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Sleep and modifiable cardiovascular risk factors in nursing staff

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ABSTRACT

Introduction. The aim of the study was to evaluate the prevalence of cardiovascular risk factors (CVRF) and to analyse the influence of sex, work shift and job position on sleep quality and other CVRF.

Methods. This was a multicenter prevalence study conducted in 2023 using a survey among nursing staff at three Spanish hospitals.

Sleep quality was assessed using the Oviedo Questionnaire; nicotine addiction with the Fagerström Test; physical activity with the IPAQ questionnaire; adherence to the Mediterranean diet with the PREDIMED questionnaire; and perceived stress with the Cohen scale.

Results. A total of 727 workers participated in the study. Rotating-shift workers (71.65%) exhibited poorer sleep quality ($p<0.001$), lower levels of physical activity ($p<0.001$), and higher perceived stress ($p<0.001$) compared to day-shift workers. Hypercholesterolemia ($p<0.05$) and hypertension ($p<0.05$) were more prevalent among day-shift workers. Women reported higher perceived stress ($p<0.01$) and poorer sleep quality ($p<0.05$) than men, whereas men had a higher prevalence of cardiovascular events (13%). Workers who had experienced a cardiovascular event or had higher perceived stress showed worse sleep quality ($p<0.01$).

Conclusions. There is evidence that the negative health effects associated with shift work increase with age. Sleep quality, hypertension, and stress are particularly affected. Shift work and physical activity appear to negatively influence sleep quality, which is worse among rotating-shift workers.

Keywords: Cardiovascular Risk Factors; Nursing; Physical activity; Sleep;

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Introduction

Cardiovascular disease (CVD) is the leading cause of death worldwide, responsible for 17.9 million deaths each year. In Spain, CVD accounts for 26.4% of all deaths, corresponding to 251.8 per 100,000 inhabitants in 2021. In Castilla y León, 330,767 deaths due to CVD were recorded in the same year [(1)]. These diseases affect the heart and blood vessels, including coronary heart disease and stroke, and are associated with a high rate of premature mortality, particularly in individuals under 70 years of age [(2)].

In 1948, the United States Public Health Service launched the Framingham Heart Study in Massachusetts to investigate the epidemiology and risk factors of CVD. Since then, the study has continued to examine CVD and its risk factors across three generations [(3)].

The American Heart Association (AHA) classifies cardiovascular risk factors (CVRF) as non-modifiable (age, sex, and genetics) and modifiable (smoking, dyslipidaemia, hypertension [HTN], physical inactivity, obesity, diabetes mellitus [DM], stress, alcohol consumption, and diet) [(4)]. In 2022, the AHA added sleep as a modifiable CVRF, highlighting that sleep duration is associated with cardiovascular health [(5)]. Modifiable cardiovascular risk factors (MCRF) are behaviours or habits that can be changed and that increase the likelihood of developing CVD [(6)].

Fifty-seven point three percent of the Spanish population aged 18–65 years have two or more CVRFs, with health care workers being particularly vulnerable [(7)]. Regarding diet, shift work is associated with higher consumption of unhealthy foods, although this does not appear to apply to coffee. Shift work also increases the risk of chronic insomnia, partly due to poor dietary habits [(8)].

Regarding physical activity, shift work can limit participation in sports and leisure activities, leading to fatigue and a more sedentary lifestyle. Regular physical activity has been shown to improve both sleep duration and quality [(9)].

Smoking negatively affects sleep, as nicotine acts as a central nervous system stimulant, increasing heart rate, blood pressure, and brain activity. This can impair sleep quality by causing difficulties in sleep initiation and maintenance. Additionally, tobacco use may induce coughing and shortness of breath, particularly in individuals with respiratory conditions. Smokers are also at an increased risk of sleep disorders, such as sleep apnea, which can result in daytime sleepiness [(10)].

Sleep and obesity are bidirectionally related. Sleep deprivation affects appetite by increasing levels of the hunger hormone ghrelin and decreasing levels of the satiety hormone leptin. Adequate and restorative sleep helps maintain the balance of this system [(11)]. Sleep disorders are also associated with disruptions in cholesterol metabolism, altering its synthesis and absorption, and exacerbating dyslipidaemia, particularly in individuals with obesity [(12)].

