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Article

The Impact of Shift Work on Perceived Sleep Quality Among Nurses and Technicians

Short Name: Shift Work and Sleep Quality

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Abstract

INTRODUCTION: Sleep is not a passive state, but a vital process that ensures the renewal and regulation of the whole organism, especially the brain. Sleep disorders, which are increasingly prevalent among nurses and shift technicians, have a significant impact on their mental health and cognitive functions, increasing the risk of developing various health problems. RESEARCH OBJECTIVES: The aim of this study was to investigate the impact of shift work on the perceived sleep quality of nurses and technicians, with an emphasis on the differences between those who work in shifts and those who work in one shift, and to compare mental health and the incidence of chronic diseases between these two groups. METHODS: The research included a survey of 299 nurses and technicians in the Republic of Croatia, of which 190 were included in the analysis. The data were collected through an anonymous online questionnaire that included sociodemographic questions, the Pittsburgh Sleep Quality Scale, the Depression, Anxiety and Stress Scale, and questions about chronic diseases. Statistical analysis was conducted using the t-test and the Chi-square test to investigate the impact of shift work on sleep quality and mental health. RESULTS: The results showed that shift-working MS/MTs had poorer perceived sleep quality with an average PSQI score of 8.9 versus 6.6 in single-shift workers. Although participants in shifts had a higher presence of symptoms of depression, anxiety and stress, the difference in the incidence of chronic diseases between the two groups was not statistically significant. Therefore, while shift work negatively affects sleep quality, the effect on mental health and the incidence of chronic diseases has not been confirmed. CONCLUSION: The study showed that shift work significantly impairs the quality of sleep of nurses and technicians, while the differences in the levels of depression, anxiety and the incidence of chronic diseases were not statistically significant. These results indicate the need for further research and adaptation of working conditions in order to reduce the negative consequences of shift work on health.

Keywords: quality; nurses-technicians; shift work; sleep

1. Introduction

Sleep is far from a passive state, it is a vital process for the renewal and regulation of the whole organism, especially the brain. Sleep disorder disrupts critical neural processes and impairs cognitive functioning [1,2]. Changing these processes provides a mechanical link through which insufficient sleep contributes to the onset or deterioration of mental health, brain disorders and chronic diseases. Sleep problems among nurse technicians (MS/MT) in shifts are increasingly recognized as a significant problem at both the individual and organizational levels. However, solutions are often dependent on the system in which MS/MT is employed. The term "shift work" generally refers to a way of organizing daily working hours in which different people or teams work consecutively to cover more than the usual 8-hour day, up to and including all 24 hours [3]. Shift work disrupts the

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circadian rhythm of individuals. This is characterized by sleep disturbances, among other adverse health consequences, such as gastrointestinal and cardiovascular diseases and psychological symptoms including anxiety and irritability [3–6]. In terms of shift patterns, rotating night shifts have been shown to be associated with greater health risks than permanent night shifts [7]. Research by Samah and Berger has shown that shift work is a danger in the workplace , as it often causes poor sleep quality which can negatively affect patient safety and MS/MT, as it leads to adverse consequences in the provision of health care [8–11]. *The Royal College of Nursing* (RCN) reports that MS/MTs are often tired due to shift work, which reduces their ability to provide quality care [12].

As sleep disorders are an important predictive factor that affects the occurrence of various chronic diseases such as hypertension and cardiovascular diseases, and diabetes, the quality of sleep must also be taken into account [13–16]. However, as modern MS/MT work becomes more and more complex, working hours are getting longer, and the tasks that need to be performed without a break are increasing, thus reducing the time and quality of sleep [17–20]. In particular, shift workers like MS/MT have irregular sleep patterns due to changes in working hours. The main goal of this research was to determine the impact of shift work on the perceived sleep quality of MS/MT. This research may contribute to a better understanding of the impact of shift work on MS/MT sleep quality, and guide future research and interventions to improve MS/MT sleep quality and mental health care, especially those working in shifts.

