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Article

# Exploration of Shift Work Among Nursing Professionals Related to Interconnected Determinants of Health in a Hospital: A Cross-Sectional Study

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## Highlights

### Public health relevance — How does this work relate to a public health issue?

- This study links shift work among nurses to a major public health issue: poor sleep quality and its interconnected effects on stress, mental health, and memory complaints in a workforce essential for 24/7 healthcare delivery.
- It shows that nurses experience poor sleep quality (PSQI >5) across all shifts, particularly in rotating and night shifts, highlighting how hospital working conditions create widespread occupational health risks.

### Public health significance — Why is this work of significance to public health?

- The study is significant because it reveals a high prevalence of poor sleep quality, moderate stress, and emotional/cognitive disturbances among 247 nurses in a tertiary hospital — a problem affecting millions of healthcare workers worldwide.
- It provides evidence that these effects are worse in female nurses on rotating shifts and in those over 50 on night shifts, reinforcing shift work as an important occupational determinant of health with implications for patient safety.

### Public health implications — What are the key implications or messages for practitioners, policy makers and/or researchers in public health?

- Calls for organizational changes (forward rotation, adequate rest periods) and individualized strategies based on chronotype to improve sleep health and reduce fatigue-related errors in nurses.
- Recommends integrating sleep quality monitoring (including wearable technology) into routine occupational health surveillance and prioritizing longitudinal studies and personalized interventions.

## Abstract

**Background:** Nursing professionals must fulfill their care duties within a system that requires 24-hour coverage. This necessitates hospitals implementing a shift-work system to meet care demands. **Purpose:** To assess sleep quality and its relationship with interconnected health variables among nursing professionals working shifts. **Method:** A cross-sectional descriptive observational study. 247 nursing professionals, 85.8% of whom were women, aged between 21 and 65, from Son Espases University Hospital in Spain. A corporate email was sent containing a link to an online: the Pittsburgh Sleep Quality Index (PSQI), Munich Chronotype Questionnaire (MCTQ) to determine chronotype, the Perceived Stress Scale (PSS-14), General Health Questionnaire (GHQ-12), Memory Failures of Everyday Life Questionnaire (MFE-30), and the World Health Organization Quality of Life Questionnaire (WHOQOL-BREF), applied across different work shifts. **Results:** Nurses, regardless of shift work, reported poor sleep quality (score > 5), a higher proportion of undefined chronotype (60%), moderate levels of perceived stress (26 points), a tendency toward poorer general mental health (14 points), and more memory complaints (60 points), but a favorable perception of their quality of life (90 points), with no statistically significant differences found. Female professionals working rotating shifts showed significant differences, presenting a higher number of memory complaints compared with males. Professionals over the age of 50 working night shifts displayed significantly poorer general mental health and severe memory complaints. **Conclusion/Implications for Practice:** Nursing professionals show poor sleep quality, elevated stress levels, signs of emotional disorders, and moderate memory complaints, particularly on night and rotating shifts, which were observed, albeit without significantly affecting perceived quality of life. These findings support the need to implement organizational strategies that safeguard the well-being of nursing professionals and to consider individual patterns to improve sleep health.

**Keywords:** sleep quality; quality of life; chronotype; perceived stress; memory complaints; nursing professionals; general mental health

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## 1. Introduction

According to the International Labour Organization (ILO), shift work is defined as “any method of organizing work schedules whereby workers succeed one another at the same workstation according to a given pattern, which may be continuous or discontinuous, and entails working at different times over a given period” (ILO 2022).

For decades, shift work has been recognized to have a negative impact on workers’ health and well-being (Yu et al. 2025). In developed countries, shift work is increasing by 3% each year; and it is estimated that, in the coming years, 50% of the global working population will be engaged in shift work, with increasingly irregular schedules in healthcare settings. According to the Spanish National Survey on Working Conditions (2015), 23% of the population works shifts: 49.4% fixed shifts, 40.6% rotating shifts, and 8.5% night shifts; with the healthcare sector the most affected – 53% men and 47% women. Irregular schedule clauses are quite common in employment contracts, appearing in up to 25% of agreements and affecting over 44% of workers (Marqueta de Salas et al. 2017).

Hospitals require shift work organization as a key element to ensure the continuity of patient care and services. In this system, nursing professionals are exposed to a work arrangement that provides 24-hour care every day of the year (Chaiard et al. 2019); as such, shift work is inherent to the nursing profession. Nurses must frequently adjust their daily routines, which impacts sleep quality and circadian rhythms, potentially leading to fatigue, as well as emotional and cognitive disturbances. Further, there is evidence that shift work is associated with various alterations in physical, biological, and mental functions (Brown et al. 2020; Silva & Costa 2023; Tahghighi et al. 2017).

In this regard, shift work has adverse consequences on health and is becoming a serious public health issue due to its impact on sleep quality, specifically leading to insomnia, excessive daytime sleepiness, fatigue, digestive problems, cardiovascular diseases, cancer, and depression and anxiety (Dai et al. 2019; Rosa et al. 2019). Hence, it is important to explore the determinants or interconnected health variables involved to gain a broader understanding of the potential consequences and to promote the development of primary and secondary prevention strategies. Interconnected health variables are interrelated factors that can affect individuals' health – in this case, shift workers – through the lens of biological, psychosocial, economic, organizational, and environmental domains. These variables interact in a complex manner, and changes in one (such as impaired sleep quality) may influence others (perceived stress, general mental health, memory complaints, and quality of life). Therefore, it is understandable that health depends not only on personal factors but also on the organizational system and the interconnected environment (Marmot et al. 2020; Solar & Irin 2021).

Moreover, the internal mechanism affected by shift work involves the circadian rhythms suprachiasmatic nucleus (SCN), due to an environmental stressor that interferes with the synchronization of the biological clock (Luca et al. 2020). The pineal gland secretes melatonin, which is regulated by the SCN and primarily depends on the most important zeitgeber: light. Light acts on the circadian system to adjust biological rhythms and has an antidepressant effect, influencing multiple systems, stabilizing mood, and regulating emotions (Wirz-Justice et al. 2021; Wright et al. 2013). Besides, there are other secondary zeitgebers, such as routine, regular mealtimes, physical activity, and social interaction (Madrid 2022). Shift work is known to be able to interfere with the melatonin secretion rhythm, to impair sleep quality, and to lead to a decline in overall health (Resuehr et al. 2019).

Further, scientific literature has shown that the mechanisms involved in sleep disorders associated with shift work support the implementation of strategies aimed at promoting both occupational health and sleep quality. In this regard, at the individual level, several interventions have been proposed before and after night shifts; such as supplementing rest with short naps, avoiding caffeine consumption during the six hours prior to the end of the shift, establishing a regular sleep routine after the shift, increasing exposure to natural light, engaging in cognitive-behavioral therapy, and, in some cases, taking melatonin to facilitate sleep onset (D'Ettorre et al. 2018; Madrid 2022; Riemann et al. 2017). From an organizational perspective, recommendations include avoiding fewer than 11 hours between consecutive shifts, providing at least two days off following night shifts, and implementing forward-rotating shift schedules (Eldevik et al. 2013).

Currently, healthcare professionals are recognized by society for their dedication and the vocation associated with their work. Healthcare staff constantly face tasks in their daily routine that entail both physical and emotional strain, which must be managed appropriately. Nurses often experience a high emotional and workload burden, further compounded by shift work, which significantly affects the quality of life and well-being of healthcare professionals.