Regarding blood glucose, sleep disturbances are linked to metabolic disorders and elevated levels of glycated haemoglobin in diabetic patients. Poor sleep quality and delayed bedtime have been associated with impaired postprandial glycaemic control, resulting in higher glucose levels, according to a study published in Diabetology by the European Association for the Study of Diabetes (EASD) [13].

In patients with hypertension, respiratory rate as well as body and brain temperature decrease during the REM phase of sleep. Heart rate and blood pressure drop during slow-wave sleep but return to regular levels during REM sleep. Obstructive sleep apnea syndrome (OSAS) is particularly important, as hypoxemia and the resulting acidosis can trigger pulmonary vasoconstriction, contributing to persistent hypertension during wakefulness. There is a direct relationship between elevated blood pressure and nocturnal hypoxemia associated with excessive snoring [14].

Sleep is a fundamental physiological need. The human body is regulated by a biological clock that adapts to light–dark cycles as well as seasonal changes. Disturbances in sleep can predispose individuals to disease, as the body struggles to maintain homeostasis. These alterations in sleep patterns have immediate effects, such as increased wakefulness, fatigue, and drowsiness, and in the long term, they are associated with a higher risk of cardiovascular, respiratory, metabolic, and digestive disorders, as well as an increased prevalence of obesity [15].

For these reasons, the present study aims to assess the prevalence of cardiovascular risk factors (CVRF), with particular emphasis on sleep quality, in a sample of nursing staff in Castilla y León.

Objectives

General objective

To describe the prevalence of modifiable cardiovascular risk factors (MCRF), including diet, physical activity, overweight/obesity, smoking, diabetes mellitus (DM), arterial hypertension (HTN), stress, and sleep among nursing staff at the University Clinical Hospital of Valladolid, Río Hortega University Hospital in Valladolid and the University Healthcare Complex of León.

Specific objectives:

- To analyze the influence of work shifts and job positions on the prevalence of cardiovascular risk factors (CVRF).
- To analyze the influence of sex on the prevalence of CVRF.

To examine the relationship between sleep quality and other CVRFs, including stress, diet, hypercholesterolemia, obesity, and physical activity

Methods

Design and scope

A cross-sectional prevalence study was conducted, with data collected between September and November 2023. The study was carried out in three tertiary hospitals under the Regional Health Management of Castilla y León, Spain: the University Clinical Hospital of Valladolid (HCUV), the Río Hortega University Hospital of Valladolid (HURH), and the University Healthcare Complex of León (CAULE).

Population and sample

The study included all nursing staff, both registered nurses and nursing care assistants (NCAs) from the participating hospitals who met the inclusion criteria, specifically working either rotating shifts that included nights or fixed day shifts. The total population was 5,892, according to data provided by the hospitals as of 1 October 2022 (Table 1).

Table 1. Distribution of the population among the different centres

	HURH	HCUV	CAULE	Total
No. of nurses in hospital	1,158 (32.6%)	1,259 (35.5%)	1,132 (31.9%)	3,549 (100%)
No. of NCA in hospital	890 (38%)	770 (32.9%)	683 (29.2%)	2,343 (100%)
Total	2,048 (34.8%)	2,029 (34.4%)	1,815 (30.8%)	5,892 (100%)

HURU=Río Hortega University Hospital; HCUV=Valladolid University Clinical Hospital; CAULE=León University Healthcare Complex; NCA=Nursing Care Assistant

Personnel working 12-hour shifts were excluded due to differences in workflow and scheduling compared with other staff. Shifts, as defined by the Workers' Statute, involve the successive occupation of positions according to a continuous or discontinuous rhythm. A shift is considered rotating if there are at least four shift changes in a month and at least 3.5 nights per

month, or 42 nights per year, with the night shift defined as occurring from 10:00 p.m. to 6:00 a.m. [16].

Because consecutive non-probability sampling was employed, the sample size was determined based on the expected response rate. Considering a response rate of 15% as sufficient, 886 completed questionnaires were required.

The estimated sample, distributed by hospital and professional category, is presented in Table 2.

Table 2. Distribution of the sample among the different centres and professional categories.

	HURH	HCUV	CAULE	Total
No. of nurses in hospital	174	189	170	533
No. of NCA in hospital	134	116	103	353
Total	308	305	273	886

HURU=Río Hortega University Hospital; HCUV=Valladolid University Clinical Hospital; CAULE=León University Healthcare Complex; NCA=Nursing Care Assistant

Variables and measuring instruments

Sociodemographic variables: Age (years), sex (male, female), marital status (single, married, divorced, widowed), dependents (yes/no).

