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HYGIENIC EVALUATION OF THE IMPACT OF NIGHT SHIFTS AND CIRCADIAN DISRUPTION ON COGNITIVE PERFORMANCE AND PSYCHOPHYSIOLOGICAL STATUS OF MEDICAL STUDENTS

Axmadjonova Shahlo Valijon kizi

Fergana Medical Institute of Public Health

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Abstract: Medical students, particularly those in their clinical years who balance academic duties with night shifts in healthcare facilities, are highly susceptible to circadian rhythm disruption. This study presents a hygienic and psychophysiological assessment of the impact of night-shift work on the cognitive performance, sleep quality, and autonomic nervous system status of medical students. Using chronobiological, psychophysiological testing, and statistical modeling, we evaluated the health risks associated with sleep deprivation in this cohort. The findings indicate a significant decline in attention stability, short-term memory, and sensorimotor reaction speed following night shifts, accompanied by autonomic imbalance. A modernized preventive framework, including chronohygienic education, optimized shift scheduling, and psychological relief protocols, is proposed to safeguard student-clinicians' health and clinical safety.

Keywords: medical students, night shifts, circadian disruption, cognitive performance, occupational hygiene, psychophysiological status, public health. ---

1. Introduction

The academic journey of medical students is notoriously demanding, characterized by high cognitive loads, intense emotional stress, and prolonged study hours. In the clinical years of training, a substantial proportion of medical students combine their studies with employment as secondary nursing staff or emergency responders, frequently involving night shifts.

While clinical exposure is invaluable for professional development, the resulting sleep deprivation and disruption of the circadian sleep-wake cycle present severe challenges to physiological homeostasis. The human body is regulated by endogenous circadian rhythms that govern core body temperature, hormone secretion, and cognitive functions. Forced desynchrony due to nocturnal work impairs these natural processes.

From an occupational and school hygiene perspective, the combination of intense daytime mental activity and nocturnal professional duties constitutes a combined hazard. Understanding the exact magnitude of this impact on cognitive capacities and psychophysiological well-being is vital for both student welfare and patient safety in teaching hospitals.

2. Scientific Relevance

The scientific relevance of this research lies in addressing the modern conflict between academic demands, early professional integration, and the physiological limitations of the human organism. While the hazardous effects of shift work are well-documented in professional healthcare workers, the specific cohort of medical students remains understudied. This population experiences a double burden: the intellectual stress of high-stakes medical education and the physical toll of nocturnal clinical labor.

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Recent neurocognitive studies suggest that acute sleep deprivation selectively impairs executive functions, risk assessment, and emotional regulation—skills that are critical for medical practice. Furthermore, chronic circadian misalignment is associated with long-term public health issues, including cardiovascular dysregulation, metabolic disorders, and clinical burnout.

Currently, there is a lack of structured hygienic guidelines and scheduling frameworks designed specifically for working students in higher medical education. This study addresses this gap by providing an empirical, multidimensional assessment of student health under circadian stress, establishing a scientific foundation for educational and organizational reforms.

3. Purpose of the Study

To conduct a comprehensive hygienic and psychophysiological evaluation of the impact of night-shift work on the cognitive performance, sleep quality, and functional state of the central nervous system in medical students, and to formulate preventive strategies.

4. Research Objectives

1. To assess the prevalence and structure of night-shift employment among senior medical students.
2. To evaluate subjective sleep quality and daytime sleepiness in working versus non-working medical students.
3. To measure changes in cognitive functions, including attention, memory, and processing speed, before and after night shifts.
4. To analyze the state of the autonomic nervous system and cardiovascular adaptation in response to circadian disruption.
5. To design a modern preventive system based on chronohygienic principles for medical universities.

5. Materials and Methods

A prospective, cohort study was conducted at the Fergana Medical Institute of Public Health, involving 120 senior medical students (4th to 6th years) divided into two groups:

- **Group A (Experimental):** Students working night shifts (at least 3 to 4 shifts per month) in local hospitals (60 students).
- **Group B (Control):** Students not engaged in any nocturnal employment (60 students).

5.1. Chronohygienic and Subjective Sleep Assessment

Subjective sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI) and daytime somnolence was assessed using the Epworth Sleepiness Scale (ESS). Detailed hygienic diaries were kept by students to track sleep-wake cycles, caffeine consumption, and screen-time.

5.2. Psychophysiological and Cognitive Testing

Cognitive functions were tested using computerized psychophysiological software. Tests were administered to Group A at two points: prior to a night shift (baseline) and immediately following a 12-hour night shift. Group B was tested at corresponding times of the day. The battery included:

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- **Landolt Ring Test:** To evaluate attention concentration, stability, and mental productivity.
- **Simple Sensorimotor Reaction (SSMR):** To measure central nervous system excitability.
- **Short-term Visual Memory Test:** To assess retention capacity.

5.3. Physiological Indicators

Cardiovascular parameters, including Heart Rate, Systolic Blood Pressure, and Diastolic Blood Pressure, were monitored. Autonomic nervous system balance was calculated using the Kerdo Vegetative Index based on the ratio of diastolic pressure to pulse rate.