Sleep quality is a crucial indicator of physical and psychological well-being; however, approximately seven out of ten nurses experience problems with sleep quality. Rotating and fixed night shifts can disrupt the internal biological clock of nursing professionals, leading to occupational fatigue and sleep disorders, with negative effects on physiological state and mental health (Alfonsi et al. 2021; Gómez-García et al. 2016). This can result in physical and mental illnesses, reduced work efficiency, increased sensitivity to stress, and even errors in clinical decision-making regarding patient care, thereby affecting patient safety and quality of care. Thus, sleep disorders among nursing professionals have been found in various studies to be closely related to rotating and fixed night shift work (Ferri et al. 2016; Lim et al. 2019; Román et al. 2023; Thorkildsen et al. 2023); in one case it was even observed that 72% of nursing professionals attributed their lack of sleep to rotating and fixed night shift work (Chang & Peng 2021). Furthermore, insomnia is prevalent among healthcare workers, influenced by shift work, the after-effects of COVID-19, and mental health factors (Rocero et al. 2025).

In accordance with the background, scientific evidence supports the need to initiate a study aimed at gaining deeper insight into sleep quality and the interconnected health variables of nursing professionals who are exposed to the consequences of shift work. This, in the future, will entail exploring and allocating healthcare resources, as well as developing effective interventions to alleviate or mitigate the negative effects of circadian alterations and sleep deprivation. It is also essential to understand the patterns of poor sleep quality among nursing professionals (Zeng et al. 2020). As such, this study sought to highlight the occupational needs of healthcare professionals within a healthcare system that is facing a situation in which staff shortages and the need to provide uninterrupted care to the population are leading professionals to work shifts of up to 24 hours, including nights and weekends.

In this context, the main objective was to assess sleep quality and its relationship with interconnected health variables such as stress, general health, memory complaints, and quality of life among nursing professionals working shifts at a level III hospital. The specific objectives were: (1) to evaluate subjective sleep quality using the Pittsburgh Sleep Quality Index (PSQI) and to identify chronotype in nursing professionals through the Munich Chronotype Questionnaire (MCTQ); (2) to assess perceived stress using the PSS-14 questionnaire, self-perceived general mental health using the PHQ-12, everyday memory failures using the MFE-30, and quality of life in the healthcare setting using the World Health Organization Quality of Life Questionnaire (WHOQOL-BREF); and (3) to analyze differences between groups of nursing professionals working day, night, and rotating shifts, as well as differences by gender and age ( $\leq$  and  $>$  50 years) in relation to interconnected health variables.

## 2. Materials and Methods

### 2.1. Design and Participants and Setting

The study was conducted using a quantitative approach and a cross-sectional descriptive observational design. The primary variables were sleep quality and type of work shift. The secondary variables were age, gender, type of employment contract, service/unit, professional category [nurse and nursing care assistant (CNA)], chronotype, perceived stress, memory complaints, general health status, and quality of life.

An initial non-random sample of 95 participants was deemed sufficient to estimate, with a 95% confidence level and a precision of  $\pm 3$  percentage points, a population percentage expected to be around 2%. The expected replacement rate was set at 15%. For CNAs, a non-random sample of 92 participants was considered sufficient to estimate, with a 95% confidence level and a precision of  $\pm 3$  percentage points, a population percentage also expected to be around 2%, with an anticipated replacement rate of 15%. The population estimation calculation was performed using the GRANMO sample size calculator, version 7.12, April 2012.

A total of 247 nursing professionals participated, out of a total staff of 1,479 nurses and 1,143 CNAs at Hospital Universitario Son Espases (HUSE) and affiliated centers, working in day shifts (fixed morning and/or afternoon), night shifts (fixed night), or rotating shifts (Table 1).

They freely and voluntarily completed an online questionnaire; therefore, the number of participants depended on their willingness to participate. Participation did not entail any financial compensation for either participants or researchers.

The following eligibility criteria were applied in this study. Inclusion criteria were: (a) nursing professionals with one month or more of work experience in any unit or department at HUSE; (b) both genders; (c) aged between 18 and 65 years; (d) voluntary participation; and (e) temporary, interim, or permanent employment. Exclusion criteria were: (a) having a diagnosed sleep disorder; (b) currently experiencing, or having experienced a negative life event (death of a family member, severe stressful situation, major economic problem, separation/divorce, severe mental and/or physical illness, etc. in the previous two months); (c) being on sick leave or having returned from sick leave less than one month prior; (d) abuse of toxic substances, hypnotics, relaxants, or sedatives; (e)

conflicts of interest with the unit or department where the participant works or with the institution; and (f) failure to complete the questionnaire in its entirety.

**Table 1.** Classification of work shifts in hospitals.

<b>SHIFT WORK and SUBGROUPS</b>	
<b>Day</b>	Morning shift (8:00 – 15:00 h)
	Afternoon shift (15:00 – 22:00 h)
	12-hour day shift (8:00 – 20:00 h)
<b>Night</b>	Mixed shift (week of morning shift-week of afternoon shift)
	Night shift (22:00 – 8:00 h)
<b>Rotating</b>	2-morning, 2-afternoon, 1-night, 1-day outgoing, 2-day off
	12-hour shift (8:00 – 20:00 h and 20:00 – 8:00 h)

This study was conducted across the various units and departments of Son Espases University Hospital, a level III hospital and the reference healthcare center in the Balearic Islands (Spain). HUSE is part of the Health Service and the Ponent healthcare sector. In addition, it manages other affiliated centers, including General Hospital, Psychiatric Hospital, and Virgen de la Salud Hospital.

## 2.2. Measures

An online form was created using the Microsoft 365® ‘Forms’ tool to integrate all standardized and validated questionnaires collecting information on sociodemographic and occupational data, sleep quality, chronotype, perceived stress, general health, memory complaints, and quality of life. Participants completed the form, which was distributed via corporate email through a link, in an average of 28 minutes.

Pittsburgh Sleep Quality Index (PSQI; Buysse et al. 1989; Macías & Royuela 1996). This is a widely used tool for assessing sleep quality and associated disturbances over the previous month. Developed at the University of Pittsburgh, the PSQI has proven to be a valid and reliable measure in both clinical and research settings, and has also been validated in the Spanish population. The instrument consists of 19 self-administered items grouped into seven components: (1) subjective sleep quality, (2) sleep latency (time taken to fall asleep), (3) sleep duration, (4) habitual sleep efficiency (proportion of time in bed spent sleeping), (5) sleep disturbances, (6) use of sleep medication, and (7) daytime dysfunction (daytime problems related to sleep). Each component is scored on a scale from zero to three, where zero indicates no difficulty and three represents the greatest severity. The sum of the component scores yields a total score ranging from 0 to 21. A total score greater than five suggests poor sleep quality (poor sleepers). The time required to complete this instrument ranges between five and ten minutes.

Munich Chronotype Questionnaire (MCTQ; Roenneberg et al. 2003). This is a self-administered tool designed to assess individual chronotype; that is, the natural predisposition to have more energy and be more active in morning or evening activities, based on actual sleep and wake times during workdays and free days. It has been validated across various populations and cultures, proving to be a reliable measure of chronotype. The questionnaire can be completed in approximately five minutes. The MCTQ consists of a set of questions that gather information on the time an individual goes to bed and wakes up on workdays and days off, sleep duration, use of alarms to wake up, and time needed to fall asleep. Based on the responses, an individual’s chronotype can be determined. Validation studies have demonstrated that the MCTQ has good reliability and convergent validity. For example, Zavada et al. (2005) found a significant correlation between the MCTQ and the Horne & Östberg Morningness-Eveningness Questionnaire, as well as objective circadian rhythm measures obtained through actigraphy. Furthermore, the MCTQ has been shown to be sensitive to variations in age, gender, and lifestyle, supporting its usefulness across diverse populations (Zavada et al. 2005).