Professional profile variables: Academic level (Bachelor's or Diploma in Nursing, Master's degree and/or Specialist, Doctorate, NCA, other).

Work-related variables: Job position, shift (daytime, rotating with nights), years of professional experience, years in current shift, type of contract (permanent, temporary, interim).

Variables related to modifiable cardiovascular risk factors (MCRF):

- Sleep quality: Measured using the Oviedo Sleep Quality Questionnaire (15 items) [17].
- History of sleep-related disorders: Yes (Obstructive Sleep Apnea Syndrome), No (self-reported).
- Smoking: Yes (assessed using the Fagerström Test for Nicotine Dependence) or No [18].
- Obesity: Measured by body mass index (BMI, kg/m²) [19].
- Hypercholesterolemia: Self-reported.
- Hypertension: Self-reported.
- Diabetes mellitus: Self-reported.

- Physical activity: Assessed using the International Physical Activity Questionnaire (IPAQ, 7 items) [20].
- Diet: Assessed using the PREDIMED Questionnaire (Mediterranean Diet Adherence, 14 items) [21].
- Stress: Measured using the Cohen Perceived Stress Scale (PSS, 14 items) [22].
- History of cardiovascular events: Yes (self-reported; including myocardial infarction, angina, arrhythmias, or other events) or No.

Data collection procedure

Data was collected using REDCap [23], hosted by the Carlos III Health Institute, to create the questionnaires. Data collection occurred between September and November 2023, with questionnaires distributed via a link and QR code on posters, the hospital intranet, and printed copies within the units. All responses were anonymous. The data were subsequently processed and analyzed in Excel to derive conclusions.

Ethical considerations

All researchers and staff involved in the project are knowledgeable of and comply with local and international regulations regarding ethical considerations for research involving human participants. The recommendations of the Declaration of Helsinki [24] and the Belmont Report [25] were strictly followed. Nevertheless, this study did not collect personal data or any information that could allow participants to be identified. Participant anonymity and the confidentiality of all responses were fully ensured.

The research protocol was submitted to and approved by the Research Ethics Committees of the participating hospitals. Approval references were as follows: University Clinical Hospital of Valladolid (HCUV), CEIm Ref.: PI 23-3189; University Healthcare Complex of León (CAULE), RI 2391; and Río Hortega University Hospital of Valladolid (HURH), CEIm Ref.: 23-PI097.

Data analysis

A descriptive analysis of the sample was first performed. Quantitative variables were reported as means and standard deviations, while qualitative variables were presented as absolute frequencies and percentages.

Subsequently, the normality and homoscedasticity of the sample were assessed using the Shapiro–Wilk and Levene tests, respectively. Statistical comparison tests such as Student's t-test or ANOVA were applied according to the number of groups, or the corresponding non-parametric tests.

Categorical variables were analyzed using the Chi-square test or Fisher's exact test, and correlations were examined using Pearson's or Spearman's correlation coefficients, as appropriate. In addition, odds ratios (ORs) and their corresponding confidence intervals were calculated.

All inferential analyses were conducted with a 95% confidence level and an alpha error of less than 5%. Data analysis was performed using SPSS statistical software (version 28).

Results

Study sample characteristics

Of the 886 calculated responses, 809 (91.3%) were obtained. Fourteen respondents accessed the questionnaire without reporting their workplace, resulting in a final dataset of 795 participants for descriptive analysis. Of these, 255 (32.1%) were from HCUV, 321 (40.4%) from HURH, and 219 (27.5%) from CAULE. Regarding sex, 69 participants (9.5%) were men and 658 (90.5%) were women.

By professional category, 542 participants (67%) were nurses and 260 (32.1%) were Nursing Care Assistants (NCA), with a loss of seven cases (0.9%).

Concerning work shifts, 66% of participants (525) worked rotating shifts, 24.5% (195) worked fixed morning shifts, 0.9% (7) worked fixed afternoon shifts, and 8.6% (68) worked other shifts; the latter were excluded from further analyses as they did not meet inclusion criteria.

Finally, the analysis of responses meeting all inclusion criteria was conducted on 727 participants (Figure 1).

