consisted of closed questions arranged in 4 domains entitled:

Domain I – Effect of shift work on the state of physical health of nurses employed in hospital wards. The questions were as follows: In your opinion does work in the ward in a shift system negatively affect the state of your physical health? If yes what type of complaints have you experienced in association with shift work? Which noxious factors occur in your shift work and negatively affect your physical health? Do you receive pharmacological treatment due to physical health disorders?

Domain II – Effect of shift work on the state of psychological health of nurses employed in hospital wards. The questions were: In your opinion does work in the ward in a shift system negatively affect the state of your psychological health? If yes what type of complaints have you experienced in association with shift work? Which noxious factors occur in your shift work and negatively affect your psychological health? Do you receive pharmacological treatment due to psychological health disorders?

Domain III – Organizational conditions of work of nurses employed in hospital wards in a shift system. The set of questions: In your opinion do the organizational conditions hinder your work in the ward in a shift system? If yes what types of organizational conditions hinder your work in the ward in a shift system?

Domain IV – Demographic and social data. The questions concerned: gender, age, place of residence, education, work experience in a shift system.

The research process was preceded by a pilot study, which enabled the verification of the author-constructed questionnaire. The questions were understandable for all and ensured the reliability of answers.

3.4. Statistical analysis

Statistical analysis was performed using the following methods: parametric (quantitative and percentage calculations), and Pearson's χ^2 test for

independence assuming the level of significance $p < 0.05$ or $p > 0.05$. Calculations were made using the software Microsoft Office Excel 2007, and statistical package IBM SPSS 23.

4. Results

4.1. Characteristics of the study group

The study included 108 nurses who worked in a shift system in hospital wards on day and night shifts. The number of females participating in the study was considerably higher than that of males (88.9% and 11.1%, respectively). The largest number of respondents were aged 31–40 (33.3%), whereas the smallest in the oldest group, i.e. aged 51–60 (13.9%). The largest number of nurses had higher Master's degree education (41.7%), followed by those with secondary school education (25.0%), whereas the smallest group were respondents with licentiate education (33.3%). In the study group the percentage of urban inhabitants was three times higher than that of urban inhabitants – 75.0% and 25.0%, respectively. Analysis of data concerning work experience of nurses in a shift system showed that the largest number of respondents had work experience from 16–25 years (50.0%), while nurses with the longest work experience in a shift system (more than 26 years) constituted 13.9%.

4.2. Negative effect of shift work on the state of physical health

The majority of nurses in the study (88.9%) considered that shift work exerted a negative effect on their physical health (88.9%), while 11.1% of respondents replied 'difficult to say'. None of the respondents reported that shift work 'does not affect' physical condition of the body – Table 1.

Socio-demographic factors, i.e. gender, age, place of residence, education, and work experience in a shift system did not significantly determine the effect of the work of nurses in a shift system on the state of their physical health ($p > 0.05$). Females more frequently than males mentioned that shift work negatively affects the state of their physical health – 89.6% and 83.3%, respectively. Nurses who had work experience from 22–25 years most often perceived a negative effect of shift work on their physical health (92.6% in this group). Physical health disorders were more frequently reported by nurses with Master's degree education (95.6%), compared to those with

a lower level of education and those with work experience in a shift system from 6-15 years (95.5%), compared to the groups with other work experience.

The respondents' answers were analyzed from the aspect of physical complaints related with shift work, with consideration of independent variables (gender, age, place of residence) – Table 2.

The physical complaint related with shift work most frequently reported by the respondents was 'musculoskeletal pain' (30.9%), followed by 'elevated arterial blood pressure' (19.9%), and 'hormonal disorders' (18.1%). In addition, the respondents mentioned also 'headache', and 'feeling of fatigue at night' (9.7% each), as well as 'gastrointestinal motility disorders' (6.1%), and 'obesity' (5.3%).

In the opinions of the nursing staff in shift work there occurred various noxious factors which negatively affected the state of physical health – Fig. 1.