Perceived Stress Scale (PSS; Cohen et al. 1983; Remor 2006). This is a widely used tool for assessing an individual’s subjective perception of stress. The PSS is based on Lazarus’s transactional

model of stress, which emphasizes the importance of cognitive appraisal in the stress experience. The instrument consists of 14 items (PSS-14) that measure the frequency with which individuals have experienced thoughts and feelings related to stressful situations over the previous month. Items are phrased both positively and negatively and are answered using a 5-point Likert-type scale ranging from 0 ("never") to 4 ("very often"). Total scores are obtained by summing the responses after reversing the scores for positively worded items. Higher scores indicate greater levels of perceived stress. The total score ranges from 0 to 56 points, reflecting the individual's perception of stress. Namely: scores of 0-14 indicate that the person is almost never or never stressed; 15-28 indicates occasional stress; 29-42 indicates frequent stress; and 43-56 indicates very frequent stress. The administration time for this scale ranges from five to ten minutes.

General Health Questionnaire (GHQ-12; Goldberg et al. 1988; Sánchez-López et al. 2008). This is a screening test that assesses overall mental health status over the previous few weeks, focusing on aspects such as stress, anxiety, depression, loss of confidence, inability to enjoy daily activities, and social dysfunction. It is a brief psychometric tool used for the detection of psychological distress and possible non-psychotic disorders in both clinical and population settings. The original version included 60 items, but was later adapted into Spanish using 12 items, which present a situation related to emotional well-being; answered using a 4-point Likert-type scale. Higher scores indicate a greater degree of emotional symptoms. A cut-off score of 12 or above suggests the possibility that the individual may be experiencing an emotional disorder, in which case a more precise clinical evaluation would be recommended. The estimated administration time is not standardized, but is generally between two and five minutes.

Memory Failures in Everyday Life (MFE-30; Lozoya-Delgado et al. 2012; Sunderland et al. 1984). This instrument assesses the perceived frequency of memory failures in everyday contexts, in both clinical and non-clinical populations. It consists of 30 items describing common situations in which a memory lapse may occur. Each item is scored on a 5-point Likert-type scale ranging from 0 ("never or almost never") to 4 ("always or almost always"). Higher scores indicate a greater perceived difficulty with memory in daily life. For clinical interpretation, the following cut-off score ranges are established: below 8 points indicates optimal memory functioning; between 8 and 35 points indicates normal functioning, with minor memory failures that do not affect daily performance; between 36 and 50 points indicates memory impairment with some impact on daily activities; and above 50 points indicates moderate to severe memory impairment with a great impact on daily functioning. The estimated administration time is not standardized, but generally ranges between 10 and 15 minutes.

World Health Organization Quality of Life (WHOQOL; Lucas-Carrasco 1998; WHOQoL Group 1993). This tool was developed to assess quality of life across various areas of healthcare in different cultural, linguistic, and national contexts. The questionnaire consists of 26 self-administered items, derived from the original 100-item instrument which had demonstrated reasonable validity and reliability. The WHOQOL-BREF evaluates four domains of quality of life: (1) physical health, (2) psychological health, (3) social relationships, and (4) environment. In addition, it contains two other questions used to rate the individual's "overall perception of quality of life" and "overall perception of health." Interpretation of the questionnaire does not involve a cut-off score; instead, scores can range from 0 to 100, with higher scores indicating better quality of life. The administration time is between 10 and 15 minutes.

### 2.3. Procedure

This study was conducted in the following phases.

Phase 1: Preparation and approval of permissions. Data collection procedures were not initiated until after approval of the study by the Research Committee of Hospital Universitario Son Espases (CI-HUSE), the Research Ethics Committee for medicinal products of the Balearic Islands (CEIm-IB), and the nursing management (see section: Ethical aspects and data security).

Phase 2: Data collection with participants. Prior to this, a literature review had been conducted to acquire the most comprehensive knowledge on the topic, and rigorous, validated questionnaires and scales were selected for the evaluation. Data collection was then carried out through an online form created using the Microsoft 365® 'Forms' tool. The different items from the questionnaires and scales were transcribed into 'Forms' and distributed to nursing professionals via corporate email containing an access link. The form was first distributed on March 3, 2025, and subsequently sent out twice more: one week and three weeks after the initial distribution. The online form was completed voluntarily by nursing professionals, ensuring anonymity and confidentiality. A sample copy can be found in the Annexes.

Phase 3: Data organization and analysis. Once the professionals had completed the questionnaire, the data were automatically collected and transferred into an Excel file generated by the 'Forms' tool. In parallel, the data were organized into different Excel sheets to establish filters by work shift (day, night, and rotating) and to calculate frequencies, percentages, means, and standard deviations for the different variables. The data were then processed using IBM SPSS Statistics (see Statistical Analysis section for further details).

Phase 4: Results, discussion, and conclusions. The results are presented according to the study objectives, interpreted, and compared with the most recent and updated literature. Finally, the limitations, future research directions, and conclusions are outlined.

#### 2.4. Data Analysis

Data analysis was carried out using descriptive and inferential statistics with the data processed in IBM SPSS Statistics, version 30.0 (2024). Descriptive statistics included means and standard deviations, as well as frequencies and percentages for the different variables. Normality criteria (Shapiro-Wilk and Kolmogorov-Smirnov tests) and homoscedasticity (Levene's test) were also assessed. Subsequently, correlational statistics were performed using Spearman's rho ( $\rho$ ) for the different shift work groups (day, night, and rotating) and the various interconnected health variables: PSQI, PSS-14, GHQ-12, MFE-30, and WHOQOL. Finally, inferential statistics were conducted using the Mann-Whitney U test (U) and the Kruskal-Wallis test (H). Statistical significance (p-value) was considered, and effect sizes were calculated using rank biserial correlation (rrb) and epsilon squared ( $\epsilon^2$ ).

#### 2.5. Ethical Aspects and Data Security

The study was approved by the Hospital Research Committee under decision number CI-989-25, the Research Ethics Committee for Medicinal Products of the Balearic Islands under decision number IB 5724/25 PI, and the nursing management of HUSE. Regarding other ethical aspects and data security, the following provisions were observed: 1) Provisions of Law 14/2007, of July 3, on Biomedical Research (LIB); 2) Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016, on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, repealing Directive 95/46/EC (General Data Protection Regulation, GDPR); 3) Organic Law 3/2018, of December 5, on the Protection of Personal Data and Guarantee of Digital Rights (LOPDGDD); 4) Ethical Principles for Medical Research Involving Human Subjects as stated in the Declaration of Helsinki (World Medical Association [WMA], 2013); 5) The principal investigator ensured participants' rights to privacy, the confidentiality of all information related to their participation, and informed consent in accordance with Law 14/1986, of April 25, General Health Law (LGS), Article 10, and that the highest standards of professional conduct, confidentiality, and anonymity were maintained at all times, complying with the applicable national data protection regulations; and 6) the criteria outlined in the Checklist for Reporting Results of Internet E-Surveys (CHERRIES; López-Rodríguez 2019) were followed for the administration of the online questionnaires.

### 3. Results

The results obtained in this study are shown below, based on the data collected and analyzed after completing the questionnaires and scales answered by the nursing professionals.

#### 3.1. Socio-Demographic Data

Table 2 presents the socio-demographic and occupational data of the 247 participants in the study, distributed according to type of work shift (day, night, or rotating). Variables such as gender, age group, professional category, and years of experience are presented. This information makes it possible to analyze potential differences between the various shifts and their possible influence on the working conditions and health of nursing professionals.