2. Subjects (Materials) and Methods

2.1. Respondents

299 nurses (MS/MT) employed in the Republic of Croatia participated in the survey. Given the larger number of respondents working in shifts (N = 204) compared to those working in one shift (N = 95), the number of respondents in the larger group was reduced to the number of respondents in the smaller group, taking into account the order in which the questionnaire was completed, and 190 respondents were included in the research. The subjects were divided into two groups: 95 respondents working in shifts (day/night) and 95 respondents working in one shift (morning/afternoon) – the control group. The division of respondents into groups was carried out after data collection. The sample was collected using a convenient sampling method during March and April 2025 through an online survey created in *Google Forms*. The study included MS/MT of different gender, age, seniority and level of education. The pattern is convenient, which limits the possibility of generalization.

2.2. Procedure and Instruments

The data in this survey was collected through an anonymous online questionnaire created on *the Google Forms platform*. The link to access the questionnaire was distributed to respondents via communication platforms *WhatsApp*, *Viber*, closed *Facebook* groups and e-mail. The questionnaire consisted of four parts. The first part contained three sociodemographic questions about gender, age and mode of work (shift or in one shift). Data on gender and age were used to describe the demographic description of the sample, while the question about the way of working allowed the respondents to be divided into two groups: those who work in shifts and those who work in one shift (control group). All the questions in this part were of a closed type. The second part of the questionnaire used the Pittsburgh Sleep Quality Scale (PSQI) to assess the quality of participants' sleep over the past month [21]. To use PSQI, the necessary permission has been obtained from the University of Pittsburgh. The scale consists of nine questions, four of which are open and five closed, and assesses seven components of sleep. The PSQI scoring was carried out according to established criteria. The third part of the questionnaire contained the Depression, Anxiety and Stress Scale (DASS) to assess the mental health of the respondents [22]. The scale consists of 42 statements divided into three subscales. Participants rated the frequency of certain feelings over the past week. The Croatian version of the DASS scale was used. The fourth part of the questionnaire included two

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questions about the presence and type of chronic diseases or conditions. The estimated time to complete the questionnaire was 10-15 minutes. In the introductory part of the questionnaire, the respondents were informed about the goal and content of the research, the anonymity and voluntary nature of participation, and their consent to the use of data.

2.3. Statistical Data Processing

The measured variables in this study were: independent variable - type of shift (day/night or morning/afternoon), expressed on a nominal scale and described in absolute frequencies and percentages; and dependent variables: perceived sleep quality (score range 0-21), expressed on a ratio scale and described by the arithmetic mean and standard deviation; mental health problems (score range 0-126 and 0-42 per subscale, respectively), and the presence ("yes", "no") and type of chronic diseases, expressed on a nominal scale and described in absolute frequencies and percentages. To test hypotheses H1, H2 and H3, the t-test for independent samples was used, while the Chi-square test was used to analyze the incidence of chronic diseases (H4). Statistical significance is defined by a p-value less than or equal to 0.05. The data were processed in the Statistica 12 program (Tibco, California).

2.4. Ethical Aspects of Research

This study was conducted as a low-risk study. The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Faculty of Health Studies Rijeka (Protocol code 602-04/25-01/219; 2170-1-65-01-2-25-1; and date of approval 11. 12. 2024.). In the introductory part of the questionnaire, the respondents were introduced to the aim and content of the research, and the filling out of the questionnaire itself represented informed consent to the use of data. Participation in the study was voluntary, and participants could opt out of the questionnaire at any time. The research was conducted in accordance with the basic ethical and bioethical principles – justice, charity, harmlessness and personal integrity, taking into account the Declaration of Helsinki. The privacy and integrity of the data subjects were not compromised.

3. Results

3.1. General Information

The study sample included 190 respondents, nurses and medical technicians (MS/MT) employed in the Republic of Croatia, the same number of those who work in shifts and those who work in one shift. The sample is dominated by women (90.53%), and all age groups are represented. Participants who work in one shift make up the control group in the study. Absolute and relative (percentage) frequency of respondents' responses to questions about gender, age and mode of work are shown in Table 1.

