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Original Article

Sleep specialist – defined phenotypes in healthcare staff: a cross-sectional study

Vlami K,[1,3] Riza E,[2] Karakatsani A,[3] Kogevinas M,[4] Farantos G,[1] Verykakis E,[3] Dounias G[1]

[1] Occupational & Environmental Health, Dept Public Health Policy, School of Public Health, University of West Attica, Athens, Greece.
[2] Department of Hygiene, Epidemiology and Medical Statistics Medical School, National and Kapodistrian University of Athens, Athens, Greece.
[3] 2nd Pulmonary Department, School of Medicine, National and Kapodistrian University of Athens, "ATTIKON" University Hospital, Haidari, Athens, Greece.
[4] Barcelona Institute for Global Health (ISGlobal), Barcelona, Spain.

Corresponding author:
Katerina Vlami,
MD, MSc. MPH, ESRS Somnologist
*Occupational & Environmental Health, Dept Public Health Policy, School of Public Health, University of West Attica, Athens, Greece.
**2nd Pulmonary Department, School of Medicine, National and Kapodistrian University of Athens, "ATTIKON" University Hospital, Haidari, Athens, Greece.
Address: Rimini 1, str, Post Code 12462, Haidari, Athens, Greece.
Tel. number: +00306977564088
E-mail: kvlami1969@yahoo.gr
ORCID ID: https://orcid.org/0000-0001-5117-2257

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ABSTRACT

Introduction: Healthcare professionals face irregular work schedules and sleep disruption. Identifying sleep–function phenotypes may support early prevention and occupational performance.

Methods: Exploratory, cross-sectional study aimed to characterize sleep parameters and work-related conditions through certified sleep specialist interviews, defining clinically meaningful sleep phenotypes in healthcare workers. This single-center cross-sectional study was conducted between December 2021 and February 2022 in a tertiary hospital. Interviews captured occupational and sleep-related parameters by a sleep specialist. Validated Greek versions of the Pittsburgh Sleep Quality Index (PSQI), Athens Insomnia Scale (AIS), and Epworth Sleepiness Scale (ESS) were administered. Data collection involved structured questionnaires and statistical analysis using STATA/IC software.

Results: Among 38 healthcare professionals, most were medical/nursing staff (71%), one-quarter worked rotating shifts (26%), and the majority reported short sleep duration (74% <7 h). Unadjusted analyses indicated that poorer sleep was associated with younger age, reduced job performance, cognitive strain, morning headaches, and being overweight, whereas evening-type individuals reported fewer sleep complaints. In adjusted models, however, chronotype remained the only independent predictor of sleep disturbance, whereas reduced job performance independently predicted excessive daytime sleepiness. Medical/nursing personnel also reported higher rates of weight gain and greater daytime sleepiness compared with non-medical staff.

Conclusion: This study demonstrates that clinician-led sleep interviews can effectively identify key sleep phenotypes in healthcare professionals, revealing that evening-type individuals consistently exhibit a more favorable sleep profile. Targeted screening of resilient sleep phenotypes—such as the evening type identified in this study—can help support safer and more sustainable working conditions for healthcare professionals.

Keywords: Chronotype, daytime sleepiness, insomnia, occupational health, shift work, sleep quality

Introduction

Sleep and occupation are both foundational to human well-being,[1] yet work demands often interfere with adequate and restorative sleep. In today's society, which increasingly depends on 24/7 services, this conflict is more pronounced than ever.[2] Irregular work schedules are common among shift workers who may work early mornings, evenings, nights, or rotating shifts. These patterns disrupt natural circadian rhythms,[3] and are associated with a range of adverse outcomes including insomnia, fatigue, cardiometabolic disorders, depression, and even increased cancer risk.[4,5]

Globally, an estimated 15–25% of the workforce is engaged in shift work, and healthcare settings often rely on round-the-clock staffing[6]. Research indicates that between 50% and 89% of nurses perform some form of shift work monthly, often reporting worse sleep duration, quality, and increased daytime fatigue compared to those with fixed daytime schedules.[7,8] Compounding this, frequent transitions between day and night shifts further misalign circadian rhythms.

Chronotype, which is an individual's natural sleep-wake preference, is a key determinant of how well one tolerates shift work.[9,10] The interaction between work schedules and chronotypes can significantly influence sleep outcomes, cognitive function, and overall job performance.[11,12]

Despite the growing body of evidence on sleep disturbances among healthcare professionals, most studies rely solely on self-administered questionnaires. As a result, nuanced sleep phenotypes—particularly those shaped by a combination of personal, occupational, and biological factors—are often overlooked.