**Table 2.** Descriptive analysis of participants' sociodemographic data in relation to shift work.

	Sociodemographic data (N: 247)	Shift work		
		Day 38.5% (95)	Night 4.5% (11)	Rotating 57.1% (141)
Gender	Males 14.2% (35)	10.5% (10)	27.3% (3)	15.6% (22)
	Females 85.8% (212)	89.5% (85)	72.7% (8)	84.4% (119)
Age	21 to 30 years 10.90% (28)	9.5% (9)	9% (1)	12.8% (18)
	31 to 40 years 19.5% (44)	12.6% (12)	18.2% (2)	24.1% (34)
	41 to 50 years 29.9% (74)	30.5% (29)	36.4% (4)	29.1% (41)
	More than 50 years 39.2% (97)	47.4% (45)	36.4% (4)	34% (48)
Professional category	Nurses	61.1% (58)	27.3% (3)	47.5% (67)
	CNAs	38.9% (37)	72.7% (8)	52.5% (74)
Years of experience	6 months to 1 year	1% (1)	0% (0)	0.7% (1)
	1 to 5 years	9.5% (9)	18.2% (2)	14.9% (21)
	5 to 10 years	8.4% (8)	27.3% (3)	20.6% (29)
	More than 10 years	81.1% (77)	54.5% (6)	63.8% (90)

Notes. CNAs, nursing assistant technicians.

The sample consisted of 247 participants, 212 of whom (85.8%) were women. It was observed that the rotating shift was the most frequent (57.1%), followed by the day shift (38.5%) and, to a lesser extent, the night shift (4.5%). In relation to age, participants over 41 years of age predominated, with the group over 50 years of age as the most representative. Professional category was practically equal between nursing staff and nursing assistant technicians although, in the night shift, the presence of CNAs was higher (72.7%). In terms of length of work experience, most of the participants had over 10 years of experience, especially in the day shift (81.1%) and rotating shift (63.8%). The sample was divided according to the participants' work center, and it was observed that a large majority of the participants (85.1%) worked at HUSE, while the rest belonged to other hospitals with less representation (General Hospital, Psychiatric Hospital, and Virgen de la Salud Hospital), with percentages not exceeding 7.3%.

#### 3.2. Description of Primary and Secondary Variables

The mean sleep quality scores (PSQI) were similar between the day, night, and rotating shifts (9.81, 10.09, and 8.78, respectively), with no statistically significant differences. However, the rotating shift had both the highest (19) and lowest (0) scores. In terms of perceived stress (PSS-14), the night shift showed the highest standard deviation (8.53), while the rotating group had the largest extreme values (0-42) and the highest standard deviation (6.27). Additionally, mean scores were close between the three shifts (26.88, day; 28.36, night; and 26.26, rotating), also without statistically significant differences. In terms of general mental health (GHQ-12), mean scores ranged between 12.52 and 13.94, whereas in memory complaints (MFE-30), the values were around 60 points, with no statistically

significant differences. Finally, in quality of life (WHOQOL), the rotating shift obtained the highest mean score (92.01), followed by the day shift (89.35) and night shift (86.35). In the latter shift, a higher dispersion was observed (16.35), whereas the rotating shift showed a lower standard deviation (12.43).

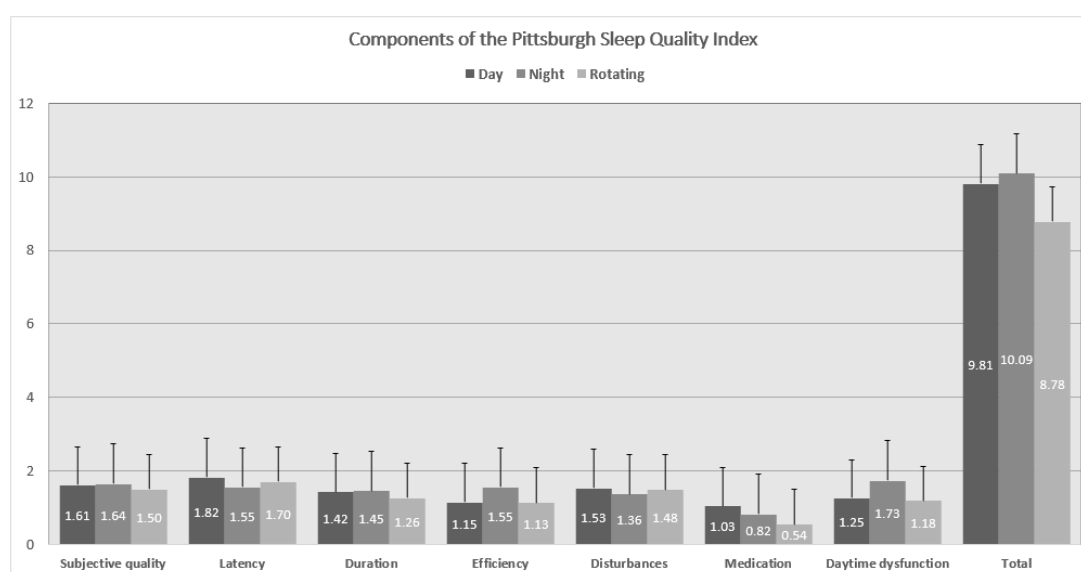
**Table 3.** Inferential analysis: Results of the interconnected health variables in relation to shift work.

Shift work	Day n = 95			Night n = 11			Rotating n = 141			p	$\epsilon^2$
	M	SD	Range	M	SD	Range	M	SD	Range		
Males	10 (10.53%)			3 (27.27%)			22 (15.60%)				
Females	85 (89.47%)			8 (72.73%)			119 (84.40%)				
<b>PSQI</b>	9.81	4.20	3-18	10.09	4.11	5-17	8.78	3.66	0-19	0.252	0.003
<b>PSS-14</b>	26.88	6.42	12-45	28.36	5.88	22-38	26.26	6.27	0-42	0.606	0.004
<b>GHQ-12</b>	13.94	6.65	4-36	13.55	7.42	3-25	12.52	5.23	1-29	0.533	0.003
<b>MFE-30</b>	58.26	21.49	30-117	60.18	25.94	32-118	55.95	18.37	30-128	0.874	0.007
<b>WHOQOL</b>	89.35	13.70	55-127	90	16.35	61-123	92.01	12.43	61-121	0.498	0.002

*Notes.* PSQI, Pittsburgh Sleep Quality Index Questionnaire; PSS-14, Perceived Stress Scale; WHOQOL, World Health Organization Quality of Life Questionnaire; GHQ-12, General Health Questionnaire; MFE-30, Memory Complaints in Everyday Life Questionnaire; M, mean; SD, Standard deviation; n, sample size; p with significance levels:  $p < 0.001$  (high),  $p < 0.01$  (medium),  $p < 0.05$  (low);  $\epsilon^2$ , epsilon squared (effect size):  $\epsilon^2 < 0.01$  (small effect),  $\epsilon^2$  between 0.06 and 0.14 (medium effect),  $\epsilon^2 > 0.14$  (large effect).

### 3.2. Pittsburgh Sleep Quality Index (PSQI)

Figure 1 shows the results obtained on the different components of the PSQI according to the participants' work shift (day, rotating, or night). Mean scores for overall sleep quality and for the seven components of the questionnaire are plotted: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Bars include the mean values and their corresponding standard deviation, allowing comparison of perceived sleep quality between different participants by work shift.



