

# Medical Science

## To Cite:

Karaś L, Prządo I, Patronik P, Krupa-Nurcek S. The impact of shift work on the health of healthcare workers an observational study. *Medical Science* 2025; 29: e213ms3662  
doi: <https://doi.org/10.54905/disssi.v29i165.e213ms3662>

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## Peer-Review History

Received: 18 March 2025  
Reviewed & Revised: 09/April/2025 to 25/October/2025  
Accepted: 01 November 2025  
Published: 11 November 2025

## Peer-review Method

External peer-review was done through double-blind method.

Medical Science  
pISSN 2321-7359; eISSN 2321-7367



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# The impact of shift work on the health of healthcare workers an observational study

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## ABSTRACT

**Background:** Shift work, being an integral part of healthcare systems, constitutes a significant risk factor for the mental and physical health of healthcare personnel, exposing them to negative health consequences. **Aim of the study:** The aim of the study was to characterize the spectrum of health effects resulting from exposure to shift work in this population. **Material and methods:** A cross-sectional observational study was conducted with 100 healthcare workers in February 2024. Data were collected using a standardized questionnaire assessing demographic characteristics, job characteristics, and selected health indicators, including insomnia symptoms using the Athens Insomnia Scale. **Results:** Shift workers dominated the study group (82%). The analysis revealed that shift work was significantly associated with higher incidence of irritability and fatigue. Furthermore, long-term shift work was associated with a higher incidence of sleep problems. Subjective health assessment was rated as „good” by 50% of respondents. **Conclusion:** No statistically significant correlation was found between shift work and the occurrence of cardiovascular disease, gastrointestinal disorders, or abnormal body weight. However, shift workers were significantly more likely to report smoking, with no differences in the frequency of alcohol consumption.

**Keywords:** insomnia; shift work; health of healthcare workers

## 1. INTRODUCTION

The World Health Organization defines health as a state of complete mental and social balance, not merely the absence of symptoms of disease. Therefore, we should all approach health from an interdisciplinary perspective (Saylor, 2004; Callahan, 1973). Shift work poses a significant threat to the overall well-being of healthcare workers. The most frequently reported complaint is insomnia. The International Classification of Diseases (ICD) divides sleep disorders into insomnia, excessive sleepiness, and circadian rhythm disorders (Roman et al., 2023; Manger and Siegel, 2020). Healthcare workers are at risk of developing cardiovascular diseases, including hypertension, various types of arrhythmias, and atherosclerosis. Therefore, early and prompt implementation of preventive measures, including lifestyle changes, significantly reduces morbidity and, above all, mortality (Visseren et al., 2021; Tykarski et al., 2019). Additionally, a high correlation was demonstrated

between chronic stress, trauma, strong emotions and the development of gastrointestinal diseases in the studied group of healthcare workers (Hwang et al., 2022).

Desynchronization of the endogenous circadian rhythm, caused by shift work, is a factor in a number of psychological and psychosocial disorders, including chronic fatigue, cardiovascular and gastrointestinal diseases, and increased susceptibility to addiction (Erren et al., 2003). Maintaining full operational readiness among healthcare facilities around the clock requires a good personnel management strategy to minimize the negative impact of shift work on the quality of services they provide (Akerstedt and Wright, 2009). Maintaining high standards of medical services and patient safety is inextricably linked to the work capacity and health of staff, making the analysis of occupational risk factors a priority.

In this context, hospitals providing 24/7 patient care operate continuously. Continuity of care is one of 15 accreditation standards for healthcare facilities. Today's patients are accustomed to high-quality services and therefore expect the same standards from the healthcare sector (Veldhuis et al., 2024).

### **Aim of the Study**

The study aimed to assess the impact of shift work on the health of healthcare workers.

## **2. MATERIALS AND METHODS**

The study, in accordance with the guidelines of the Declaration of Helsinki, involved collecting data from healthcare staff in Polish hospitals from February 1 to 29, 2024. Participants represented a variety of professional experiences, specialties, and roles. Targeted recruitment was conducted via email, institutional advertisements, and social media. Participants voluntarily completed anonymous electronic surveys and provided informed consent for the use of the obtained statistical data for scientific purposes. Each participant had the right to withdraw from the study at any stage voluntarily.

### **Ethical approval**

The research protocol was assessed and approved by the Bioethics Committee at the University of Rzeszow (KBE no. 09/05/2020), and the entire procedure was carried out in accordance with applicable ethical standards, with particular emphasis on data confidentiality and protection of the rights of the study participants.

### **Participants and sample size**

During the initial recruitment phase, an invitation to participate was sent to a cohort of 150 healthcare workers. Of these, 100 completed the questionnaire, met the inclusion criteria, and were included in the final analysis. The remaining 50 participants were excluded due to incomplete questionnaire responses ( $n = 30$ ), refusal to provide informed consent ( $n = 10$ ), or extended sick leave during the study period ( $n = 10$ ).