Therefore, our aim was to investigate sleep patterns of healthcare professionals at a large tertiary university hospital, using in-person interviews conducted by a certified sleep specialist, who administered validated sleep instruments such as PSQI,[13] AIS,[14,15] and ESS.[16-18]

Methods

This observational, cross-sectional study was conducted at a single large tertiary university hospital between December 2021 and February 2022. The target population comprised all hospital employees (clinical, technical, and administrative staff). The employee cohort at the time included approximately 600 staff members, from whom the study sample was drawn. The initial invitation was directed specifically to this subgroup. As an exploratory study designed to identify sleep-related phenotypes using in-depth interviews, our recruitment strategy prioritized feasibility and direct engagement over random sampling. A total of 115 hospital employees were informed about the study via institutional email from the sleep specialist (KV), who explained the objectives and procedures. The study followed a convenience sampling approach. Recruitment was conducted through walk-around visits during morning and early-afternoon hours—periods when most staff members are present. During these walk-arounds, KV visited clinical, technical, and administrative departments to explain the study procedures, answer questions, and invite employees to participate. Of these 55 employees expressed interest and underwent pre-screening. Of these, 42 met the inclusion criteria and were invited to participate. Thirty-eight employees, (90.5%) fully completed the required protocol, forming the final study sample. This corresponds to a participation rate of 33% based on the initially informed group and a high response rate of 90.5% among eligible individuals.

Employees who worked typical shifts (7:00 a.m.–3:00 p.m.) or non-regular rotating shift patterns (i.e., hours outside the conventional 7 a.m.–6 p.m. timeframe or involving rotation) were eligible. Participation in the study was voluntary. Exclusion criteria included temporary employees, a history of alcoholism, depression or anxiety disorders, use of medications that affect sleep, known malignancy, diagnosed sleep disorders and pregnancy.

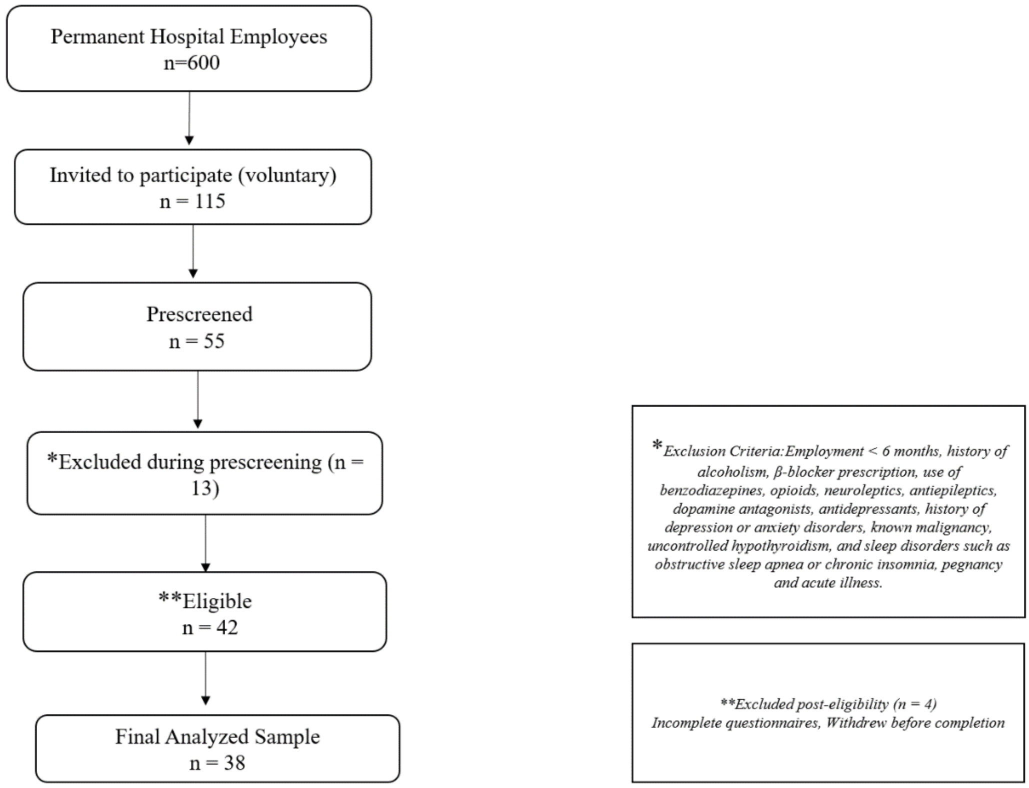


Figure 1: Participant flow according to STROBE guidelines.