**Figure 1.** Results of the PSQI components in relation to shift work.

On the PSQI, overall mean scores were high in all three shifts (9.81 in day, 10.09 in night, and 8.78 in rotating), exceeding the cut-off point of 5.00 and indicating poor sleep quality. Mean scores for the seven components ranged from 0.54 to 1.82, suggesting a low to moderate range of dysfunction. The night shift had higher scores on the components: subjective sleep quality (1.64), habitual sleep efficiency (1.55), and daytime dysfunction (1.73). Meanwhile, the day shift showed higher scores in: sleep latency (1.82), sleep duration (1.42), sleep disturbances (1.53), and use of sleep medication (1.25).

Table 4 represents the mean values, standard deviations, range, mean contrast ( $p$ ), and effect size ( $\epsilon^2$ ) of the PSQI components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction), as well as the total score according to shift work (day, night, or rotating).

**Table 4.** Inferential analysis: Results of sleep quality components and PSQI total score in relation to shift work.

Shift work	Day n = 95			Night n = 11			Rotating n = 141			$p$	$\epsilon^2$
	M	SD	Range	M	SD	Range	M	SD	Range		
<b>PSQI COMPONENTS</b>											
<b>Subjective Quality</b>	1.61	0.74	0-3	1.64	0.80	1-3	1.50	0.68	0-3	0.449	0.001
<b>Latency</b>	1.82	0.92	0-3	1.55	1.21	0-3	1.70	0.94	0-3	0.498	0.002
<b>Duration</b>	1.42	0.72	0-3	1.45	0.82	0-3	1.26	0.78	0-3	0.180	0.005
<b>Efficiency</b>	1.15	1.09	0-3	1.55	1.36	0-3	1.13	1.04	0-3	0.635	0.004
<b>Disturbances</b>	1.53	0.58	1-3	1.36	0.67	1-3	1.48	0.60	0-3	0.543	0.003
<b>Medication</b>	1.03	1.29	0-3	0.82	1.25	0-3	0.54	0.98	0-3	0.011	0.028
<b>Daytime Dysfunction</b>	1.25	0.95	0-3	1.73	0.64	1-3	1.18	0.86	0-3	0.125	0.008
<b>Score Total</b>	9.81	4.20	3-18	10.09	4.11	5-17	8.78	3.66	0-19	0.252	0.003

Notes. M, mean; SD, Standard Deviation, n, sample size; PSQI, Pittsburgh Sleep Quality Index;  $p$  with significance levels:  $p < 0.001$  (high),  $p < 0.01$  (medium),  $p < 0.05$  (low);  $\epsilon^2$ , epsilon squared (effect size):  $\epsilon^2 < 0.01$  (small effect),  $\epsilon^2$  between 0.06 and 0.14 (medium effect),  $\epsilon^2 > 0.14$  (large effect).

In the component analysis of the PSQI shown in Table 4, statistically significant differences were found between shifts in the use of sleep medication ( $p = 0.011$ ), with a very small effect size ( $\epsilon^2 = 0.028$ ). The day shift had the highest mean score in this component (1.03), followed by the night shift (0.82) and the rotating shift (0.59). For the remaining components, no statistically significant differences between shifts were observed. After identifying statistically significant differences between shift types in the sleep medication component, post-hoc comparisons were performed using the Mann-Whitney U test, with a Bonferroni correction adjusting the significance threshold to  $p < 0.016$ . The results revealed that only the comparison between the day shift and the rotating shift was significant ( $p = 0.003$ ), indicating that nursing professionals on rotating shifts use sleep medication more frequently than those on day shifts. In contrast, no significant differences were observed between the day and night shifts ( $p = 0.595$ ) or between the night and rotating shifts ( $p = 0.462$ ).

### 3.4. Chronotype

Table 5 shows the distribution of chronotypes in the total sample and according to work shift.

**Table 5.** Results of the percentage distribution and direct scores of the chronotypes in relation to shift work.

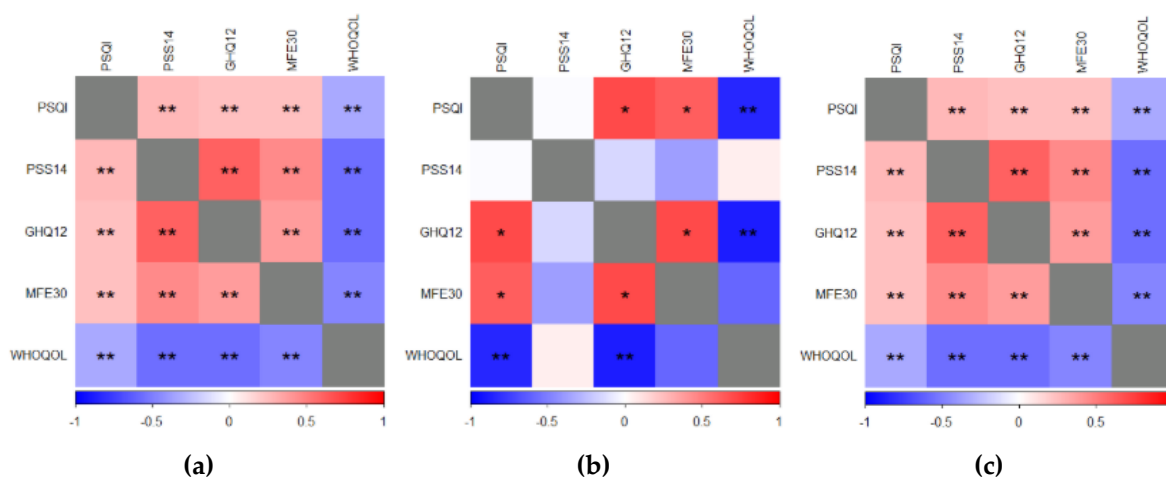
Chronotype subtypes	Shift work		
	Day 38% (89)	Night 5% (11)	Rotating 58% (136)
<b>Extreme morning</b>	1% (1)	9% (1)	4% (5)
<b>Morning</b>	28% (25)	9% (1)	24% (32)
<b>Indefinite</b>	66% (59)	45% (5)	64% (88)
<b>Evening</b>	2% (2)	18% (2)	4% (5)
<b>Extreme evening</b>	2% (2)	18% (2)	4% (6)

Notes. Initially, data were collected from 247 participants, but 11 responses were removed because they were not answered correctly. Therefore, the result was for a final sample of 236 participants to explore the chronotype of nursing professionals.

In the total sample, the predominant chronotype was indefinite (64%), followed by morning chronotype (25%), while extreme evening (4%), afternoon (4%), and extreme morning (3%) chronotypes were less frequent. In the analysis of the distribution by work shift, it was observed that in the day shift (38%), there was a predominance of indefinite (66%) and morning (28%) chronotypes, with less frequent evening and extreme chronotypes. On the other hand, the night shift (5%) showed a high presence of extreme evening chronotype (18%) and evening chronotype (18%), suggesting a certain biological relationship with night hours. However, morning and extreme morning chronotypes were also observed (9% in both). In the rotating shift (58%), the indefinite chronotype predominated (64%), followed by morning (24%), with low representation of evening (4%) and extreme evening (4%) chronotypes.