Table 1. *Tabular presentation of the sample description.*

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	Frequency	Percentage	Cumulative Frequency	Cumulative Percentage
GENDER				
Male	18	9,47	18	9,47
Female	172	90,53	190	100,00
DOB				
18-25	21	11,05	21	11,05
26-35	42	22,11	63	33,16
36-45	55	28,95	118	62,11
46-55	52	27,37	170	89,47
56-65	19	10,00	189	99,47
>65	1	0,53	190	100,00
HOW IT WORKS				
Work in shifts (day/night)	95	50,00	95	50,00
Work in one shift (morning/afternoon)	95	50,00	190	100,00

3.2. Measured Variables in Research

Table 2 provides some basic descriptive statistical measures for the variable PSQI – perceived sleep quality (total score on the PSQI scale), with regard to the way the subjects work. The following indicators are given: number of subjects in each group (N), minimum and maximum value of the variable (Min, Max), first quartile (Q1 – for 25% of respondents in the group, the value of the variable PSQI is less than or equal to Q1), arithmetic mean (M), standard deviation (SD – mean deviation from the arithmetic mean), median (Median - for 50% of respondents in the group, the value of the variable PSQI is less than or equal to the Median), the most common value (Mod) and the third quartile (Q3 - for 75% of respondents in the group, the value of the variable PSQI is less than or equal to Q3).

Table 2. *Descriptive statistical measures for PSQI.*

	N	Min	Max	Q1	M	SD	Median	Mod	Q3
Work in shifts (day/night)	95	1	20	6	8,9	3,6	9	10	11
Work in one shift (morning/afternoon)	95	0	17	4	6,6	3,6	6	4	8

A higher number of points on the PSQI scale indicates poorer sleep quality. In Table 2, all statistical indicators except the standard deviation are higher for the group of respondents who work in shifts (day/night) than for those who work in one shift, which indicates poorer sleep quality of those who work in shifts. A higher number of points on the DASS scale indicates the presence of symptoms of depression, anxiety and stress. In Table 3 as well as in Table 2, statistical indicators are

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higher for respondents who work in shifts, which indicates a higher presence of symptoms of depression, anxiety and stress in them than in the group working in one shift.

Table 3. *Descriptive statistical measures for DASS.*

	N	Min	Max	Q1	M	SD	Median	Mod	Q3
Work in shifts (day/night)	95	0	111	7	31,2	29,5	22	0	49
Work in one shift (morning/afternoon)	95	0	113	4	24,2	26,0	15	0	32

In the examined sample, 60% of respondents employed in shift work and 53.68% of respondents employed in one shift reported the presence of chronic diseases (Table 4).

Table 4. *Frequencies of chronic diseases by work schedule with χ^2-test results.*

NACIN_RADA(Mode?)	KRONICNA_BOLEST(Do you suffer from a chronic disease?)		
FrequencyPercentage in a rowPercentage in a column	DA	NE	Total
Work in shifts (day/night)	5760,0052,78	3840,0046,34	95
Work in one shift (morning/afternoon)	5153,6847,22	4446,3253,66	95
Total	108	82	190

Statistics DF Value p Chi-square 1 0.7724 0.3795.

The most common diseases in the subjects, both in those who work in shifts and in those who work in one shift, are obesity, asthma, heart and blood vessel diseases.

3.2.1. Perceived Sleep Quality MS/MT Depending on Shift Work

Differences in perceived sleep quality MS/MT depending on shift work were tested by parametric t-test for two independent samples. The respondents were divided into two groups: those who worked in shifts and those who worked in one shift. Both groups had the same and sufficiently large number of subjects, which met the prerequisites for the use of the t-test. The equality of arithmetic means of the variable PSQI (dependent variable) between the groups (null – hypothesis) was tested. The value of the PSQI variable < 5 is associated with good sleep quality, the value of the PSQI variable >= 5 is associated with poor sleep quality. With a statistical significance of α=0.05, the t-test result indicates a statistically significant difference in perceived sleep quality between groups ($p < \alpha$) indicating poor perceived sleep quality in shift nurses (MS/MT). The perceived sleep quality of single-shift MS/MTs is poor, but it is still better than that of MS/MTs who work shifts.