Among noxious factors occurring in shift work which negatively affect the state of physical health the nurses most frequently reported 'microclimate' (25.2%), and 'physical effort' (22.0%), followed by 'noise', and 'forced body position' (20.0% each). The list of noxious factors included also 'insufficient night-time nurse staffing' (12.6%).

More than a half of nurses employed in a shift system (54.5%) received pharmacological treatment due to physical health disorders, 28.8% of respondents took medicines 'periodically in the past', whereas the reminder (16.7%) did not use pharmacotherapy – Table 3.

Pharmacological treatment due to physical health disorders related with shift work was more often applied by respondents living in urban areas (58.0%), compared to rural inhabitants (44.4%), which was statistically significant ($p=0.026$). Also, urban

Table 1

Respondents' opinions concerning negative effect of shift work on the state of their physical health according to respondents' gender, age, and place of residence

Effect of shift work on the state of physical health		Total	Gender		Age				Place of residence	
			F	M	22-30	31-40	41-50	51-60	U	R
Yes	n	96	86	10	25	33	26	12	70	26
	%	88.9	89.6	83.3	92.6	91.7	86.7	80.0	86.4	96.3
No	n	–	–	–	–	–	–	–	–	–
	%	–	–	–	–	–	–	–	–	–
Difficult to say	n	12	10	2	2	3	4	3	11	1
	%	11.1	10.4	16.7	7.4	8.3	13.3	20.0	13.6	3.7
Total	n	108	96	12	27	36	30	15	81	27
<i>Result of Chi² test</i>			$p=0.516$		$p=0.571$				$p=0.157$	

Table 2

Respondents' opinions concerning the experienced physical complaints related with shift work, according to gender, age, and place of residence

Type of physical complaints experienced in relation with shift work		Total	Gender		Age				Place of residence	
			K	M	22-30	31-40	41-50	51-60	M	W
Elevated arterial blood pressure	n	45	39	6	11	18	11	5	33	12
	%	19.9	19.5	22.2	19.2	23.0	16.4	21.7	20.1	19.3
Feeling of physical fatigue at night	n	22	20	2	6	7	7	2	17	5
	%	9.7	10.0	7.4	10.5	8.9	10.4	8.6	10.3	8.0
Headache	n	22	19	3	6	8	6	2	18	4
	%	9.7	9.5	11.1	10.5	10.2	8.9	8.6	10.9	6.4
Musculoskeletal pain	n	70	63	7	20	23	20	7	48	22
	%	30.9	31.6	25.9	35.0	29.4	29.8	30.4	29.2	35.4
Obesity	n	12	11	1	4	3	4	1	9	3
	%	5.3	5.5	3.7	7.0	3.8	5.9	4.3	5.4	4.8
Hormonal disorders	n	41	36	5	8	15	15	3	28	13
	%	18.1	18.0	20.8	14.0	19.2	22.3	13.0	17.0	20.9
Gastrointestinal motility disorders	n	14	11	3	2	5	4	3	11	3
	%	6.1	5.5	11.1	3.5	6.4	5.9	13.0	6.7	4.8
Number of answers	n	226	199	27	57	78	67	23	164	62

Possibility to choose several answers, the results do not sum up to 100%.