Demographic data were collected. Occupational and cognitive variables were assessed using a structured set of interviewer-administered Yes/No questions. These included: work performance impairment: 'Did you have good job performance in the previous month?', perceived workload: 'Do you feel that your workload is excessive or unmanageable?', presenteeism: 'Have you worked while feeling unwell or unfit for work in the past month?', mental strain: 'Do you often feel mentally exhausted or overwhelmed during or after work?', concentration difficulties: 'Do you often have poor concentration during work?', memory problems: 'Do you often have disturbed memory?', morning headaches: 'Do you often wake up with a headache?'

Weight gain in our study was assessed using a single self-reported item 'Have you gained weight in the last six months?' coded Yes/No. All dichotomous variables (Yes/No responses) were coded binarily (0 = No, 1 = Yes).

Sleep and daytime sleepiness were assessed through three validated, Greek-translated, interviewer-administered questionnaires: the PSQI, the AIS, and the ESS. The PSQI is a self-rated 19-item questionnaire measuring sleep quantity and quality over the previous month. Scores range from 0 to 21, with higher scores indicating poorer sleep; scores ⩾ 5 indicate clinically significant sleep disturbances. The AIS includes 8 items reflecting ICD-10 insomnia criteria, scored on a 4-point Likert scale (total score: 0 – 24), with scores ⩾ 6 suggesting insomnia. The ESS assesses daytime sleepiness using 8 scenarios, each rated 0 – 3 (total score: 0 – 24); scores ⩾ 10 indicate excessive daytime sleepiness. The scoring procedures and diagnostic cut-offs for each questionnaire (PSQI ⩾5, AIS ⩾6, ESS ⩾10) were pre-specified based on their validated Greek versions and established clinical criteria. The questionnaires were administered via a structured interviewer-assisted format to ensure completeness and accuracy, a method consistent with their validated use in Greek clinical studies.

Chronotype was assessed using a single self-reported question about time-of-day preference, categorizing individuals as morning, evening, or neither type. This approach was selected to minimize respondent burden and maintain feasibility within the interviewer-administered format of this exploratory study. For analysis, comparisons were made between evening types and non-evening types to reduce potential misclassification from the "neither type" category. All responses were binary-coded and used in univariate analyses to examine associations with PSQI, AIS, and ESS scores. Data were entered into Microsoft Excel and analyzed using STATA/IC 13.0 (Stata Corp, College Station, TX). Normality was assessed with the Kolmogorov–Smirnov test and, as distributions were non-normal, quantitative variables are reported as medians with interquartile ranges (IQRs), and categorical variables as frequencies and percentages. Group comparisons for PSQI, AIS, and ESS scores were performed using the Mann–Whitney U test, while categorical variables were examined using Chi-square tests; Fisher's exact test was applied when expected cell counts were <5. Multivariable logistic regression models were constructed to evaluate independent predictors of poor sleep quality, insomnia symptoms, and excessive daytime sleepiness. Statistical significance was set at $p \leqslant 0.05$. The study adhered to STROBE guidelines (Supplementary File 1).

Ethics Approval and Consent to Participate

The study protocol was approved by the Human Research Ethics Committee of the General University Hospital (ΒΠΝΕΥΜ, ΕΒΔ549/11-10-2021) and was conducted in accordance with the principles of the Declaration of Helsinki (2013 revision). All participants were enrolled voluntarily.

Results

Thirty-eight employees fully completed the required protocol, with 37% being men and a mean age of 44 ± 9.68. Participants' characteristics are shown in Table 1.

Table 1: Demographic and clinical characteristics of the participants (n = 38).

CHARACTERISTIC	VALUE
Gender, men, n (%)	14/38 (37%)
Age, (years) (mean ± sd)	44 ± 9.68
Self-perceived overweight, n (%)	18/38 (47%)
Smoking, n (%)	19/38 (50%)
Medical/nurse staff, n (%)	23/38 (60%)
Non-standard work schedule, n (%)	10/38 (26%)
Sleep duration, (hours/day) (mean ± sd)	6.31 ± 1.08
PSQI ≥ 5, n (%)	28/38 (74%)
AIS ≥ 6, n (%)	19/38 (50%)
ESS ≥ 10, n (%)	12/38 (32%)

Abbreviations: AIS: Athens Insomnia Scale (range 0–24); ESS: Epworth Sleepiness Scale (range 0–24); PSQI: Pittsburgh Sleep Quality Index (range 0–21)

Table 1 shows that a total of 38 healthcare professionals were included in the analysis. Most participants were medical or nursing staff (23/38; 60%), and 10/38 (26%) reported a non-standard or rotating shift schedule. Sleep duration was below the recommended minimum for the majority of participants, with 28/38 (74%) reporting <7 hours of sleep per night (mean 6.31 ± 1.08 hours). Poor sleep quality was common: 28/38 (74%) scored ⩾5 on the PSQI, while 19/38 (50%) scored ⩾6 on the AIS, indicating insomnia symptoms. Excessive daytime sleepiness (ESS ⩾ 10) was reported by 12/38 (32%).Table 2 summarizes the associations between sleep measures and occupational or individual characteristics. In this sample, poor sleepers