3.2.2. Incidence of Chronic Diseases Depending on Shift Work

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To analyze the incidence of chronic diseases depending on shift work, the Chi-square test was used to compare frequencies between groups (Table 4). There is no statistically significant difference in the incidence of chronic diseases between shift-work nurses (MS/MT) and those working in a single shift ($p = 0.3795 > \alpha = 0.05$).

4. Discussion

The study was conducted with the aim of examining the impact of shift work on sleep quality and the incidence of chronic diseases in MS/MT. The sample included 190 MS/MT, divided into two equal groups: those who worked in shifts and those who worked in one shift. The analysis included the Pittsburgh Sleep Quality Index (PSQI), the Depression, Anxiety and Stress Scale (DASS) and a self-assessment of the presence of chronic diseases.

The results showed a statistically significant difference in perceived sleep quality between the two groups ($p < 0.05$). MS/MTs working in shifts had a significantly higher mean PSQI score ($M = 8.9$, $SD = 3.6$) compared to those working in one shift ($M = 6.6$, $SD = 3.6$), which confirms the H1 hypothesis of poor sleep quality in MS/MT working shifts. Although the average PSQI score is also above the threshold of 5 for MS/MT single-shift workers, indicating poorer sleep quality, this score is still significantly lower compared to shift workers. These findings are in line with previous research that shows the negative impact of shift work on sleep.

McDowall et al. (2017) published a cross-sectional study conducted among 888 nurses, also using the PSQI questionnaire. The main conclusions of the study are that nurses who work in shifts have significantly poorer sleep quality compared to those who work standard hours. 78% of shift nurses reported poor sleep quality, compared to 59% of those who did not work shifts. The difference in sleep quality between the two groups was significant, with an average difference in sleep quality score of 1.58. Shift work was the only significant factor associated with poor sleep quality, even when age, gender, and years of work experience were taken into account [23]

Also, Alameri et al. (2024) published the results of their study conducted on 177 nurses working in highly demanding clinical settings in Saudi Arabia. The majority of nurses surveyed (73.4%) reported poor sleep quality, which is in line with global trends among healthcare professionals [24].

A study by Zhang et al. conducted in Shanghai, China, between 1 August and 30 August 2012. on a sample of 513 nurses using self-reported PSQI, they also came up with similar results confirming H1. According to the results of this study, nurses who were currently working shifts or had done so in the past had significantly worse sleep quality compared to those who had never worked shifts. Furthermore, shift nurses had shorter sleep duration and lower sleep efficiency, poorer sense of rest, more trouble falling asleep, a higher incidence of daytime sleepiness, and reduced cognitive function. Additionally, nurses who stopped working shifts more than six months ago still had sleep problems, especially in the area of subjective sleep quality and daytime disturbances. [25] .

And a recent study conducted by Mohamud et al. (2024) among nurses in Somalia, using the PSQI and DASS questionnaire, among others, found that 45.7% of nurses surveyed ($N = 280$) reported poor sleep quality. The subjects worked different types of shifts, including day, night and mixed shifts. The study found that nurses who worked night shifts were significantly more likely to report poor sleep quality compared to those who worked day or mixed shifts [26] .

Another study in favor of H1 was conducted from April to June 2016 in China. The study included nurses ($N = 686$) who had worked rotating night shifts since the beginning of their careers, as well as those who had previously worked night shifts but left before the survey period. The study used PSQI as the main tool to assess sleep quality and analyzed the association between the duration of night shifts and poor sleep quality. The authors of this study, Huang et al., point out that 62.11% of nurses who currently work night shifts and 55.75% of those who previously worked them reported sleep problems. . This study is particularly interesting because it reveals an S-shaped pattern of changes in sleep quality: sleep quality begins to deteriorate in the first years of work, probably due to circadian rhythm disruption and increased stress. During the first 12 years or so, sleep problems become more pronounced, as the body is unable to fully adapt to the constant changes in schedules.