### 3.5. Correlations of health variables interconnected to shift work

The relationships between health variables and shift work revealed that participants on the day shift (Figure 2A) presented significant correlations between poorer sleep quality and higher perceived stress scores ( $\rho = 0.468^{**}$ ), poorer mental health ( $\rho = 0.563^{**}$ ), and lower quality of life ( $\rho = -0.475^{**}$ ). Perceived stress was positively correlated with poorer mental health ( $\rho = 0.722^{**}$ ) and a higher number of memory complaints ( $\rho = 0.450^{**}$ ) but negatively correlated with quality of life ( $\rho = -0.594^{**}$ ). Likewise, poorer mental health was associated with more memory complaints ( $\rho = 0.385^{**}$ ) and lower quality of life ( $\rho = -0.537^{**}$ ). For the night shift (Figure 2B), a negative correlation was observed between sleep quality and quality of life ( $\rho = -0.848^{**}$ ), along with associations between poorer sleep quality and poorer mental health ( $\rho = 0.700^{*}$ ) and more memory complaints ( $\rho = 0.624^{*}$ ). Poorer mental health was also linked to a higher number of memory complaints ( $\rho = 0.703^{*}$ ) and lower quality of life ( $\rho = -0.881^{**}$ ). Regarding the rotating shift (Figure 2C), poor sleep quality was associated with higher stress ( $\rho = 0.279^{**}$ ), poorer mental health ( $\rho = 0.249^{**}$ ), and more memory complaints ( $\rho = 0.240^{**}$ ). Perceived stress was associated with poorer mental health ( $\rho = 0.616^{**}$ ), more memory complaints ( $\rho = 0.451^{**}$ ), and lower quality of life ( $\rho = -0.569^{**}$ ). Additionally, poorer mental health was linked to a higher number of memory complaints ( $\rho = 0.388^{**}$ ) and reduced quality of life ( $\rho = -0.560^{**}$ ).



**Figure 2.** (A) (day shift), (B) (night shift,) and (C) (rotating shift) show the correlations ( $\rho$ ) between sleep quality (PSQI), perceived stress (PSS-14), general mental health (GHQ-12), memory complaints (MFE-30), and quality of life (WHOQOL) in relation to shift work.

Table 6 represents the mean values, standard deviation, range, mean contrast ( $p$ ), and effect size ( $r_{rb}$ ) of the different interconnected health variables in relation to gender.

**Table 6.** Inferential analysis: Results of interconnected health variables in relation to shift work and gender differences.

Shift work	Gender	Male 10 (10.53%)			Female 85 (89.47%)			$p$	$r_{rb}$
		M	SD	Range	M	SD	Range		
Day (n = 95)	PSQI	8.70	4.32	3-17	9.94	4.19	3-18	0.364	0.093
	PSS-14	25.30	8.74	12-36	27.07	6.13	15-45	0.627	0.050
	GHQ-12	13.90	8.54	6-28	13.94	6.46	4-36	0.488	0.071
	MFE-30	49.40	18.99	30-82	59.31	21.63	31-117	0.152	0.147
	WHOQOL	90	14.92	67-113	89.27	13.64	55-127	0.851	0.019
		3 (27.27%)			8 (72.73%)				
Night (n = 11)	PSQI	10.33	3.21	8-14	10	4.59	5-17	0.921	0.062
	PSS-14	28.67	3.05	26-32	28.25	6.84	22-38	0.630	0.185
	GHQ-12	16.33	6.11	11-23	12.50	7.96	3-25	0.376	0.278
	MFE-30	52	22.91	32-77	63.25	27.79	32-118	0.497	0.216
	WHOQOL	81	4.58	76-85	93.38	18.12	61-123	0.194	0.432
		22 (15.60%)			119 (84.40%)				
Rotating (n = 141)	PSQI	8.09	3.50	3-15	8.91	3.69	0-19	0.314	0.085
	PSS-14	25	4.52	17-34	26.50	6.53	0-42	0.185	0.112
	GHQ-12	12.91	4.11	7-22	12.45	5.42	1-29	0.359	0.077
	MFE-30	46.64	13.24	32-83	57.67	18.71	30-128	0.005	0.237
	WHOQOL	92.05	10.24	76-113	92	12.83	61-121	0.964	0.003

Notes. PSQI, Pittsburgh Sleep Quality Index; PSS-14, Perceived Stress Scale; WHOQOL, World Health Organization Quality of Life Questionnaire; GHQ-12, General Health Questionnaire; MFE-30, Memory Complaints in Everyday Life Questionnaire; M, mean; SD, Standard Deviation. N, sample size;  $p$  with significance levels:  $p < 0.001$  (high),  $p < 0.01$  (medium),  $p < 0.05$  (low);  $r_{rb}$ , rank biserial correlation (effect size):  $r_{rb} < 0.3$  small effect,  $r_{rb}$  between 0.30 to 0.50 medium effect,  $r_{rb} > 0.50$  large effect (Cohen 2016).

Gender analysis revealed statistically significant differences in the rotating shift for the memory complaints questionnaire ( $p = 0.023$ ), with higher scores in women compared to men. The effect size for this variable was small, very small, or practically negligible for the remaining variables (sleep quality, perceived stress, general mental health, and quality of life). Moreover, no statistically significant differences were observed in any of the other variables between men and women, regardless of work shift.

Table 7 represents the mean values, standard deviation, range, mean contrast ( $p$ ), and effect size ( $r_{rb}$ ) of the different interconnected health variables in relation to age.

**Table 7.** Inferential analysis: Results of interconnected health variables in relation to shift work and differences by age ( $\leq 50$  and  $> 50$  Ayears).

Shift work	Age	$\leq 50$ years 93 (65.96%)			$> 50$ years 48 (34.04%)			$p$	$r_{rb}$
		M	SD	Range	M	SD	Range		
Day (n = 95)	PSQI	8.38	3.36	2-17	9.56	4.09	0-19	0.076	0.149
	PSS-14	26.61	6.73	0-42	25.58	5.26	14-37	0.312	0.085
	GHQ-12	13.17	5.58	1-29	11.25	4.25	6-23	0.047	0.167
	MFE-30	56.41	19.62	30-128	55.06	15.84	32-92	0.998	$< 0.001$
	WHOQOL	92.58	13.11	61-121	90.90	11.03	72-118	0.444	0.065

		7 (63.63%)			4 (36.36%)				
Night (n = 11)	PSQI	8.43	2.07	6-12	13	5.47	5-17	0.230	0.403
	PSS-14	28.29	6.29	22-38	28.50	6.02	22-35	0.927	0.057
	GHQ-12	9.43	3.99	3-15	20.75	6.55	11-25	0.024	0.656
	MFE-30	46	13.11	32-67	85	24.69	59-118	0.012	0.742
	WHOQOL	95.14	13.32	82-123	81	19.16	61-107	0.164	0.457
		93 (65.96%)			48 (34.04%)				
Rotating (n = 141)	PSQI	8.38	3.36	2-17	9.56	4.09	0-19	0.076	0.149
	PSS-14	26.61	6.73	0-42	25.58	5.26	14-37	0.312	0.085
	GHQ-12	13.17	5.58	1-29	11.25	4.25	6-23	0.047	0.167
	MFE-30	56.41	19.62	30-128	55.06	15.48	32-92	0.998	< 0.001
	WHOQOL	92.58	13.11	61.121	90.90	11.03	72-118	0.444	0.065

Notes. PSQI, Pittsburgh Sleep Quality Index; PSS-14, Perceived Stress Scale; WHOQOL, World Health Organization Quality of Life Questionnaire; GHQ-12, General Health Questionnaire; MFE-30, Memory Complaints in Everyday Life Questionnaire; M, mean; SD, Standard Deviation. N, sample size;  $p$  with significance levels:  $p < 0.001$  (high),  $p < 0.01$  (medium),  $p < 0.05$  (low);  $r_{rb}$ , rank biserial correlation (effect size):  $r_{rb} < 0.3$  small effect,  $r_{rb}$  between 0.30 to 0.50 medium effect,  $r_{rb} > 0.50$  large effect (Cohen 2016).