(PSQI ⩾ 5) were younger (p = 0.002) and showed higher insomnia and daytime sleepiness scores. Participants reporting poor job performance tended to show higher PSQI, AIS, and ESS scores compared with those without perceived impairment (PSQI: 10 [8–12] vs. 7 [4–8], p = 0.014; AIS: 8 [6–15] vs. 4 [1–8]; ESS: 10 [8–12] vs. 6.5 [3–9.5]). Evening-type individuals reported lower PSQI, AIS, and ESS scores (PSQI: 5.5 [3–9] vs. 8 [6.5–10], p = 0.043; AIS: 2.5 [1–6] vs. 8 [5–10.5], p = 0.002; ESS: 5.5 [1–8] vs. 9 [5.5–10], p = 0.015). Mental strain was significantly associated with insomnia severity (AIS 6.5 [3–9] vs. 1.5 [1–6.5]; p = 0.028), but not with PSQI or ESS. Poor concentration was associated with higher PSQI, AIS, and ESS scores (PSQI: 8 [7–10] vs. 6 [3–8], p = 0.014; AIS: 8 [5–10] vs. 3 [1–7], p = 0.007; ESS: 9 [7–11] vs. 5 [3–9], p = 0.030). Morning headaches also clustered with poorer sleep across all indices (PSQI: 9 [7.5–11.5] vs. 6 [4–8], p = 0.011; AIS: 10 [8.5–14.5] vs. 3 [1–7], p < 0.001; ESS: 11.5 [8.5–15] vs. 5.5 [3–9], p = 0.001). Increased weight was similarly associated with higher AIS (7 [3–10] vs. 2 [1–7.5], p = 0.008) and ESS (10 [5–11] vs. 5.5 [1.5–7.5], p = 0.003). In the multivariable logistic regression models adjusted for age, sex, profession, shift status, workload, presenteeism, and job performance, chronotype emerged as the only consistent independent predictor of sleep quality and insomnia, with evening-type individuals showing markedly lower odds of PSQI⩾5 (OR 0.09, p = 0.046) and AIS⩾6 (OR 0.17, p = 0.046) (Supplement file A). Conversely, reduced job performance independently predicted excessive daytime sleepiness (ESS⩾10; OR 0.06, p = 0.049) (Supplement file A).

Table 2: Comparison of sleep, cognition and occupational parameters of the employees according to PSQI, AIS and ESS (n=38)

Variable	Condition	PSQI (Median (IQR)	pa	AIS (Median (IQR)	pb	ESS (Median IQR)	pc
Age	<40	8 (8-11)	0.002	8 (3-8)	0.089	9 (6-10)	0.077
	≥40	6 (3-8)		3 (1-7)		5 (3-9)	
"Did you have good job performance in the previous month?"	No (poor performance)	10 (8-12)	0.014	8 (6-15)	0.067	10 (8-12)	0.066
	Yes (good performance)	7 (4-8)		4 (1-8)		6.5 (3-9.5)	
"Do you feel that your workload is excessive or unmanageable?"	No	5.5 (2-8)	0.375	3 (1-5)	0.432	7 (3-10)	0.967
	Yes	7.5 (5-9)		6 (1.5-8)		7 (4-10)	
"Have you worked while feeling unwell or unfit for work in the past month?"	No	8 (4-9.5)	0.720	5 (1-8)	0.326	6.5 (3-9.5)	0.187
	Yes	7 (6-8)		7 (6-8)		10 (7-11)	
"Are you an evening type?"	No	8 (6.5-10)	0.043	8 (5-10.5)	0.002	9 (5.5-10)	0.015
	Yes	5.5 (3-9)		2.5 (1-6)		5.5 (1-8)	

"Feeling mentally exhausted or overwhelmed during/after work?"	No	6 (2.5-9)	0.3676	1.5 (1-6.5)	0.028	6.5 (2.5-10)	0.613
	Yes	7.5 (5-9)		6.5 (3-9)		7 (5-10)	
"Do you often have disturbed memory?"	No	7.5 (4.5-8.5)	0.701	5 (1-8)	0.317	7 (3-9.5)	0.385
	Yes	7 (4-10)		6.5 (3-10)		9 (5-10)	
"Do you often have poor concentration during work?"	No	6 (3-8)	0.014	3 (1-7)	0.007	5 (3-9)	0.030
	Yes	8 (7-10)		8 (5-10)		9 (7-11)	
"Do you often wake up with a headache?"	No	6 (4-8)	0.011	3 (1-7)	0.000	5.5 (3-9)	0.001
	Yes	9 (7.5-11.5)		10 (8.5-14.5)		11.5 (8.5-15)	
Self-perceived overweight	No	7 (3.5-8.5)	0.331	2(1-7.5)	0.0082	5.5 (1.5-7.5)	0.003
	Yes	8 (5-10)		7(3-10)		10 (5-11)	