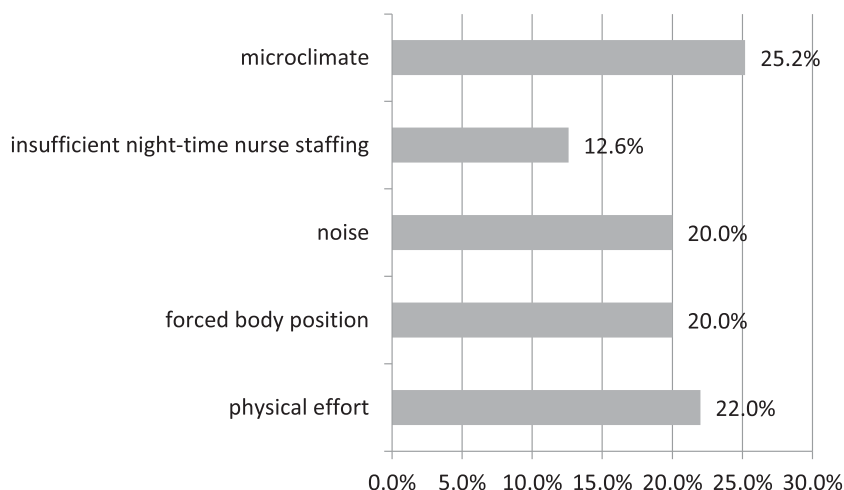


Fig. 1. Most frequent noxious factors affecting the state of physical health occurring in shift work according to respondents' opinions.

Table 3

Respondents' opinions concerning pharmacological treatment due to physical complaints related with shift work according to gender, age, and place of residence

Pharmacological treatment due to physical complaints		Total	Gender		Age				Place of residence	
			K	M	22-30	31-40	41-50	51-60	M	W
Yes	n	59	51	6	20	17	15	7	47	12
	%	54.5	53.1	60.0	74.0	47.2	50.0	46.6	58.0	44.4
No	n	18	15	3	4	6	6	2	16	2
	%	16.7	15.6	30.0	14.8	16.7	20.0	13.4	19.7	7.4
Periodically in the past	n	31	30	1	3	13	9	6	18	13
	%	28.8	31.3	10.0	11.2	36.1	30.0	40.0	22.3	18.2
Total		n 108	96	10	27	36	30	15	81	27
		Result of χ^2 test	$p=0.238$		$p=0.306$				$p=0.026$	

inhabitants more frequently than rural inhabitants used pharmacological treatment periodically in the past - 22.3% and 18.2%, respectively. Gender, age, education, and work experience in a shift system did not significantly determine pharmacological treatment due to physical health disorders ($p > 0.05$). Males, respondents aged 22–30 (74.0%), with licentiate in nursing (66.7%), and work experience in shift work of less than 5 years (82.4%) more often declared pharmacological treatment.

4.3. Negative effect of shift work on the state of psychological health

The negative effect of shift work on the state of psychological health was confirmed by 75.0% of respondents, whereas 16.7% of them admitted that it is 'difficult to say'. A small group of respondents – 8.3% did not perceive a negative effect on psychological health – Tables 4 and 5.

Negative effect of shift work on the state of psychological health of the examined nurses was significantly related with gender ($p = 0.035$) and the level of education ($p < 0.001$). Females more often than males experienced a negative effect of shift work on their psychological health – 77.0% and (58.3%), respectively. They mentioned that before night duty they had accumulated household chores. Apart from this, they observed in themselves mood swings associated with the menstrual cycle, and shift work intensified these complaints. Before the pandemic approximately 12.0% of the examined women worked in a single shift system due to their family roles, whereas during the COVID-19 pandemic the work conditions were changed from working during the day into shift work. Males significantly more frequently than females reported that it is 'difficult to say' whether work in the ward in a shift system exerts a negative effect on the state of psychological health – 41.7% and 13.6%, respectively. Respondents with Master's degree considerably more

Table 4

Respondents' opinions concerning a negative effect of shift work on the state of psychological health according to gender, age, and place of residence

Effect of shift work on the state of psychological health		Total	Gender		Age				Place of residence	
			K	M	22-30	31-40	41-50	51-60	M	W
Yes	n	81	74	7	18	27	25	11	60	21
	%	75.0	77.0	58.3	66.7	75.0	83.3	73.4	74.0	77.8
No	n	9	9	–	4	4	1	–	8	1
	%	8.3	9.4	–	14.8	11.1	3.3	–	10.0	3.7
Difficult to say	n	18	13	5	5	5	4	4	13	5
	%	16.7	13.6	41.7	18.5	13.9	13.4	26.6	16.0	18.5
Total	n	108	96	12	27	36	30	15	81	27
<i>Result of Chi² test</i>			<i>p=0.035</i>		<i>p=0.458</i>				<i>p=0.595</i>	