Figure 1. Flowchart 1. Number of responses

Data on job position were available for 723 participants. Among those working rotating shifts (morning/afternoon/night, with at least 3–4 nights per month), there were 518 workers

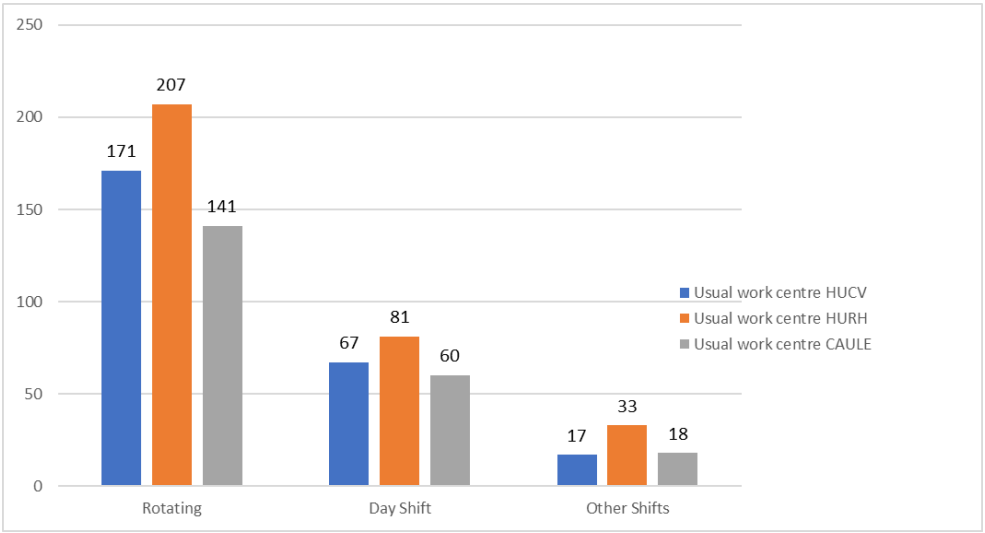
(71.7% of the sample). Of these, 387 (74.7%) were assigned to hospitalization services, 25 (4.8%) to the operating room, and 106 (20.5%) to the emergency department.

In the fixed morning shift, there were 198 workers (27.4% of the sample), distributed as follows: 122 (61.6%) in consultations, 48 (24.2%) in hospitalization, 21 (10.6%) in the operating theatre, and 7 (3.5%) in emergencies.

The fixed afternoon shift included 7 workers (1% of the sample): 1 (14.3%) in consultations, 3 (42.9%) in hospitalization, and 3 (42.9%) in the operating room.

For correlation analyses, morning and afternoon shifts were combined into a single daytime shift group, comprising 205 participants (28.4%).

The distribution of participants by hospital and work shift is presented in Figure 2.



HURU=Río Hortega University Hospital; HCUV=Valladolid University Clinical Hospital; CAULE=León University Healthcare Complex

Figure 2. Comparison of workers by work centre and shifts.

Bivariate analysis

Regarding sleep satisfaction, 629 responses (77.8% of the sample) were obtained. Of these, 178 participants (27.8%) rated their sleep as moderately satisfactory, 125 (19.9%) as unsatisfactory, 109 (17.3%) as satisfactory, 76 (12.6%) as quite satisfactory, 73 (11.6%) as quite unsatisfactory, 42 (6.7%) as very dissatisfied, and 26 (4.1%) as very satisfied (Figure 3).