Analysis by age demonstrated statistically significant differences in all three shifts. In both day and night shifts, nurses older than 50 years had higher scores on the general mental health questionnaire ( $p = 0.047$ , day shift;  $p = 0.024$ , night shift), reflecting a worse mental health status. In addition, the night shift showed significantly higher scores for the presence of memory complaints ( $p = 0.012$ ) in this group of participants compared to those under 50 years of age. The effect size was large for both variables in the night shift. In contrast, an opposite trend was observed in the rotating shift, where nurses under 50 years of age obtained higher scores in the mental health questionnaire ( $p = 0.047$ ), indicating poorer mental health. In the rest of the variables analyzed (quality of sleep, perceived stress, and quality of life), no statistically significant differences between work shifts were found according to age. However, a non-significant trend was observed in day and rotating shifts in the sleep quality variable.

#### 4. Discussion

The main objective of this research was to assess sleep quality and its relationship with interconnected health variables such as stress, general health, memory complaints, and quality of life of shift-work nurses in a level III hospital.

The data obtained in a sample of 247 professionals from HUSE and its associated centers enabled us to observe in detail how interconnected health variables (quality of sleep, perceived stress, general mental health, memory complaints, and quality of life) are related to these dimensions and with each other (age:  $\leq 50$  and  $> 50$  years; and gender: men and women), and how they vary according to work shift (day, night, or rotating). The methodology used, based on validated questionnaires and scales such as the PSQI, PSS-14, GHQ-12, MFE-30, and WHOQOL-BREF, provides a solid basis for interpreting the results with rigor based on validated assessment tests. Further, the use of the Munich chronotype questionnaire adds a relevant biological dimension to understand possible mismatches between the internal rhythm of workers and the schedules imposed by the organization.

The present study is framed in a healthcare reality where care of professionals still does not receive the attention it deserves. Analyzing the effects of shift work on sleep quality (Castillo-Guerra et al. 2022; Haij Mohamud et al. 2025), perceived stress (Weng and Chang 2025), and quality of life (Orszulak et al. 2022; Özyürek et al. 2021) is key to understanding the factors that affect the well-being of those who sustain the healthcare system (Yu et al. 2025) to generate evidence to guide future intervention strategies.

Shift work represents one of the main forms of work organization in the health sector. This system, although necessary to ensure continuous patient care, has important repercussions on the physical and mental health of professionals. Numerous studies show that rotating and night shifts directly affect circadian rhythms, leading to sleep disturbances, increased stress, and reduced quality of life (Deschamps Perdomo et al. 2011; Zeng et al. 2020). In this context, nursing professionals represent one of the most exposed populations, due to the nature of their work and the high physical and emotional demands they face daily.

The study sample consisted of 247 nursing professionals, mostly women (85.8%), reflecting the historical and structural feminization of the profession, which is widely documented in the literature (Arroyo Rodríguez et al. 2011). This pattern of representation has also been reported in research focused on sleep quality and occupational health of nursing professionals (Chang & Peng 2021; Zeng et al. 2020). In terms of age and professional experience, the group of professionals older than 41 years (69.1%) and with more than 10 years of work experience (65.6%) predominated, reflecting a workforce within the healthcare system (Table 1). This age and seniority profile has relevant implications for adaptation to shift work, as well as for the perception of sleep quality and work stress, as previous studies have pointed out (Chang & Peng 2021). Although greater experience may favor the development of coping strategies, prolonged exposure to irregular shifts has been shown to produce cumulative negative effects on physical and mental health (Chang & Peng 2021).

This study employed the Pittsburgh Sleep Quality Index (PSQI; Buysse et al. 1989; Macias & Royuela 1996) and the Munich Chronotype Questionnaire (MCTQ; Roenneberg et al. 2003), widely used and validated tools to assess rest and circadian rhythm adjustment. The results of the PSQI showed mean scores above the cut-off point ( $\geq 5$ ) in all shifts, indicating a generalized poor sleep quality in the sample (Table 2). These results are similarly aligned with findings from other studies with nursing professionals (Castillo-Guerra et al. 2022; Chang & Peng 2021; Haij Mohamud et al. 2025; Zeng et al. 2020). The different components and total score of the PSQI did not reveal statistically significant differences in relation to gender and age ( $\leq 50$  and  $> 50$  years) (Tables 5 and 6, respectively in supplements). The use of this tool enabled us to break down the impact of shift on different aspects of sleep, with a particularly notable impact on subjective quality, habitual efficiency, and daytime dysfunction in the night shift. In addition, the day shift revealed a higher use of medication than the night and rotating shifts, with significant differences between them (Table 3, in supplements) similar to other studies (Di Muzio et al. 2020; Gómez-García et al. 2016; Huang et al. 2021). Chronotype analysis showed a predominance of the indefinite type, with 66% in the day shift, 64% in the rotating shift, and 44% in the night shift (Table 4, in supplements). These data are consistent with previous studies describing a higher prevalence of the indefinite chronotype in the general population and in healthcare professionals (Debbia et al. 2021; Leung et al. 2016). However, in the nocturnal group, a higher representation of evening chronotypes was observed, suggesting a possible biological adaptation to nighttime schedules. In this sense, the evidence reflects that a greater alignment between chronotype and shift is associated with better performance and less sleep impairment (López-Soto et al. 2019; Weng & Chang 2025).

Perceived stress in nursing professionals displayed high levels in all shift types, with means above 26 points on the PSS-14 scale (Table 2), thereby indicating a significant psychological burden. This result was consistent with previous studies that identified nurses as a group particularly vulnerable to chronic stress due to high emotional demands, caregiving pressure, and irregular work shifts (Chang & Peng 2021; Weng & Chang 2025). Correlation analysis also reinforced this observation. Negative and statistically significant associations between perceived stress and quality of life (WHOQOL-BREF) were detected in all groups, with medium level of significance in the day shift ( $\rho = -0.594^{**}$ ) and rotating shift ( $\rho = -0.569^{**}$ ), indicating that as levels of perceived stress increased, the perception of general well-being decreased. Furthermore, a positive correlation was identified between the PSS-14 and the PSQI in both the daytime ( $\rho = 0.468^{**}$ ) and rotational ( $\rho = 0.279^{**}$ ) groups, implying that perceived stress tended to increase when sleep quality was worse (Figures 2A, 2B, and 2C; in supplements). This bidirectionality between poorer sleep quality and

higher stress could explain the reciprocal influence between physiological and emotional factors in the context of shift work. Meanwhile, no statistically significant differences were observed in relation to gender and age ( $\leq 50$  and  $> 50$  years) (Tables 5 and 6, respectively, in supplements).