Table 5

Respondents' opinions concerning a negative effect of shift work on the state of psychological health according to education and work experience

Effect of shift work on the state of psychological health		Education			Work experience in a shift system				
		Secondary school	Licentiate in nursing	Master's degree in nursing	Less than 5 years	6-15	16-25	More than 26 years	
Yes	n	29	15	37	11	16	43	11	
	%	80.5	55.5	82.2	64.8	72.8	79.6	73.4	
No	n	–	7	2	1	3	5	–	
	%	–	26.0	4.4	5.8	13.6	9.2	–	
Difficult to say	n	7	5	6	5	3	6	4	
	%	19.5	18.5	13.4	29.4	13.6	11.2	26.6	
Total	n	36	27	45	17	22	54	15	
<i>Result of Chi² test</i>			<i>p<0.001</i>			<i>p=0.394</i>			

often (82.2%) experienced problems in the emotional sphere. The majority of the nurses in this group had specialization and used additional attractive work offers during the pandemic. Approximately 10.0% of respondents with higher education and specialization were periodically delegated by the decision of the chief provincial administrative officer to dedicated COVID-19 hospitals to provide care for severely ill patients infected with SARS-CoV-2 virus (unconscious, under monitoring, on a respirator). Apart from this, about 5.0% of the examined nurses after completing Master's degree study undertook specialization in various nursing specialities. Frequently, on a day free of work, or after/before night duty they had internship training in another hospital.

It was confirmed that respondents with licentiate education significantly more frequently than those who had Master's degree mentioned that shift work did not affect the state of their psychological health – 26.0% and 4.4%, respectively. No significant differences were observed between the respondents' age, place of residence and work experience in a shift system, and a negative effect of shift work on psycho-

logical health ($p > 0.05$). However, respondents aged 41-50 (83.3%), living in rural areas (77.8%), who had work experience from 16-26 years (79.6%) indicated a negative effect of shift work on their psychological health.

The concept of the study considered also the recognition of the type of psychological complaints which occurred in nurses in relation to shift work – Fig. 2.

The psychological complaint related with shift work most often mentioned by the respondents was 'deconcentration' (28.6%), followed by 'sleep disorders' (20.7%), the 'feeling of occupational burnout', and 'decreased resistance to stress' (17.0% each). Among the complaints the respondents also indicated the 'feeling of psychological fatigue at night' (16.4%).

In the opinions of nurses in the study shift work was accompanied by various noxious factors, which negatively affected the state of their psychological health. According to $1/3$ of the respondents the most frequent factor related with shift work which negatively affected the state of psychological health was 'circadian rhythm disturbance by shift work'

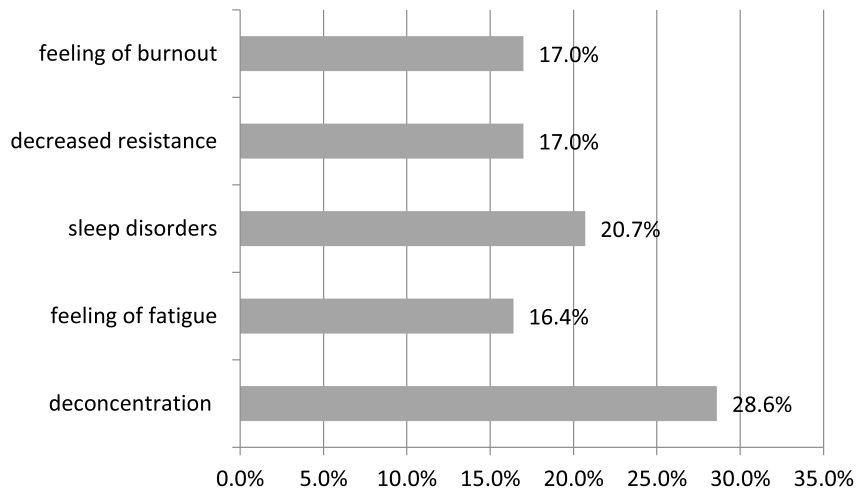


Fig. 2. Most frequent psychological complaints accompanying shift work in respondents' opinions.