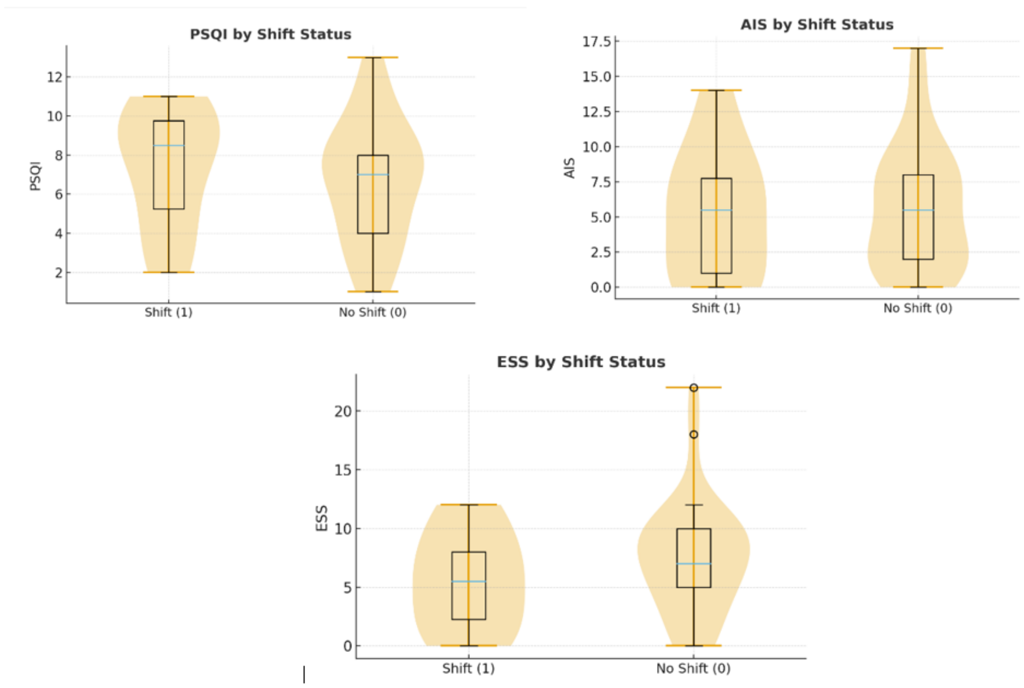
(YES = presence of symptom/condition; NO = absence) Abbreviations: AIS: Athens Insomnia Scale (range 0–24); ESS: Epworth Sleepiness Scale (range 0–24); IQR: interquartile range; PSQI: Pittsburgh Sleep Quality Index (range 0–21); p-value: pa based on PSQI; pb based on AIS; pc based on ESS. In bold are statistically significant results when $p < 0.05$.

Table 3 presents a comparison of occupational, cognitive, and sleep parameters between medical-nurse staff and non-medical staff. Decreased job performance issues were more prevalent among the medical-nurse staff, with 6/23 (26%) reporting "No" compared to none in the non-medical staff group ($p = 0.031$). Weight gain was significantly higher in the medical-nurse group, with 14/23 (60.87%) reporting increased weight versus 4/15 (26.67%) in the non-medical group ($p = 0.039$). Additionally, daytime sleepiness, as measured by the ESS, was greater in the medical-nurse staff, with a median score of 9 (IQR: 3–10), compared to 5 (IQR: 2–7) in the non-medical group ($p = 0.036$), suggesting greater occupational and health challenges among the medical-nurse staff. When categorical comparisons were recalculated using Fisher's exact test to account for small cell counts, the previously observed association between professional group and self-reported job performance no longer reached statistical significance and instead showed a non-significant trend ($p = 0.063$). All other Fisher-adjusted comparisons remained significant (See Supplement file A). Violin plots demonstrated that medical–nursing staff exhibited a clear shift toward higher ESS scores compared with non-medical staff, whereas the distributions of PSQI and AIS scores were broadly similar across professional groups. Likewise, no meaningful differences in PSQI, AIS, or ESS distributions were observed between shift-workers and non–shift-workers, supporting the absence of a shift-work effect in our cohort (Figure 2).