Inclusion criteria for the study included: active medical license (physician, nurse, medical technician), employment in a facility providing direct patient care, age between 22 and 65, at least six months of professional experience in the current position, and prior informed and voluntary consent to participate in the study. Individuals on long-term sick leave or maternity leave, as well as participants with documented chronic conditions unrelated to work that could significantly interfere with self-assessment of health, were excluded from participation. Furthermore, exclusion criteria included refusal to participate, withdrawal of consent during the project, and submission of incomplete or contradictory survey data.

### **Recruitment Flow (Prisma/ Consort Style Diagram - Textual)**

Invitations sent: 150

Responded and assessed for eligibility: 130

Excluded: 30

- Incomplete questionnaires: 20
- Declined consent: 5
- On extended leave: 5

Included in final analysis: 100

Data sources and measurement

A standardized questionnaire, whose accuracy and comprehensibility had been verified in a pilot study, was used to collect data. This tool, consisting of 20 closed questions, was divided into three research domains: 1) sociodemographic characteristics of respondents, 2) the specifics of occupational stress, and 3) subjective assessment of health, with particular attention paid to the symptoms of insomnia (using elements of the Athens Insomnia Scale) and the occurrence of risky behaviors.

Statistical analysis

The analysis of statistical data collected during the entire study was performed using IBM SPSS Statistics, version 23 and Microsoft Excel 2026. Descriptive statistics included calculating the mean values marked as (M), median (Me) and standard deviations (SD) for quantitative variables, and the frequency distributions and their percentage structure (n, %) for qualitative variables. Group comparisons between shift workers and single-shift workers were performed using the Mann-Whitney U test for continuous nonparametric data and chi-square tests for categorical data, with Fisher's exact test correction when the number of cells was less than 5. Statistical significance was set at  $p \leq 0.05$ .

3. RESULTS

Professional profile of respondents and general health status of participants

The analysis of participants revealed the following demographic distribution. Several age groups were identified, with the largest being people over 46 years of age (61%, n=61) and the smallest being people aged 22–25 (2%, n=2). The gender analysis revealed that women comprised the majority (87%, n=87), while men accounted for only 13% (n=13). The educational background of the respondents was as follows: master's degree 39% (n=39), bachelor's degree 33% (n=33), medical high school graduate 28% (n=28). Completion of a qualification course was reported by 13% (n=13) of respondents, while completion of a specialization was reported by 43% (n=43) of respondents.

To obtain comprehensive information on their health status, participants provided information based on their work over a full week. 64% (n=64) of respondents worked more than 40 hours per week, and the remaining 34% (n=34) worked less than 40 hours. The classification of professional experience was as follows: over 20 years – 64% (n=64) of respondents, 11–20 years – 19% (n=19), 5–10 years – 10% (n=10), less than 5 years – 7% (n=7). Employment in several workplaces: one workplace – 54% (n=54), two workplaces – 44% (n=44), three workplaces – 2% (n=2). Responses regarding self-assessment of health status included: good 50% (n=50), average 27% (n=27), excellent 23% (n=23). As many as 76% (n=76) of respondents denied having thyroid disease, while only 24% (n=24) confirmed the presence of these disorders.

To assess the prevalence of psychological symptoms, participants were asked to indicate the presence of the following conditions: irritability, concentration disorders, chronic fatigue, apathy, reduced sexual activity, or lack thereof. The most common response was chronic fatigue, affecting as many as 40% (n = 40) of respondents (Table 1).

Table 1. Prevalence of other complaints

| Variable                  | Number of people | Percentage |
|---------------------------|------------------|------------|
| Irritability              | 25               | 25.0       |
| Concentration disorders   | 20               | 20.0       |
| Chronic fatigue           | 35               | 35.0       |
| Apathy                    | 8                | 8.0        |
| Decreased sexual activity | 12               | 12.0       |

Analysis of the statistical dependence of the survey results

In response to questions about difficulty falling asleep, 62% (n=62) of respondents denied having this problem, while 38% (n=38) confirmed it. The assessment of sleep quality yielded the following results: slightly unsatisfactory 41% (n=41), satisfactory 31% (n=31), clearly unsatisfactory 22% (n=22), and completely unsatisfactory 6% (n=6). On the Athens Insomnia Scale, scores ranged from 0 to 19 points, with an arithmetic mean of 7.64, which corresponds to the normal range; scores above 10 points indicate the presence of sleep

disorders. The most common score was 4 points among 14 respondents, while the highest scores, 17 and 19 points, were obtained by only one person.