(34.7%), more often reported by females than males – 35.6% and 28.5%, respectively, followed by 'chronic stress' (22.6%), 'conflicts at work' (16.0%), 'insufficient payment for shift work' (13.9%), and 'noise' (12.6%).

The majority of nurses employed in a shift system did not use pharmacological treatment (50.9%). More than $\frac{1}{3}$ of the respondents (38.9%) definitely took medicines, while 10.2% of the examined nurses used such treatment periodically in the past – Table 6.

The respondents' age, their place of residence, level of education, and work experience in a shift system did not significantly determine pharmacological treatment due to psychological health disorders ($p > 0.05$); however, females declared pharmacological treatment more often than males – 40.6% and 25.0%, respectively. Apart from this, medicines were more often used by respondents aged 22-30 (48.2%), compared to the remaining age groups, those living in urban areas (43.1%), compared to rural inhabitants (25.9%), who had Master's degree (44.5%), compared to the groups with a lower level of education, and respondents with the shortest work experience in a shift system – less than 5 years (41.2%), compared to those with a longer work experience.

4.4. Difficulties at shift work due to organizational conditions

More than a half of respondents (69.5%) considered that many organizational conditions hindered shift work. As many as 17.6% of them had problems with specifying this issue, whereas 12.9% of the examined female and male nurses admitted that

organizational conditions did not hinder their work in a shift system – Table 7.

Respondents' age, their place of residence, level of education, and work experience in a shift system did not significantly determine organizational conditions hindering work in a shift system ($p > 0.05$).

Females more often than males observed problems in the organization of work in a shift system – 69.7% and 66.7%, respectively. Problems of organizational nature were more frequently perceived by nurses aged 41-50 (76.7%), compared to those in other age groups. As a justification the women reported that the source of problems were prolonged duties which hindered the fulfilment of family roles. Sometimes a change of work schedule and the decision about taking an additional duty working overtime caused frustration due to the accumulation of household chores. These problems were more frequently observed by urban inhabitants (71.7%), compared to rural inhabitants (62.9%). Urban inhabitants more often mentioned difficulties with the organization of work, compared to respondents living in rural areas. The respondents indicated that switching to a shift system, or working overtime during COVID-19 pandemic, made it impossible for them to work in another treatment facility (most often a private sector functioning in cities) in the afternoon hours or on a day off. Difficulties with the organization of work were more frequently perceived by respondents with secondary school education (72.2%), compared to nurses with higher education (licentiate – 70.3%; Master's degree – 66.7%). The nurses justified that having secondary school education before the COVID-19 pandemic they more often worked in a single-shift

Table 6

Respondents' opinions concerning pharmacological treatment due to psychological complaints related with shift work according to gender, age, and place of residence

Pharmacological treatment due to psychological complaints		Total	Gender		Age				Place of residence	
			K	M	22-30	31-40	41-50	51-60	M	W
Yes	n	42	39	3	13	12	12	5	35	7
	%	38.9	40.6	25.0	48.2	33.4	40.0	33.3	43.1	25.9
No	n	55	48	7	12	20	14	9	40	15
	%	50.9	50.0	58.4	44.4	55.5	46.6	60.0	49.8	55.6
Periodically in the past	n	11	9	2	2	4	4	1	6	5
	%	10.2	9.4	16.6	7.4	11.1	13.4	6.7	7.4	18.5
Total	n	108	96	12	27	36	30	15	81	27
		<i>Result of Chi² test</i>	<i>p=1.371</i>		<i>p=2.442</i>				<i>p=4.161</i>	