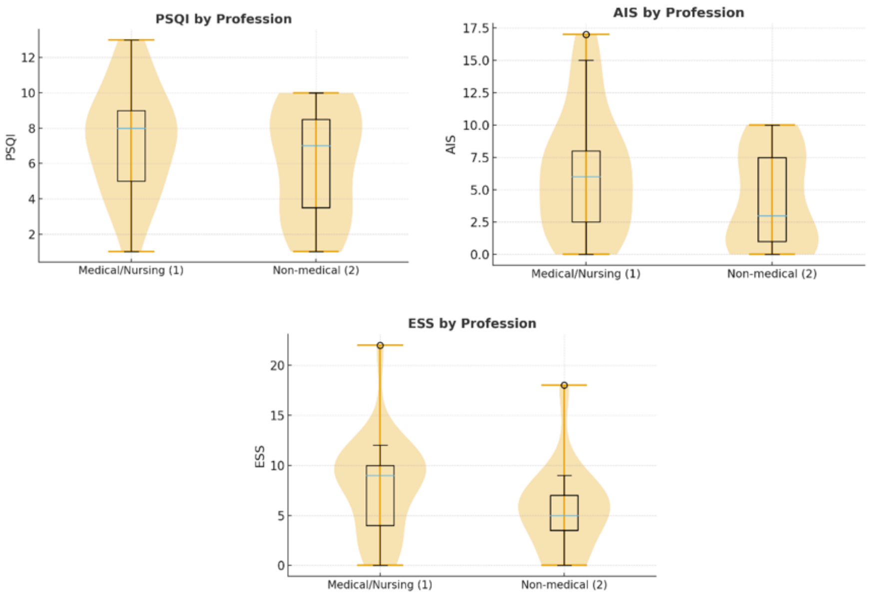
Table 3: Comparison of sleep, cognition and occupational parameters of medical-nurse and non medical staff n=38

Parameters		**Medical-Nurse staff**	**Non Medical-Nurse staff**	**p-value**
"Did you have good job performance in the previous month?" (n, %)	No	6/23 (26%)	0 (0%)	**0.031**
	Yes	17/23 (73.91%)	15/15 (100%)	
"Do you feel that your workload is excessive or unmanageable?" (n, %)	No	3/23 (13.04%)	3/15 (20%)	0.565
	Yes	20/23 (86.96%)	12/15 (80%)	
"Have you worked while feeling unwell or unfit for work in the past month?" (n, %)	No	22/23 (95.65%)	15/15 (100%)	0.314
	Yes	1/23 (4.35%)	0 (0%)	
"Are you an Evening Type? " (n, %)	No	12/23 (52.17%)	4/15 (26.67 %)	0.428
	Yes	11/23 (47.83%)	11/15 (73.33%)	
"Feeling mentally exhausted or overwhelmed during/after work?" (n, %)	No	7/23 (30.43%)	5/15 (33.33%)	0.851
	Yes	16/23 (69.57%)	10/15 (66.6%)	
"Do you often have disturbed memory?" (n, %)	No	16/23 (69.57%)	12/15 (80%)	0.475
	Yes	7/23 (30.43%)	3/15 (20%)	
"Do you often have poor concentration during work?" (n, %)	No	13/23 (56.52%)	10/15 (66.67%)	0.532
	Yes	10/23 (43.48%)	5/15 (33.33%)	
"Do you often wake up with a headache?" (n, %)	No	17/23 (73.91%)	13/15 (86.67%)	0.346
	Yes	6/23 (26.09%)	2/15 (13.33%)	
Self-perceived overweight (n, %)	No	9/23 (39.13%)	11/15 (73.33%)	**0.039**
	Yes	14/23 (60.87%)	4/15 (26.67%)	
PSQI (Median, IQR)		8 (5-9)	7 (3-9)	0.285
AIS (Median, IQR)		6 (2-8)	3 (1-8)	0.158
ESS (Median, IQR)		9 (3-10)	5 (2-7)	**0.036**

(Yes = presence of symptom/condition; No = absence)



Violin plots with embedded boxplots illustrate the distribution and central tendency of PSQI, AIS, and ESS scores by shift work.



Violin plots with embedded boxplots illustrate the distribution and central tendency of PSQI, AIS, and ESS scores by profession.

Figure 2: Violin plots with embedded boxplots illustrate the distribution and central tendency of PSQI, AIS, and ESS scores by profession and shift work

Discussion

This exploratory study shows that combining in-person interviews conducted by a certified sleep specialist with validated sleep instruments (PSQI, AIS, ESS) effectively characterizes sleep patterns and delineates sleep phenotypes among healthcare professionals in a large tertiary university hospital. A substantial proportion of participants reported poor sleep quality, short sleep duration, and frequent symptoms of insomnia and daytime sleepiness.