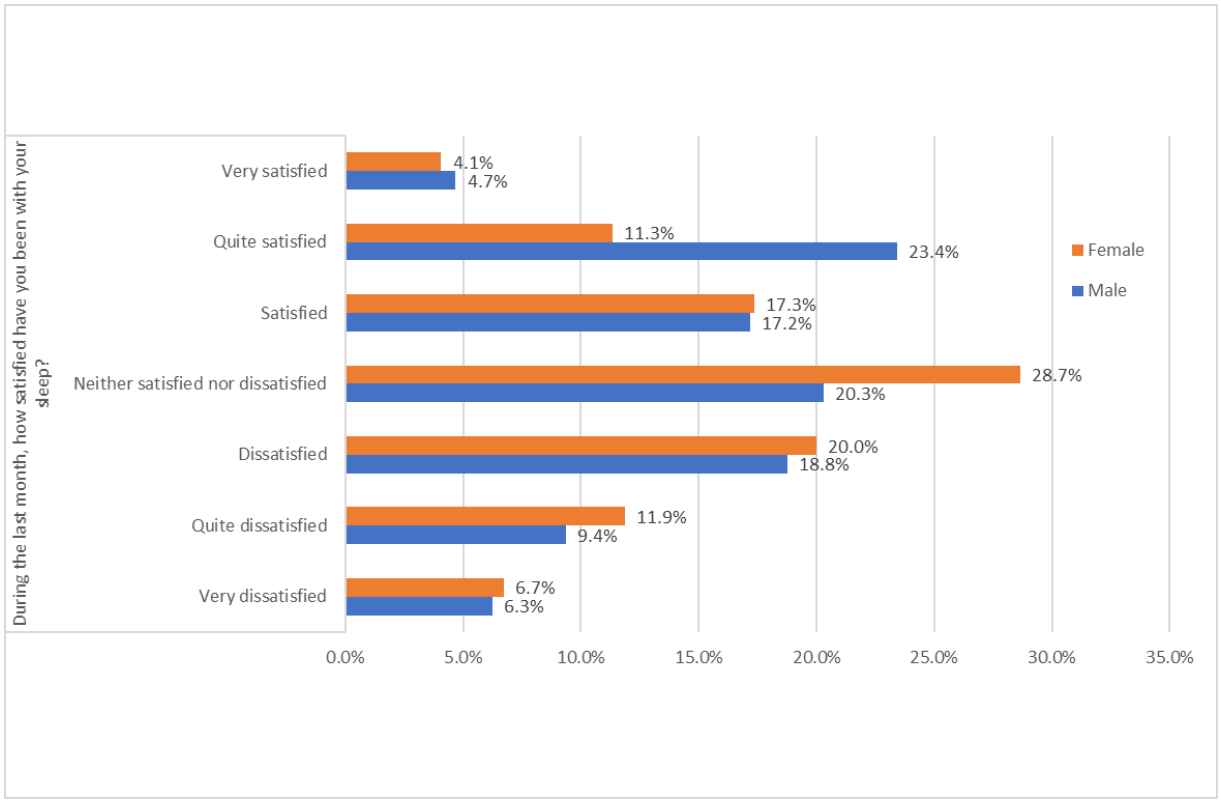


Figure 3. Sleep satisfaction in percentages by sex.

The mean age of the sample was 41 years, with 75% of participants under 49 years of age. Regarding arterial hypertension, 718 participants provided responses, of whom 61 (7.7%) were hypertensive. Among men, 8 (11.6%) reported hypertension, while 53 women (8.2%) reported the condition.

For type II diabetes mellitus, 714 participants responded, with 19 (2.3%) reporting diabetes, 1 man (1.4%) and 18 women (2.8%).

Concerning hypercholesterolemia, 718 participants responded, of whom 85 (10.5%) reported the condition, including 8 men (11.6%) and 77 women (11.9%).

Finally, 723 participants responded regarding a history of cardiovascular events, of whom 42 (5.2%) reported having experienced one. Among men, 9 (13%) reported a cardiovascular event, compared with 33 women (5%).

Analysis of the influence of shift and job on the prevalence of CVRF.

To analyze work shifts, participants were grouped into two categories: day shift and rotating shift.

Shifts and Sleep Quality

A Student's t-test was performed, yielding a statistically significant difference ($p < 0.0001$). Participants on rotating shifts that included nights had a mean Oviedo Sleep Quality Questionnaire score of 32.99, compared with 28.99 for those on day shifts.

Shifts and Physical Activity

The Chi-square test was performed for qualitative variables ($n = 621$), yielding a statistically significant result ($p = 0.0006$), indicating an association between work shift and physical activity (Table 3).

Shifts and Perceived Stress

A Student's t-test was conducted, revealing a statistically significant difference ($p < 0.001$). Participants on rotating shifts that included nights had a mean Cohen Perceived Stress Scale score of 23.9, compared with 22.1 for those on day shifts, indicating an association between work shift and perceived stress.

Shifts and Hypertension

The Chi-square test was performed for qualitative variables ($n = 720$), yielding a statistically significant result ($p < 0.001$). These findings suggest a potential association between work shift and the presence of hypertension (Table 3).