To examine the relationship between shift work and the incidence of insomnia among hospital employees, a Mann-Whitney U test was conducted due to the non-parametric nature of the data. The study included 100 participants: 82 working in a shift system and 18 in a single-shift system. The mean scores on the Athens Insomnia Scale were 8.01 (arithmetic mean 4.34) for the single-shift groups and 5.94 (arithmetic mean 4.09) for the shift-work groups. Despite noticeable differences, statistical analysis showed  $p = 0.074$ , indicating no statistical significance (Table 2).

**Table 2.** The difference between shift and single-shift work in terms of scores on the Athens Insomnia Scale

| Type of work   | Work in shifts (a) |      |      | Single-shift work (b) |      |      | U Mann-Whitney test |       |                   |
|----------------|--------------------|------|------|-----------------------|------|------|---------------------|-------|-------------------|
|                | N                  | M    | SD   | N                     | M    | SD   | U                   | P     | Difference a vs b |
| Insomnia scale | 82                 | 8.01 | 4.34 | 18                    | 5.94 | 4.09 | 539.0               | 0.074 | a = b             |

*N* – number of people, *M* – median, *SD* – standard deviation, *U* – test statistics, *p* – probability

In the analysis of cardiovascular complaints, it was found that the most frequently reported condition was no complaints, followed by hypertension (Table 3). Analysis using the chi-square test did not show a statistically significant relationship between the work system and the occurrence of elevated blood pressure ( $\chi^2(1) = 2.87$ ;  $p = 0.090$ ), palpitations ( $\chi^2(1) = 0.36$ ;  $p = 0.756$ ) or lipid disorders ( $\chi^2(1) = 0.07$ ;  $p = 1.000$ ).

A comparison of cardiovascular disorders throughout the working week using the chi-square test and Fisher's correction (for expectations <5) did not show statistical significance in the case of elevated blood pressure ( $\chi^2(1) = 0.69$ ;  $p = 0.405$ ), heart palpitations ( $\chi^2(1) = 0.00$ ;  $p = 0.968$ ), and lipid disorders ( $\chi^2(1) = 0.67$ ;  $p = 0.537$ ). In each case, the incidence of disorders remained similar among employees working <40 and >40 hours per week.

**Table 3.** Prevalence of cardiovascular complaints

| Variable           | Number of people | Percentage |
|--------------------|------------------|------------|
| Increased pressure | 30               | 30.0       |
| Palpitations       | 20               | 20.0       |
| Atherosclerosis    | 1                | 1.0        |
| Lipid disorders    | 13               | 13.0       |
| Not applicable     | 36               | 36.0       |

Gastrointestinal symptoms, performed using the chi-square test (in some cases it was also necessary to use the Fisher test), did not show a significant relationship (Table 4). The differences in the frequency of abdominal pain ( $\chi^2(1) = 2.58$ ;  $p = 0.183$ ), constipation ( $\chi^2(1) = 1.29$ ;  $p = 0.348$ ), flatulence ( $\chi^2(1) = 0.16$ ;  $p = 0.775$ ), diarrhea ( $\chi^2(1) = 0.66$ ;  $p = 0.683$ ) and nausea ( $\chi^2(1) = 1.16$ ;  $p = 0.582$ ) were statistically insignificant. A comparison of BMI between shift workers and the second study group using the chi-square test and Fisher's correction for expectations below 5 showed no association with regard to BMI variables:  $\chi^2(4) = 0.48$ ;  $p = 0.959$ . No association was found between the type of work and its impact on BMI.

**Table 4.** Prevalence of gastrointestinal ailments

| Variable       | Number of people | Percentage |
|----------------|------------------|------------|
| Abdominal pain | 13               | 13.0       |
| Constipation   | 17               | 17.0       |
| Bloating       | 18               | 18.0       |
| Diarrhea       | 9                | 9.0        |
| Nausea         | 5                | 5.0        |
| None           | 38               | 38.0       |

69% of respondents (n=69) denied smoking cigarettes, while 31% (n=31) admitted to smoking. Regarding alcohol, the responses were as follows: several times a year 45% (n=45), monthly 16% (n=16), weekly 14% (n=14), never 10% (n=10), twice a month 8% (n=8), and more than once a week 7% (n=7). The study also showed that shift work increases the likelihood of tobacco use among staff. Statistical analysis showed that hospital employees smoke more frequently, as shown in the results ( $\chi^2(1) = 4.06$ ;  $p = 0.044$ ). However, no correlation was found between alcohol consumption and work schedule among staff ( $\chi^2(5) = 9.44$ ;  $p = 0.105$ ). Conclusions were based on the results of the chi-square test and the Fisher test (Table 5).