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After about 12 years, sleep quality reaches the peak of poor condition, but no longer deteriorates. After stopping working night shifts, sleep begins to improve, but never reaches the quality of sleep before night work begins. After a few years, sleep deteriorates again, which is associated with aging and long-term effects on the body [27].

Contrary to these studies, Spano (2024) conducted a study with 64 respondents (MS/MT) on the impact of shift work on sleep quality, but with an emphasis on the perception of the effects of night shifts. Although it was stated that the respondents believe that night shifts make certain aspects of personal life and health difficult, most of them do not experience serious consequences related to the performance of work duties, which differs from our results, which indicated significant negative effects of shift work on the quality of sleep. Together, both studies point to the impact of work schedules on the well-being of healthcare workers, but our results highlight poorer perceptions of sleep quality, while in this study, respondents reported moderate quality of life with expressed concerns about personal responsibilities and well-being [28].

Contrary to expectations, no statistically significant difference was found in DASS scores between the two groups ($p > 0.05$). Although the average DASS score was higher for MS/MT shift workers ($M = 31.2$, $SD = 29.5$) compared to single shift workers ($M = 24.2$, $SD = 26.0$), this difference was not large enough to be considered statistically significant. This result contrasts with the results of most studies.

For example, Okechukwu et al. (2023) investigated the association between night shifts and depression among nurses through a systematic review and meta-analysis. Based on 8 studies, they found that nurses who work night shifts have a 49% higher risk of depression compared to those who work during the day [29].

Furthermore, a study conducted by Roman et al. (2023) during the first semester of 2019, in which 380 nurses from different Spanish cities participated, divided into two groups: fixed shifts ($n = 159$) and rotating shifts ($n = 221$), found that nurses working in rotating shifts showed more symptoms of depersonalization and emotional stress. Additionally, prolonged stress and irregular working hours can increase the risk of burnout [30].

A study on the impact of shift work on depression and anxiety in nurses, conducted by Wang et al. (2022), also showed that nurses working in rotating shifts had significantly higher rates of depression (62.08%) and anxiety (58.82%) compared to those who did not work shifts. Working more than 40 hours per week, fatigue, psychological stress before, during, and after night shifts, poor sleep quality, use of sleep medication, and physical discomfort during night shifts were associated with an increased risk of depression and anxiety [31].

Also, a study carried out by Hutapea et al., carried out in February 2025, which involved 30 nurses who had at least two years of experience in night and rotating shifts, found that nurses who work in rotating shifts have a higher risk of circadian rhythm disorders, leading to chronic sleep problems. increased stress levels, decreased cognitive function, and metabolic problems such as obesity and diabetes. On the other hand, nurses who work in stable shifts, without frequent changes in working hours, show better sleep patterns and lower stress levels. Also, the study states that nurses who work night shifts have a higher risk of burnout, while those who only work day shifts have a slightly better work-life balance [32].

In contrast, Alghamdi and Bahari (2025) published a study looking at the impact of shift work on psychological health and sense of security at work among nurses in Saudi Arabia. The aim was to determine the links between shift work, symptoms of psychological disorders (such as depression, anxiety, stress and fatigue) and experienced safety at work. A cross-sectional, descriptive-correlation approach was conducted with an online survey that surveyed 163 nurses. The questionnaire contained demographic data, measures of psychological disorders using the DASS-21 scale, the level of fatigue through a special scale, and one question about the feeling of security at work. Fatigue has been found to be positively associated with depression, anxiety, and stress. There is a strong link between anxiety and stress. Interestingly, nurses who worked one shift report higher levels of fatigue and depression compared to those who worked 12-hour shifts, which differs from the results of some

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earlier studies. This difference from this and other studies highlights the complexity of this issue and the need for further research [33].

However, a study by Özyürek et al. conducted at a university hospital in Afyonkarahisar Province, Turkey, between October 2014 and January 2015, in which 60 nurses participated, came to similar results as this study. According to the results of the study, no significant difference was found between nurses who work exclusively during the day and those who work in shifts when it comes to stress levels, quality of life, life satisfaction and sensitivity to anxiety [34].