Interestingly, in this study, chronotype emerged as the clearest individual characteristic linked to sleep outcomes, with evening-type participants showing markedly lower odds of both poor sleep quality and insomnia symptoms even after adjustment for demographic and occupational factors. In contrast, job performance was the only variable that demonstrated an independent association with daytime sleepiness. Additionally, medical/nursing staff showed higher levels of self-perceived overweight and daytime sleepiness compared with non-medical staff. Although younger participants initially showed poorer sleep quality on the PSQI—mirroring prior findings that younger employees often experience greater insomnia symptoms and daytime sleepiness due to circadian misalignment, social jetlag, and lifestyle pressures—these age-related differences were no longer significant after adjusting for key demographic and occupational factors, indicating that age itself was not an independent predictor of sleep outcomes.[19] This suggests that the vulnerability of younger workers observed in unadjusted data may largely reflect underlying circadian preference rather than chronological age per se.[20] This interpretation aligns with broader evidence showing that younger adults are more often evening types and more prone to behaviors that exacerbate circadian misalignment and sleep restriction.[21]

In our cohort, evening-type workers demonstrated better sleep quality and fewer insomnia symptoms, and chronotype emerged as the only independent predictor of both outcomes. Although eveningness is often associated with poorer mental health and increased vulnerability to shift-work–related strain in larger epidemiological studies,[22] our findings are consistent with research showing that when work demands align more closely with an individual's circadian preference, sleep outcomes may transiently improve.[23,24] Importantly, most participants in this study were over 40 years old, an age group in which evening preference is typically less pronounced physiologically. This suggests that the evening types in our sample may represent individuals whose circadian preference is either stable and biologically rooted, or who have adapted over years of professional exposure to rotating or late schedules, potentially mitigating sleep disruption.[25] Longitudinal evidence in newly hired nurses indicates that chronotype before shift-work exposure predicts later resilience trajectories: morning types maintain stable resilience, whereas intermediate and evening types show declines in resilience and worsening sleep over time, with resilience mediating these effects.[26] Such findings imply that eveningness may be advantageous in the short term when schedules are compatible with circadian preference, but may confer long-term vulnerability under sustained misalignment. Within this framework, the better sleep outcomes observed in evening-type staff in our sample may reflect a selection or adaptation effect, whereby individuals with an evening orientation are better able to cope with irregular or late hospital schedules, at least at present. Nevertheless, despite the more favorable sleep profile observed among evening-type employees, no corresponding advantage was detected in self-reported job performance. This discrepancy likely reflects the multifactorial nature of occupational functioning, in which sleep interacts with workload intensity, organizational culture, role-specific demands, and individual coping strategies.[27] According to the literature, research on chronotype and workplace performance similarly reports mixed findings: some studies suggest that evening types tolerate night work better, whereas others show no consistent advantage and, in some cases, poorer overall work ability relative to morning types.[28] Although evening-type individuals may experience fewer sleep complaints due to alignment with late-night schedules, they are at a disadvantage in healthcare environments that rely heavily on early-morning activity and tightly structured daytime routines.[29] Any misalignment between circadian biology and job requirements can impair alertness, psychomotor function, and productivity, highlighting the complex interplay between chronotype and occupational scheduling.[30,31,32] Additionally, evidence from Crowley et al. shows that even when circadian alignment improves, as occurred during COVID-19 lockdowns, individuals with stronger evening tendencies may experience reduced work engagement, despite reporting longer sleep duration, reduced social jetlag, and better synchronization between biological and social time.[33] These results suggest that eveningness may carry inherent vulnerabilities for cognitive, motivational, or attentional performance, independent of sleep quality itself.[34] Moreover, evening types often experience poorer daytime alertness, reduced morning cognitive efficiency, and less optimal alignment with early-day task demands, factors that may persist even when sleep health is improved. Thus, our finding of diminished job performance among evening-type staff—despite their better sleep quality—may reflect a broader pattern in which evening chronotype supports sleep continuity but does not confer advantages for work performance, particularly in professions that demand sustained vigilance, early-day functioning, or high emotional and cognitive engagement. Moreover, poor job performance itself emerged as a strong independent predictor of higher daytime sleepiness (ESS $\geqslant$ 10). This aligns with conceptual models suggesting that decrements in work performance — whether subjective or objective—may signal underlying fatigue, reduced alertness, or cognitive inefficiency, which subsequently manifest as excessive daytime sleepiness.[35]