Shifts and Hypercholesterolemia

The Chi-square test was performed for qualitative variables ($n = 719$), yielding a statistically significant result ($p < 0.01$). These findings suggest a potential association between work shift and the presence of hypercholesterolemia (Table 3).

Shifts and Age

A Student's t-test was performed, revealing a statistically significant difference ($p < 0.001$). The mean age of the total sample was 41 years. Participants on rotating shifts that included nights had a mean age of 39.7 years, whereas those on day shifts had a mean age of 44.1 years, indicating an association between work shift and age, with day-shift workers being older on average (Table 3).

Table 3. Relationship between work shift and modifiable cardiovascular risk factors.

			Total	Rotating shift	Day shift	P-value
CVRF	Physical	High	143 (23%)	105 (23.1%)	38 (22.9%)	<0.001
		Moderate	315 (50.7%)	213 (46.8%)	102 (61.5%)	
		Low	163 (26.3%)	137 (30.1%)	26 (15.7%)	
	HTN	Yes	62 (8.6%)	33 (6.4%)	29 (14.4%)	<0.001
		No	658 (91.4%)	485 (93.6%)	173 (85.6%)	
	Hypercholesterolem	Yes	85 (11.8%)	50 (9.7%)	35 (17.2%)	<0.01
		No	634 (88.3%)	466 (90.3%)	168 (82.8%)	
	Mean Age	Age	41	39.7	44.1	<0.001

CVRF = Cardiovascular Risk Factors; HTN = Hypertension

Job Position and Sleep Quality

To examine the relationship between job position and sleep quality (n = 608), a one-way ANOVA was performed, yielding a statistically significant difference ($p < 0.001$). Participants working in hospitalization services reported the poorest sleep quality, with a mean Oviedo Sleep Quality Questionnaire score of 33.4, followed by those in the emergency department (mean = 31.7) and the operating theatre (mean = 29.4). Participants in consultation services reported the best sleep quality, with a mean score of 28.1.

Job Position and Perceived Stress

The relationship between job position and perceived stress was analyzed using a one-way ANOVA (n = 531), yielding a statistically significant result ($p < 0.001$). Participants working in hospitalization services reported the highest levels of perceived stress, while those in consultation services reported the lowest.

Job Position and Hypertension

The association between job position and arterial hypertension was analyzed using Pearson's Chi-square test (n = 715), yielding a statistically significant result ($p < 0.05$). A higher proportion of hypertensive participants was observed among those working in consultation services.

Job Position and Hypercholesterolemia

The association between job position and hypercholesterolemia was analyzed using the Chi-square test with a likelihood ratio (n = 714), yielding a statistically significant result ($p < 0.05$). A higher proportion of participants with hypercholesterolemia was observed in consultation and operating room positions.

Job Position and Physical Activity

The relationship between job position and physical activity was analyzed using the Chi-square test with a likelihood ratio (n = 573), yielding a statistically significant result ($p < 0.05$). Participants working in hospitalization services reported higher levels of physical activity compared with other job positions (Figure 4, Table 4).

No significant associations were observed between job position or work shift and the prevalence of the remaining modifiable cardiovascular risk factors.