**Table 5.** The frequency of alcohol consumption and the type of work performed

| Alcohol               | Type of work      |                | Total         |
|-----------------------|-------------------|----------------|---------------|
|                       | Single-shift work | Work in shifts |               |
| More than once a week | 2 (2.00%)         | 5 (5.00%)      | 7 (7.00%)     |
| Twice a month         | 1 (1.00%)         | 7 (7.00%)      | 8 (8.00%)     |
| Several times a year  | 7 (7.00%)         | 38 (38.00%)    | 45 (45.00)    |
| Never                 | 5 (5.00%)         | 5 (5.00%)      | 10 (10.00%)   |
| Once a month          | 1 (1.00%)         | 15 (15.00%)    | 16 (16.00%)   |
| Once a week           | 2 (2.00%)         | 12 (12.00%)    | 14 (14.00%)   |
| Total                 | 18 (18.00%)       | 82 (82.00%)    | 100 (100.00%) |

4. DISCUSSION

Shift work is a significant burden on the body, negatively disrupting the circadian rhythm and increasing the risk of developing lifestyle diseases. Dibben et al., (2023) study showed a link between night work and an increased risk of developing type 2 diabetes and hypertension. In these findings confirm that the irregular lifestyle of medical personnel affects the development of metabolic and cardiovascular disorders. In the study population, the dominant age group were people over 46 years of age (61%, n=61), which is consistent with nationwide demographic data indicating the progressive aging of the medical staff.

It was found that the dominant group of respondents consisted of personnel with over 20 years of professional experience (64%), which corresponds with data from the study of Ulfik, (2022) and confirms the advanced age structure of medical staff. In addition, it was observed that nearly half of the respondents (46%) took on additional employment, which, in light of reports by Lipina et al., (2020), can be interpreted as an indicator of systemic staff shortages.

In a subjective assessment of health status, half of the respondents (50%) described it as good, which corresponds with the reports of Makara-Studzińska et al., (2019), but a higher percentage of very good assessments (23%) was recorded. With regard to anthropometric indicators, it was observed that 35% of respondents were overweight, which is inconsistent with the data collected by Sternal et al., (2023) where the dominant group consisted of people with normal body weight.

An analysis of risky behaviors showed that 31% of respondents were smokers, which is consistent with the data from Ramus, but other, more recent reports suggest that this phenomenon may be escalating in certain professional groups. With regard to alcohol consumption, 45% of respondents declared that they consume alcohol occasionally, according to Rasmus et al., (2015).

The spectrum of reported somatic complaints, dominated by gastroenterological and cardiovascular symptoms, is consistent with previous reports on shift workers with constipation by Sadłowska and Prędecka, (2021). In addition, the average score of 7.64 points obtained on the Athens Insomnia Scale, indicating clinically significant sleep problems, corresponds to the results presented by Ulfik (2022).

5. CONCLUSION

Our study found no statistically significant correlations between shift work and the occurrence of health problems such as sleep disorders, cardiovascular disease, gastrointestinal disease, or changes in body mass index (BMI). The results obtained using the Athens Insomnia Scale were found to be within normal limits. Therefore, it can be concluded that other factors, such as lifestyle and individual habits, have a greater impact on the sleep quality of healthcare workers.

Regarding the cardiovascular system functioning, there was no higher incidence of hypertension, arrhythmia, or lipid disorder among shift workers compared with employees working a regular daytime schedule. Similarly, analysis of gastrointestinal function

indices revealed no significant differences between the study groups. One of the key findings of the study is the statistically significant association between shift work and increased smoking. This may indicate that the psychosocial consequences of shift work, such as increased stress, are a more significant risk factor for the development of addictions in the study population than the occurrence of somatic symptoms, the association of which with work patterns was not confirmed. However, the frequency of alcohol consumption did not differ significantly between the study groups, suggesting that work schedules are not a key factor influencing this issue.

The results suggest the need for further research, considering additional variables such as occupational stress levels, stress-coping strategies, and individual health habits. In terms of preventive health care, it seems necessary to implement educational and health-promoting measures, particularly in the areas of sleep hygiene and reducing the risk factors for lifestyle diseases among medical personnel working shifts.

### Acknowledgments

We thank the participants who took part in our research.

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Conceptualization: Łukasz Karaś

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All authors have read and agreed with the final, published version of the manuscript.

### Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study.

### Ethical approval

The research protocol was assessed and approved by the Bioethics Committee at the University of Rzeszow (KBE no. 09/05/2020). The study was done in conformity with ethical guidelines. Participation was entirely voluntary, and all respondents provided informed consent. The participants' anonymity and confidentiality were ensured, and the data obtained were utilized purely for the study. The ethical guidelines for Human Subjects are followed in the study.

### Funding

This research did not receive any external funding like specific grant from funding agencies in the public, commercial, or nonprofit sectors.

### Conflict of interest

The authors declare that they have no conflicts of interests, competing financial interests or personal relationships that could have influenced the work reported in this paper.

### Data and materials availability

All data associated with this study will be available based on the reasonable request to corresponding author.

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