Table 7

Respondents' opinions concerning organizational conditions hindering shift work according to gender, age, and place of residence

Difficulties in shift work due to organizational conditions		Total	Gender		Age				Place of residence	
			K	M	22-30	31-40	41-50	51-60	M	W
Yes	n	75	67	8	20	22	23	10	58	17
	%	69.5	69.7	66.7	74.1	61.2	76.7	66.7	71.7	62.9
No	n	14	13	1	2	7	2	3	8	6
	%	12.9	13.6	8.3	7.4	19.4	6.7	20.0	9.8	22.3
Difficult to say	n	19	16	3	5	7	5	2	15	4
	%	17.6	16.7	25.0	18.5	19.4	16.6	13.3	18.5	14.8
Total	n	108	96	12	27	36	30	15	81	27
		<i>Result of Chi² test</i>	<i>p=0.659</i>		<i>p=4.237</i>				<i>p=2.756</i>	

system in outpatient care, without overtime hours, and had no specialization in various clinical nursing specialities. During the pandemic their working conditions changed from a single-shift into the shift system, thus they faced the necessity to work overtime, and provide care for patients in a severe clinical condition. Difficulties with the organization of work were more often reported by nurses with work experience in a shift system from 16-25 years (72.2%), compared to the groups with other duration of work experience. They indicated that their occupational activity before the COVID-19 pandemic was more systematized, and the specificity of the ward was in line with their interests. The COVID-19 pandemic caused reorganization of wards, suspension of wards, current rotation, frequent change of work schedule, and an enhanced pace of work, which was the source of stress.

In respondents' opinions there are various organizational determinants which hinder shift work in a hospital ward – Fig. 3. They indicated eight main factors which disorganized shift work: 'badly planned work schedule' (17.2%), 'enhanced pace of work due to staff shortage' (16.4%), 'ambiguous division of duties, rights, and responsibilities' (15.1%), 'shortages of equipment at the workplace' (13.5%),

'poor lighting' (12.7%), 'fluctuation of nursing staff' (11.9%), 'lack of procedures, occupational standards' (6.8%), and 'overtime work' (6.1%).

5. Discussion

The presented study demonstrates an assessment of work conditions of nurses employed in a shift system in hospital wards in health care facilities during the COVID-19 pandemic. According to researchers work in a shift system, especially at night, disturbs the circadian rhythm, which may result in various types of disorders in physical health. In the opinion of Polish researchers (Serzysko, Podsiadło, Kazimierczak), shift work is a risk factor of complaints on the part of individual systems of the body [2]. A study conducted in 2016 by Szymańska-Czechór and Kędra among nurses employed in health facilities on various duties (24% of them worked at night) showed that 83.3% of respondents mentioned the disruption of the rhythm of physiological processes of the body [14]. Our study showed that the majority of nurses in the study (88.9%) considered that shift work exerted a negative effect on the state of their physical health. A small group of respondents (11.1%) provided an

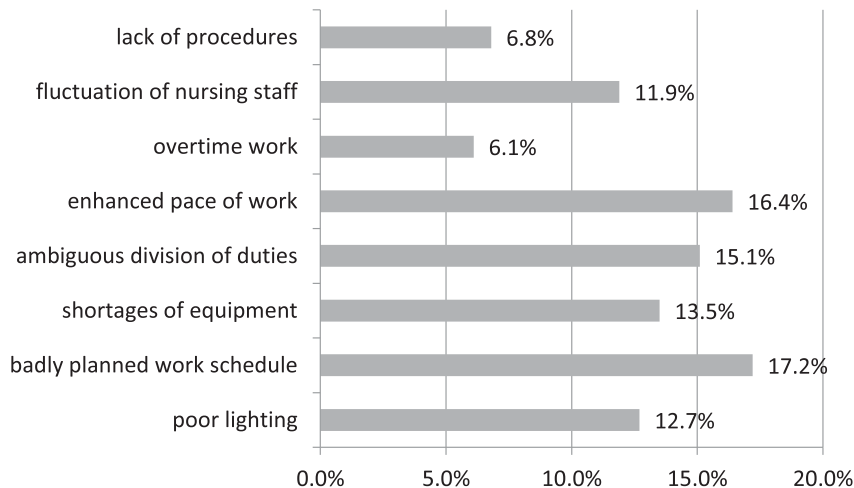


Fig. 3. Most frequent organizational factors hindering shift work in a hospital ward according to respondents' opinions.

answer 'difficult to say', and none of them denied this.