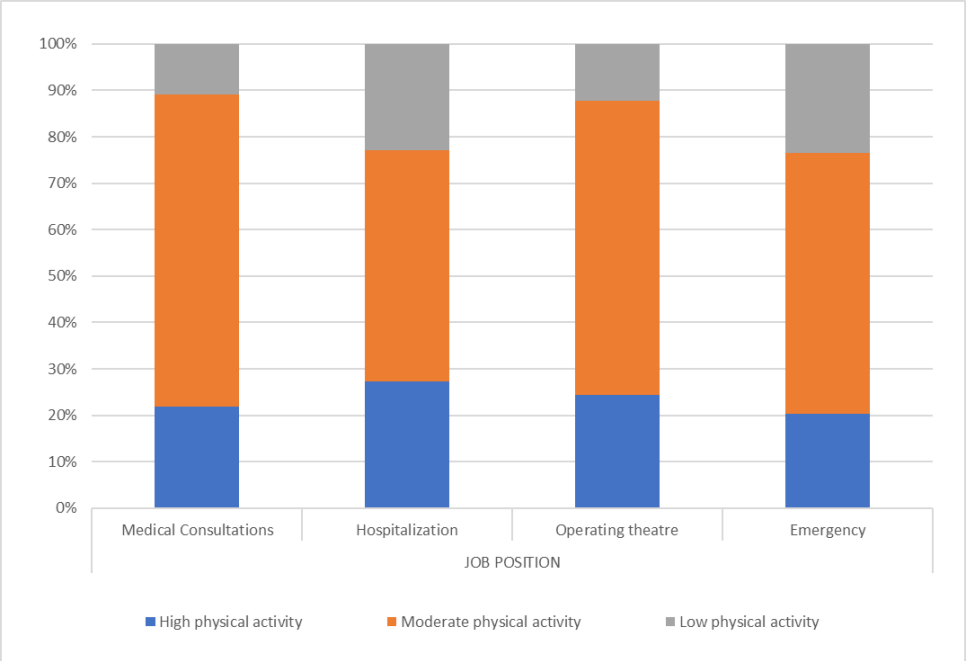


Figure 4. Comparison of physical activity levels among workers by job position.

Table 4. Physical activity by job position.

		Total mets minutes/week:			
		High physical activity	Moderate physical activity	Low physical activity	Total
Workstation	Inquiries	22	68	11	101
	Hospitalization	92	168	77	337
	Operating room	10	26	5	41
	Emergencies	19	53	22	94
	Total	143	315	115	573

Analysis of the influence of sex on the prevalence of CVRF.

Sex and Sleep Quality

The relationship between sex and sleep quality was analyzed in 609 participants, of whom 546 (89.7%) were women. A Student's t-test revealed a statistically significant difference ($p < 0.05$). Women reported poorer sleep quality, with a mean Oviedo Sleep Quality Questionnaire score of 32.2, compared with 29.6 in men.

Sex and Perceived Stress

The relationship between sex and perceived stress was analyzed in 531 participants using a Student's t-test, which revealed a statistically significant difference ($p < 0.01$). Women reported higher perceived stress, with a mean Cohen Perceived Stress Scale score of 23.7, compared with 20.3 in men.

Sex and Cardiovascular Events

The relationship between sex and a history of cardiovascular events was analyzed in 723 participants using the Chi-square test, yielding a statistically significant result ($p < 0.05$). Men reported a higher prevalence of cardiovascular events (13%) compared with women (5%).

Sex and Body Mass Index (BMI)

The association between sex and BMI was analyzed in 708 participants using the Chi-square test, which revealed a statistically significant difference ($p < 0.01$). Women were the only participants classified as underweight, while men were more likely to be overweight than women (Table 5).
No significant associations were observed between sex and the remaining modifiable cardiovascular risk factors.

Table 5. Body Mass Index by Sex of Workers.

		BMI						
		Low weight	Normal weight	Overweight	Grade I obesity	Grade II obesity	Morbid obesity	Total
Sex	Men	0	29	32	5	2	0	68
	Women	20	386	166	52	13	3	640
	Total	20	415	198	57	15	3	708

Analysis of sleep and cardiovascular risk factors.

In the Oviedo Sleep Questionnaire, a total of 609 participants were included, with a mean age of 41 years and a standard deviation of 11.6 years. The questionnaire yielded a mean score of 31.9 with a standard deviation of 8.4.

Pearson's correlation test showed a correlation coefficient of 0.1 with a p-value < 0.05, indicating a statistically significant association between sleep quality and age, whereby older participants had poorer sleep quality than younger participants. However, this association was weak, suggesting that other factors may have influenced sleep quality.

When analysing sleep quality in relation to a history of cardiovascular events, a Student's t-test was performed, yielding a p-value < 0.01, which indicates a statistically significant difference. Participants who had experienced a cardiovascular event showed poorer sleep quality compared with those who had not experienced such an event.

Finally, a Pearson correlation analysis was conducted to examine the relationship between perceived stress and sleep quality. A correlation coefficient of 0.6 was obtained, indicating a strong association, with a statistical significance of $p < 0.001$. Thus, individuals with higher levels of perceived stress reported poorer sleep quality.

No association was observed between sleep quality and the remaining modifiable cardiovascular risk factors (CVRFs).

Discussion

The present study reflects the cardiovascular risk factors of nurses and nursing care assistants (NCAs) and reports on their knowledge of health care and nursing practice, disease prevention, and health promotion.