Finally, medical and nursing staff in our sample reported greater weight gain and higher daytime sleepiness than their non-medical counterparts. The distributional patterns of PSQI and AIS scores were broadly similar across professional groups, and no meaningful differences in any sleep measure were observed between shift-workers and non–shift-workers, indicating that shift schedule alone did not account for sleep outcomes in this cohort. Instead, the most prominent difference concerned daytime sleepiness, which was markedly higher among medical–nursing staff. This dissociation suggests that excessive daytime sleepiness in frontline healthcare workers may arise from factors beyond nocturnal sleep disturbances—such as cognitive overload, emotional strain, high work intensity, or chronic effort–reward imbalance—all of which can impair alertness even when sleep quality appears relatively preserved.[36] The significantly higher prevalence of overweight/obesity among medical–nursing staff may further contribute to elevated sleepiness through metabolic and inflammatory pathways, independent of sleep-disordered breathing, which was excluded by design. Although our sample size did not permit formal mediation analysis, excess weight remains a plausible contributor. Given the cross-sectional nature of the study, these associations must be interpreted cautiously: weight gain and daytime sleepiness may influence one another bidirectionally, and both may be shaped by unmeasured factors such as workload intensity, psychosocial stress, or compensatory caffeine use. Overall, our findings suggest that daytime sleepiness in this occupational group is more likely to arise from a multifactorial interplay of metabolic burden and occupational stressors rather than from impaired sleep per se. Prior literature supports a bidirectional relationship between obesity and sleep-related symptoms, whereby insufficient sleep can worsen insulin resistance and disrupt ghrelin–leptin regulation, increasing appetite and weight gain, while excess weight can independently contribute to fatigue and daytime sleepiness.[37] These patterns may be amplified in clinical roles that involve heavier workloads, high emotional demands, and greater exposure to circadian strain, underscoring the need for targeted strategies to protect the health and performance of healthcare personnel.[38, 39]

The strengths of this study include the use of specialist-led, face-to-face sleep interviews, which enhanced the accuracy and interpretability of questionnaire responses. Combining clinical interviewing with validated sleep measures (PSQI, AIS, ESS) enabled a more nuanced characterization of sleep patterns than would be achievable using self-administered surveys alone. Nonetheless, several limitations warrant consideration. Participation was voluntary, raising the possibility of self-selection bias, although proactive walk-arounds across departments helped mitigate this risk. Several constructs—including chronotype—were assessed using single-item measures rather than full validated questionnaires, reflecting the practical constraints of a structured interview design. The small sample size restricted the power to detect subtle associations, limited multivariable modeling, and reduces generalizability. In addition, the single-site design and underrepresentation of permanent night-shift workers—likely due to morning recruitment—further limit applicability. As an exploratory study aimed at identifying sleep-related phenotypes, feasibility and direct engagement were prioritized over random sampling; however, larger stratified studies are needed to validate and extend these findings.

Conclusion

This study underscores the clear diagnostic value of personal, clinician-led interviews in revealing how demographic, cognitive, and occupational factors interact to drive sleep disturbances in healthcare professionals (Figure 3). High-risk profiles—particularly younger staff and those with an evening-type circadian rhythm—exhibit a multifaceted, sleep-deficit phenotype that undermines both professional performance and personal well-being. Integrating face-to-face interviews by trained sleep specialists into occupational health programs can enhance early detection and more precise characterization of sleep problems. Such integration should inform targeted interventions to improve staff well-being—an essential prerequisite for safeguarding clinicians' health and maintaining the quality and safety of patient care. Addressing these issues is vital, as the strengthening of hospital occupational health and safety services has been shown to be a critical factor in preventing workplace accidents and occupational hazards, particularly in the demanding environment of healthcare settings.[39,40]

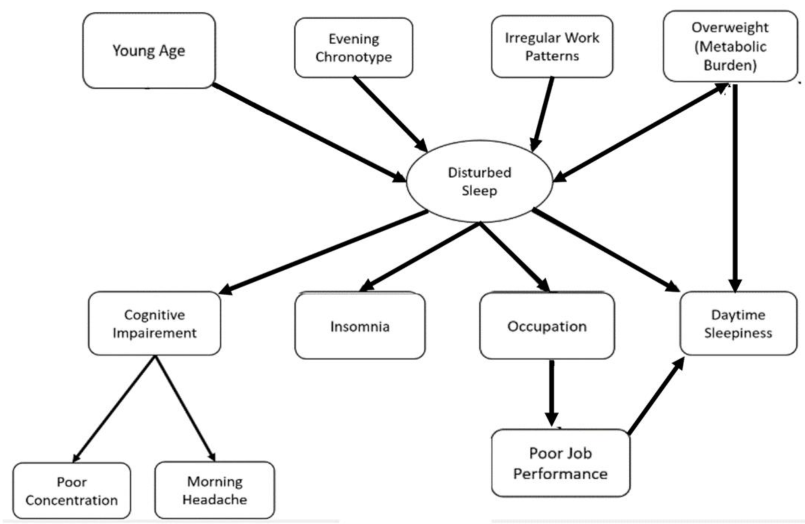


Figure 3: The multifaceted phenotype of healthcare professionals: Sleep Disturbance defines the Multifaceted Phenotype of Healthcare Professionals

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