Analysis of the incidence of chronic diseases, conducted by Chi-square test, did not show a statistically significant difference between the two groups ($p > 0.05$). Although obesity, asthma, cardiovascular diseases were among the most common chronic diseases in both groups, the distribution of these diseases did not differ significantly in relation to the way they work. It is important to note that this study used a self-assessment of the presence of chronic diseases, which may affect the reliability of the results. However, it is important to emphasize that more than half of the respondents in both groups stated that they suffer from at least one chronic disease. Although these results are not in line with most other studies, they certainly contribute to the existing literature.

The already mentioned study by Roman et al. He points out that long-term stress and shift work can affect hormonal balance, especially cortisol, which can have wider health consequences, and puts special emphasis on the fact that shift work is associated with more common digestive problems such as abdominal pain and indigestion.

Similarly, a study conducted at the University Clinical Hospital Mostar in Bosnia and Herzegovina, conducted by Ljevak et al. (2021) on a sample of 157 nurses, of which 51% in shift work and 49% in one shift, points out that nurses who work in shifts are more likely to have gastrointestinal problems such as loss of appetite, heartburn, nausea and weight gain. Also, reduced circulation in the lower extremities and varicose veins are more common in shift workers. The study did not show statistically significant differences in cardiovascular problems between shift and day work.

Furthermore, a study conducted by Kliman (2024) on 144 respondents, MS/MT of the Pula General Hospital, indicates similar patterns in MS/MT who work in shifts. While our study did not show a statistically significant difference in the incidence of chronic diseases between groups, this study reveals a significant percentage of respondents who work shifts and have hypertension or thyroid disease, as well as a sense that working hours affect their private lives [36].

Also, Anbazhagan et al. (2016) conducted a study that investigates shift work disorder (Shift Work Disorder). Shift work disorder (SWD) and related health problems among nurses ($N = 130$) at a hospital in Bangalore, India. According to the results of the study, the most common complaints include headache (60%), back pain (57.6%), gastritis (32.3%) and menstrual disorders (30%). Anxiety was found in 17.6% of nurses, while depression was diagnosed in 23.8%. The average age of the respondents was 27.4 years [37].

Shift work disrupts the body's natural rhythm that is aligned with the light-dark cycle, which can lead to sleep disturbances, increased risk of accidents, and social isolation. There are changes in body temperature, hormonal levels, immune system function, and rest and activity cycles. Nurses can improve the tolerability of shift work by adjusting internal biological rhythms to work hours.

5. Conclusions

Research has shown that shift work has a significant impact on the quality of MS/MT sleep. The results of the study clearly show that MS/MT who work in shifts have poorer sleep quality compared to those who work in one shift. Although no statistically significant difference was found in the levels of depression, anxiety, and incidence of chronic illness between the two groups, it is important to note that sleep problems and their long-term health effects have been documented multiple times and may have broader consequences, including an increased risk of chronic disease and a deterioration in mental health. These results highlight the need for further research to examine these associations in more detail, as well as to adapt working conditions to reduce the negative consequences of shift work on the health well-being of nurses and technicians. A specific measure

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that could significantly reduce the harmful impact of sleep disorders in MS/MT who work in shifts is the use of flexible shift schedules. This would include rotating shifts in a way that allows for a longer rest period between shifts, as well as a reduced frequency of night work. For example, systematic work planning could be considered so that shifts are rotated every few weeks, with a minimum of 48 hours of rest between the end of one shift and the start of the next. Also, introducing guidelines for the optimal length of shift work (for example, limiting shifts to 8 hours) can help reduce fatigue and improve sleep quality. In addition, this system should include regular breaks during working hours, as well as education on relaxation techniques that can be used to reduce stress and improve sleep quality. These adjustments could contribute to better health and satisfaction in the workplace, reducing the long-term adverse effects of sleep disorders.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Faculty of Health Studies Rijeka (Protocol code 602-04/25-01/219; 2170-1-65-01-2-25-1; date of approval 11. 12. 2024.).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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