Regarding sleep quality, work shifts, and physical activity, our results indicate that rotating shifts negatively impact sleep quality. Workers on rotating shifts, particularly in the emergency department and hospitalization services, reported poorer sleep quality and lower levels of physical activity compared with those on day shifts (consultations and operating theatre). These findings are consistent with Flahr et al., who reported that regular physical activity improves sleep quality [(26)]. Similarly, Castillo-Guerra et al. found that 65.8% of nursing staff had poor sleep quality, with shift work being an important contributing factor [(27)]. Gómez-Garcia et al. also concluded that work shift negatively affect sleep quality, with workers on night shifts reporting worse sleep than those on day shifts ($p < 0.05$) [(28)].

Analyzing the relationship between perceived stress, work shifts, and job position, we found that day-shift workers reported lower perceived stress than those on rotating shifts. Similarly, participants working in consultations and operating theatre positions (primarily day shifts) reported lower stress levels compared with those in hospitalization and emergency services (rotating shifts). These results are consistent with the study by Shang-Lin, C. et al., which found that day-shift workers had better sleep quality, longer sleep duration, and lower perceived stress [(29)]. It is noteworthy that the percentage of hypertensive individuals is higher in the day shift (mainly in operating room and outpatient consultation positions) than in the rotating shift (emergency and hospitalization positions). This finding could be partly explained by the age of the subjects in this shift. In our study, the mean age of workers on the rotating shift was 39.7 years, compared with 44.1 years for those on the day shift, confirming that day-shift workers are older than rotating-shift workers. In addition, this difference may also be explained by the fact that some workers may have previously worked for a variable period in rotating shifts, a variable that was not available in this study.

In the study by Pérez S.G. et al., 81.1% of hypertensive participants were found to have sleep disorders [(14)]. In our sample, it is possible that some morning-shift workers previously worked primarily in rotating shifts, which may have contributed to sleep disturbances.

Moreover, as reported in other studies, age is a statistically significant factor in relation to work shifts. Therefore, the age of workers should be considered when assigning shifts, since evidence indicates that the negative health effects associated with shift work increase with age [(25,28,29)].

A similar pattern was observed for hypercholesterolemia, which was more prevalent among day-shift workers. This suggests a potential selection bias in our sample, as day-shift participants had a higher mean age. Consequently, rotating shifts appeared, in our sample, to be "protective" against hypertension and hypercholesterolemia. We interpret this finding as a specific characteristic of our study population, likely influenced by the fact that some day-shift workers may have previously worked in rotating shifts.

Regarding sex, women were overrepresented in our study. In terms of perceived stress, women reported higher levels than men. However, we did not find previous studies establishing a consistent relationship between sex and perceived stress, either favoring women or men [(32)].

Analyzing the relationship between sex and a history of cardiovascular events, we found that men had a proportionally higher prevalence of cardiovascular events compared with women. However, we did not identify studies that consistently support this finding. Regitz-Zagrosek, V et al. (2023) note that, although several studies have examined the association between sex and cardiovascular events, no definitive relationship has been established [(33)].

In the present study, sex was associated with sleep quality, with women reporting poorer sleep than men. However, findings from other studies are inconsistent. Contreras S. et al. reported that women had better overall sleep quality but experienced greater insomnia and daytime sleepiness, differences that were attributed to hormonal changes [(34)].

In our study, we also found that participants who had experienced a cardiovascular event reported poorer sleep quality. This is consistent with the study by Bornhausen A. et al., which indicated that a high prevalence of cardiovascular risk factors contributes to poorer sleep quality [(35)].

Regarding perceived stress in relation to sleep quality, we found a correlation whereby individuals with higher perceived stress also had poorer sleep quality. This finding contrasts with the results reported by Téllez A. et al., who found only a weak correlation between these two variables [(36)].

Conclusions

The age of workers should be considered when assigning work shifts, as evidence suggests that the negative health effects associated with shift work increase with age.

Modifiable cardiovascular risk factors, including sleep quality, hypertension, and perceived stress, are particularly affected by shift work.

It should be taken into account that women present higher levels of perceived stress and poorer sleep quality than men when these variables are assessed. However, men show a higher proportion of a history of cardiovascular events.

Work shifts and physical activity appear to have a negative influence on sleep quality, which is poorer among rotating shift workers

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