According to the opinions of two teams of researchers (Matheson et al., and Zhang et al.), shift work negatively affects physical health and causes many complaints on the part of the motor organs, as well as musculoskeletal disorders, which may be the cause of claims for compensations by nurses [15, 16]. Relevant literature shows that work in a shift system is associated with an increased BMI, carries the risk of abdominal obesity, and increases the risk of type 2 diabetes [17–20]. A study carried out in the years 2014–2015 in Norway confirmed the occurrence of various complaints among nurses employed in a shift system: pain in the neck and shoulders, upper back, upper extremities, lower back, lower extremities ($p < 0.001$), or abdominal pain ($p < 0.001$) [21]. Our study indicated that the somatic disorders most frequently mentioned by nurses employed in a shift system were: 'musculoskeletal pain' (30.9%), 'elevated arterial blood pressure' (19.9%), and 'hormonal disorders' (18.1%). In addition, the nurses also reported 'headache', and 'feeling of physical fatigue at night' (9.7% each).

According to researchers (Sabeti and Moravveji), among Iranian nurses on duties in a shift system, complaints occurred on the part of the gastrointestinal system. A vast majority in this group - 81.9% complained of at least one ailment, i.e. diarrhoea, bloating, constipation, heartburn, and some of them mentioned tarry stools [22]. A study conducted by a team of researchers under the direction of Cooperato confirmed the occurrence of overweight and

obesity in 12% of nurses employed in a shift system [23]. A study of a large group of nurses in France also confirmed that nurses employed in a shift system more frequently reported overweight, compared to those working only during the day shift [24]. Our study demonstrated that the examined nurses also observed in themselves 'gastrointestinal motility disorders' (6.1%), and 'obesity' (5.3%). Physical complaints due to shift work mentioned by nurses were the cause of pharmacological treatment in more than a half of the respondents (54.5%), 28.8% of them used medicines 'periodically in the past', while the remainder (16.7%) did not use pharmacotherapy. According to $\frac{1}{4}$ of respondents (25.2%) the noxious factors occurring during shift work were: 'microclimate' (25.2%), followed by 'physical effort' (22.0%), as well as 'noise', and 'forced body position' (20.0% each). A part of the respondents (12.6%) indicated that shift work was hindered by 'insufficient nighttime nurse staffing' (12.6%).

Based on a study carried out by Franek et al. among nurses and midwives employed in various health care facilities in Poland, more than a half of the respondents (54.3%) frequently felt psychological fatigue [25]. Iranian researchers (Ardekani et al.) confirmed that 45% of nurses employed on various duties in hospitals in Iran had psychological disorders, work in a shift system resulted in disturbed social contacts (79.5%), and was associated with the occurrence of depression (11.2%) [26]. The current study showed that $\frac{3}{4}$ of the examined nurses confirmed the negative effect of shift work on the state of their psychological health (75.0%), whereas 16.7% of respondents

indicated 'difficult to say'. A small group of respondents – 8.3% did not mention health problems in the psychological sphere.