Shift nurses face demanding working conditions that impact their self-perceived mental health. Factors such as rotating shifts, extended working hours, and high emotional workload contribute to problems such as stress, anxiety, depression, and burnout. In this study, professionals with shift work (day, night, and rotating shifts) had poor sleep quality (Table 3) with a significant mild to moderate relationship with overall mental health (Figures 2A, 2B, and 2C). On the whole, women and men presented similar overall mental health, with no statistically significant differences (Table 5, in supplements), whereas professionals showed statistically significant differences with respect to age ( $\leq 50$  and  $> 50$  years), mainly in the night shift. This could reflect the presence of emotional disturbances in nursing professionals  $> 50$  years of age (Table 6, in supplements). Along these lines, the findings of the Clendon & Walker (2013) study pointed to detrimental effects on family and social relationships, physical and mental health (particularly sleep patterns and fatigue), and a lower tolerance for shift work with age. Similarly, another review by Uthaman et al. (2016) noted that personal health concerns and limitations, computerization, and shift work were common challenges. Thus, there is evidence that nurses on rotating shifts showed greater emotional disturbances than those on fixed shifts (day or night) (Chiang et al. 2022; Ferri et al. 2016; Román et al. 2023). This can be explained, in part, by the influence of sleep habits, defined as quality, quantity, and sleep routines, on individual health and well-being, which is particularly relevant in the case of healthcare personnel who work shifts, given their long, rotating workdays (Díaz-Ramiro et al. 2020). Thus, it has been suggested that complaints about poor sleep quality can be used as an indicator in assessing quality of life (Bazazan et al. 2019). In this sense, sleep routines are another aspect to be considered by healthcare professionals, precisely because this group exhibits notable differences in the stability of intra-individual sleep hours. Results indicate that shift workers, with greater stability in sleep hours outside of shifts, display fewer errors in memory tasks and better overall health (Panczyk et al. 2018).

Shift work can cause nursing professionals to experience poor sleep quality and impaired everyday memory (Lin et al. 2024; Moosave et al. 2025). Nursing professionals with this shift work (day, night, and rotating shifts) reported poor sleep quality (Table 2), with a significant, mild to moderate relationship with memory complaints (Figures 2A, 2B, and 2C, in supplements). Moreover, women reported milder memory complaints compared to men (Table 6), and nursing professionals aged  $\leq 50$  years reported mild memory complaints for day and rotating shifts. However, nursing professionals aged  $> 50$  years reported severe memory complaints (Table 6, in supplements). Similar studies have confirmed the relationship between shift work experience and impaired cognitive function (Marquié et al. 2015; Thun et al. 2021; Titova et al. 2016). This implies that sleep problems are varied, namely difficulty falling asleep, sleep fragmentation, poor sleep quality, and short sleep duration. Shift work can be a precipitating factor for insomnia or exacerbate existing insomnia symptoms. During the waking period, shift workers tend to suffer from excessive sleepiness, impaired cognitive and psychomotor functions, and poor emotional regulation (Rosa et al. 2019; Sun et al. 2019). Along these lines, cognitive processes regulated by the endogenous circadian clock and shift work can alter cognitive functioning, disrupt the sleep regulatory mechanism, and cause desynchronization of circadian rhythms, with the resulting accumulation of sleep deprivation. Furthermore, disruptions in these sleep regulatory processes have been shown to lead to decreased cognitive abilities (Bath et al. 2020; Zion & Shochat 2018).

The assessment of quality of life using the WHOQOL-BREF showed mean scores of around 90 points for the three types of shift work (day, night, and rotating), with a slight increase in the rotating group (mean = 92.01), followed by the night (mean = 90), and the day (mean = 89.35) (Table 2). Although the descriptive differences were subtle in the mean scores, the standard deviation values showed heterogeneity in the night group, which could suggest that the professionals had more variable personal experiences. Correlation analysis revealed a significant negative association between quality of life and sleep quality in all three types of shifts; which was especially notable in

the night group ( $\rho = -0.848^{**}$ ), where this relationship was stronger than in the other shifts. This result highlighted the evidence that healthcare workers' perception of overall well-being was closely linked to their nighttime sleep, especially in the most demanding and least circadian-compatible contexts. However, in the daytime and rotating groups, the relationship between quality of life and sleep quality was also statistically significant ( $\rho = -0.475^{**}$  and  $\rho = -0.333^{**}$ , respectively), confirming that poorer sleep quality directly impacted their overall perception of physical, psychological, and social well-being (Figures 2A, 2B, and 2C; in supplements). These results are consistent with previous studies that highlighted sleep quality as one of the main determining factors of perceived well-being in healthcare workers (Morris et al. 2018). Finally, no statistically significant differences were observed based on gender and age ( $\leq 50$  and  $> 50$  years) (Tables 5 and 6, in supplements).

This study presents some limitations and barriers that should be taken into account: 1) The cross-sectional design prevents establishing causal relationships between the variables analyzed; 2) The use of self-administered questionnaires may involve social desirability bias or recall errors; and 3) The sample, although large, corresponds to a single hospital and its associated centers, which could limit the generalization of the results to other healthcare settings.

For future research, it is important to consider: 1) Conducting longitudinal studies that allow observing the evolution of these interconnected health variables over time and assessing the cumulative impact of shift work and gaining a better understanding of the phenomenon; 2) Increasing the sample size for each of the groups of professionals who work shifts to boost statistical power; 3) Exploring the effectiveness of personalized specific interventions aimed at improving sleep quality and emotional care in nursing professionals, according to chronotype; 4) The integration of objective measures, such as the use of actimetry or sleep biomarkers, which would also enrich the analysis in future research; 5) Promoting funded experimental studies that integrate strategic interventions for sleep care for healthcare professionals; and 6) Although a rigorous, science-based methodology was used, it requires revision to incorporate and control for a greater number of variables. Ultimately, in this context, promoting and fostering policies based on the science of sleep health and chronobiology to protect the health and well-being of the nursing community is a challenge.

#### *Implications for Nursing & Health Policy*

Finally, the relevance and impact of this study in the healthcare sector provide a set of benefits: 1) The results of this study demonstrate the importance of addressing the effects of shift work on the health of nursing professionals, especially regarding rest, stress, and quality of life; 2) The data obtained should be taken into consideration as a basis for alerting professionals themselves to the need to pay attention to self-care, as well as for promoting organizational changes aimed at prevention; 3) The methodology used in this research could be part of a standardized protocol for evaluating sleep quality and its impact on health due to shift work in nursing professionals. In this sense, the institution's occupational risk and prevention service should be informed to assess the possibility of incorporating it transversally in routine and scheduled check-ups of healthcare professionals. This would be part of occupational health assessments for the continuity of care longitudinally in the career path of nursing professionals; 4) The planning of self-care strategies (Williams et al. 2022) to improve sleep and the implementation of personalized intervention programs adapted to different work shifts should represent an effective way to mitigate the negative effects of sleep disturbances and chronodisruption (Alfonsi et al. 2021; Booker et al. 2022). To this end, it is essential to establish synergies between intermediate positions, nursing management, and occupational health services, both at the hospital and institutional levels; and 5) It is necessary to make this problem visible in the healthcare field.

## 5. Conclusions

The literature review and the results of this study demonstrate that shift work significantly influences sleep quality, perceived stress, emotional state, memory complaints, and the quality of life

of nursing professionals. Therefore, it can be concluded that: 1) Nursing professionals report poor sleep quality during shift work. Further, the indefinite chronotype predominates during daytime and rotating shifts, suggesting a possible adaptation to different shifts; which is associated with the need to consider individual biological rhythms when scheduling; 2) Nursing professionals report a mild level of perceived stress, accompanied by possible signs of emotional disturbances and moderate memory complaints during nighttime and rotating shifts; however, they maintain a good quality of life that is comparable across shifts. Equally, poor sleep quality, higher stress levels, and impaired mental health are shown to be related to decreased well-being and quality of life, especially during night and rotating shifts; and 3) Female nursing professionals on rotating shifts report moderate memory complaints more than men. Moreover, professionals over 50 years of age on night shifts tend to report more emotional disturbances and memory complaints than those under 50 years of age. Shift workers do not present statistically significant differences with the rest of the interconnected health variables.

These findings highlight the need to establish preventive strategies and palliative interventions that will improve working conditions, promote self-care, and reduce the negative impact of shift work on the health of nursing professionals.

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