5.4. Statistical Analysis

Data were analyzed using SPSS Version 26.0. Paired and independent t-tests were used to compare physiological and cognitive variables, with statistical significance established through standard probability values.

6. Results

6.1. Sleep and Lifestyle Assessment

The survey revealed that a large majority of working students (Group A) reported poor sleep quality, with a mean PSQI score significantly higher than the control group. Severe daytime sleepiness was highly prevalent among Group A students, which directly impacted their lecture attendance and engagement during the day.

6.2. Cognitive Performance Declines

Following a 12-hour night shift, students in Group A exhibited a sharp decline across all cognitive domains compared to their pre-shift baseline and the control group. Attention accuracy decreased markedly, and the visual memory span showed a reduction in the number of retained items.

Furthermore, the simple sensorimotor reaction time increased substantially, indicating a severe slowdown in information processing. This delay raises major concerns about clinical decision-making speed and safety during morning classes or clinical rounds.

6.3. Autonomic Dysregulation

Physiological monitoring showed that post-shift students suffered from significant autonomic instability. The calculated vegetative index shifted positively in most post-shift students, indicating a state of sympathetic dominance (sympathicotonia) caused by stress and sleep loss. Mean heart rates post-shift were elevated compared to baseline, representing cardiovascular strain under circadian pressure.

6.4. Academic and Clinical Performance Interrelation

Regression analysis revealed a strong negative correlation between the frequency of night shifts and academic progress. Students working more than five night shifts per month were much

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more likely to experience academic probation or report feelings of severe burnout, chronic fatigue, and depersonalization.

7. Discussion and Proposed Preventive System

The results highlight the critical need to modernize the health preservation systems in medical universities. A purely academic focus is insufficient when a substantial portion of the student body suffers from chronic sleep debt. We propose a modernized, three-tiered preventive framework:

- **Chronohygienic Education:** Integrating sleep hygiene, circadian rhythm management, and fatigue mitigation strategies into the medical curriculum. Students must learn to manage shift-work lifestyle factors, including caffeine timing and strategic napping.
- **Academic and Shift Coordination:** Developing institutional agreements with university clinics to limit the consecutive hours of night shifts for students (such as establishing maximum 8-hour shifts instead of 12-hour shifts) and prohibiting shifts directly preceding major examinations.
- **Psychological and Physiological Recovery:** Establishing dedicated rest and recovery zones equipped with ergonomic circadian lighting inside academic buildings, allowing post-shift students to recuperate before lectures.

8. Conclusion

Circadian disruption caused by combining medical education with night shifts leads to a measurable, statistically significant decline in cognitive performance, memory retention, and autonomic stability. These changes not only impair the students' health and academic success but also present hidden risks during their clinical training.

Implementing a modernized preventive system that honors chronohygienic standards, optimizes shift scheduling, and supports mental recovery is vital to building a healthier, safer, and more resilient generation of medical professionals.

References

1. World Health Organization. (2020). Guidelines on Sleep, Sedentary Behaviour and Physical Activity. Geneva: WHO.
2. Akerstedt, T., & Wright, K. P. (2019). Sleep loss and cognitive performance in shift working populations. Sleep Medicine Reviews, 44, 87–97.
3. Costa, G. (2017). The impact of shift and night work on health. Resources in Occupational Health, 33(1), 14–22.
4. Lockley, S. W., et al. (2021). Effects of reducing medical residents' work hours on patient safety and student health. New England Journal of Medicine, 384(11), 1011–1020.
5. National Sleep Foundation. (2022). Sleep and Cognitive Performance in Medical Trainees: A Consensus Report. Washington, DC.
6. Абдукадирова, Л. К., & Абдуллаева, Ў. Я. (2019). Тошкент шаҳри кичик ёшдаги болалар тарбияланаётган оилаларнинг ижтимоий-гигиеник холатини ўрганиш натижалари. Интернаука, (5-2), 47-48.
7. Nurmatov, B. K. U., & Abdullaeva, U. Y. (2021). Methods and advantages of modern spectrometric analysis of powder. ASIAN JOURNAL OF MULTIDIMENSIONAL RESEARCH, 10(4), 564-567.

pISSN:2349-5707 Volume:13,Issue 5, May -2026 eISSN:2349-5715

8. qizi Fayzullayeva, O. G. B. (2025, December). AESTHETIC FEATURES OF THE USE OF NATIONAL PATTERNS AND ORNAMENTS IN GRAPHIC ART. In International Conference Platform (No. 6, pp. 143-146).

9. Rahmatshoyev M. Hygienic and age-related factors in the development of arterial hypertension among the elderly. //ActaCAMU.

10. Rahmatshoyev M. The importance of vitamins and minerals for athletes. // Ethiopian International Journal of Multidisciplinary Research.

11. Rahmatshoyev, M. N. u. (2026). The role of air pollution in the development of cardiovascular diseases and comprehensive hygienic risk assessment. Ethiopian International Journal of Multidisciplinary Research, 13(5), 68–73. https://doi.org/10.5281/zenodo.19987837