A study carried out in a hospital in Kongo by Ebate-tou, Atipo-Galloye, and Moukassa demonstrated that 13.6% of nurses employed in a shift system suffered from deconcentration, had sleep problems, and had taken sleeping pills within the last several months [27]. McDowall et al. emphasized that 12-hour nursing shifts lead to sleep disorders [28]. Zisapel reported that a regulated circadian rhythm plays an important role in the maintenance of human health [8]. According to Polish researchers (Galeba et al.), chronic stress during shift work may lead to occupational burnout in medical staff, including nurses [29]. Serzysko et al. confirmed that among Polish nurses shift work may be associated with various symptoms evidencing psychological health disorders, e.g., sleep disorders – difficulty falling asleep, sleeplessness, waking up at night (62.5%), irritation (38%), increased emotional tension (36%), lack of patience (18%), weariness (13%), and concentration disorders (12.5%) [2]. The presented study showed that the most frequent psychological complaint related with shift work was 'deconcentration' (28.6%), 'sleep disorders' (20.7%), 'feeling of occupational burnout' and 'decreased psychological resistance to stress' (17.0% each). A part of the respondents (16.4%) mentioned the 'feeling of psychological fatigue at night'. Analysis of the collected research material demonstrated that despite the reported psychological complaints related with work in a shift system more than a half of respondents (50.9%) did not use pharmacological treatment, while more than $\frac{1}{3}$ of them (38.9%) took medicines (among others, due to sleep disorders). Apart from this, it was confirmed that 10.2% of the examined nurses used pharmacological treatment 'periodically in the past' due to psychological health disorders. The presented study also demonstrated what factors exerted a negative effect on the state of psychological health of nurses employed in a shift system: 'circadian rhythm disturbance by shift work' (34.7%), 'chronic stress' (22.6%), 'conflicts at work' (16.0%), 'insufficient payment for shift work' (13.9%), and 'noise' (12.6%).

Australian researchers (Treuer and Fuller-Tyszkiewicz) found that the atmosphere during shift work facilitates optimum organizational conditions for nurses [30]. Ksykiewicz-Dorota emphasized that work schedule is very important in shift work of nurses [31], while Zahradniczek pointed out ambiguous division of duties, rights and responsibilities,

and equipment at the workplace [32]. Our study showed that more than a half of respondents (69.5%) experienced many difficulties during shift work due to organizational conditions. As major difficulties the respondents mentioned: 'badly planned work schedule' (17.2%), 'enhanced pace of work due to staff shortage' (16.4%), 'ambiguous division of duties, rights, and responsibilities' (15.1%), 'shortages of equipment at the workplace' (13.5%), 'poor lighting' (12.7%), 'fluctuation of nursing staff' (11.9%), 'lack of procedures, occupational standards' (6.8%), and 'overtime work' (6.1%).

6. Limitations

The limitation of the study was that its duration was too short - from 2 January – 28 February 2020, hence, the research sample was 108 nurses working on 12-hour day and night shifts. Due to the development of the COVID-19 pandemic, there were difficulties with admission to hospital wards. Therefore, the study was conducted through a social networking site using Google Forms and social media. It is advisable to extend the research on a larger sample during the period of escalation of epidemic threats.

7. Conclusions

The examined nurses experienced a negative effect of shift work during the COVID-19 pandemic on the state of their physical health (musculoskeletal pain, elevated blood pressure, hormonal disorders, headache, feeling of physical fatigue at night, gastrointestinal motility disorders, and obesity), and psychological health (deconcentration, sleep disorders, feeling of occupational burnout, decreased psychological resistance to stress, and the feeling of psychological fatigue at night), which, for some of them, was the cause of using pharmacological treatment. Many organizational factors (badly planned work schedule, enhanced pace of work due to staff shortage, ambiguous division of duties, rights, and responsibilities, shortages of equipment at the workplace, poor lighting, fluctuation of nursing staff, lack of procedures, occupational standards, overtime work) hindered nurses' work in a shift system in hospital wards.

Ethical approval

Not applicable.

Informed consent

Not applicable.

Conflict of interest

None to report.

Acknowledgment

The authors are grateful to all individuals who participated in the study.

Funding

Not applicable.

Author contributions

Study design: LS, EP; Manuscript writing: LS, EP; Data collection: EP; Data analysis: LS, EP; Study supervision: LS; Critical revisions for important intellectual content: LS.

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