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ORIGINAL ARTICLE

Factors Associated With Elevated Blood Pressure in Nursing Workers

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Abstract

Introduction: Nurses from the night shift are exposed to sleep deprivation, which is associated with circadian rhythm alteration, lifestyle changes, psychosocial stress, and, consequently, increased risk of blood pressure (BP) deregulation and hypertension.

Objective: To analyze risk factors associated with elevated BP levels in nursing workers.

Methods: A transversal, quantitative study was conducted with 172 nursing professionals of a large hospital in the state of Minas Gerais, Brazil. The following data were collected: anthropometric and BP measurements, sociodemographic characteristics, clinical variables, and lifestyle habits. Results were evaluated by bivariate analysis and logistic regression. The level of significance adopted in the statistical analysis was 5%.

Results: Participants' average age was 42.7 ± 9.6 years old; 86.6% (n = 149) were female, and 20.3% (n = 35) had previous diagnosis of hypertension. Overweight and obesity (odds ratio [OR]: 2.187, 95% confidence interval [CI]: 1.060 – 4.509) and night shift (OR: 2.100, CI 95%: 1.061 – 4.158) were statistically significant ($p < 0.05$) for increased risk of elevated BP level.

Conclusion: Excessive weight and night shift were significant factors for increased BP in nursing workers.

Keywords: Blood pressure; Nursing team; Shift work schedule; Body weight.

Introduction

Nursing is associated with physical and emotional demands that often result in sickness, such as mental disorders and musculoskeletal system illness.[1] Also, it is a profession subjected to work shifts. Work shifts demand constant attention, and the night shift is associated with sleep deprivation and, consequently, chronobiological desynchronization.[2] Pathologically, alterations are observed in the hypothalamus-pituitary-adrenal axis in sleep deprivation, resulting in blood pressure (BP) elevation in the beginning of the nocturnal period, with excitation of the sympathetic nervous system, increased blood and urine norepinephrine, altered heart rate variability, vascular structure damage, vascular stiffness, and reduction of vascular endothelium-dependent vasodilation.[3] In this context, sleep deprivation is considered a risk factor for various diseases, especially cardiometabolic diseases, such as systemic arterial hypertension (SAH).[4]

According to the World Health Organization (WHO), over one billion people worldwide are hypertensive.[5] This disease is noteworthy due to its silent progress, resulting in a significant number of people unaware of their hypertensive condition.[2] Researchers have observed a high prevalence of SAH among nursing professionals (52%), with suboptimal BP control.[6,7] It is well known that SAH leads to other cardiac and brain vascular diseases, such as myocardial infarction and stroke, and it is the main contributor to mortality and disease burden.[4]

Considering that nursing professionals from the night shift are exposed to sleep deprivation, which is

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responsible for alterations in the circadian rhythm, lifestyle, and psychosocial stress, in addition to being associated with an increased risk of SAH, this study analyzed the risk factors associated with elevated BP levels in nursing workers.[8]

Methods

Trial design and location

This observational, transversal, and quantitative study was conducted in the sectors of clinical medicine, emergency room, and intensive care units of a large hospital, with 526 beds distributed in diverse specialties, in the state of Minas Gerais, Brazil.

Participants and inclusion criteria

The sample size was calculated considering the following parameters: 32.5% prevalence of SAH,[9] 5% accuracy, and 95% confidence interval, for a finite population of 500 nursing professionals, resulting in a total of 202 participants (formula: $n = Z^2 \alpha / 2\ p(1\text{-}p) / E^2$). The recruitment process was non-probabilistic.

Permanent staff nurses and nursing technicians who had been employed for at least 1 year, were over 18 years old, regardless of gender, were included, from July 2018 to January 2019. Professionals from the day shift working night shifts were excluded.

Data collection

Data collection was conducted at the beginning of each shift without interfering with the professionals' work starting time in their sectors. Participants responded to a data collection instrument elaborated by the authors, with sociodemographic characteristics, clinical variables, and lifestyle habits (gender, age, self-declared color, comorbidities [SAH, diabetes, obesity, dyslipidemia], smoking, sedentary behavior, alcohol consumption, physical activity practice, and personal background). Anthropometric data (weight, height, BP, and heart rate) were also measured.

Shifts were categorized into day and night shifts. Workers considered exposed were from the night shift, that is, those who initiated their workday at 18:30/19:00. Workers considered non-exposed were from the day shift, with workdays starting at 6:30/7:00 or 12:30/13:00. For anthropometric data measurement, an electronic digital scale was used (model Omron HBF-214), with 150 kg capacity and 50 g sensibility. Height was measured using a non-extensible measuring tape against a 90º wall with no baseboard, with the participant standing in the proper position for this measurement. The body mass index (BMI) was calculated with the following formula: BMI = weight (kg) / height (m).[2] BMI classes were: normal (BMI between 18.5 and 24.9 kg/m^2), overweight (BMI between 25 and 29.9 kg/m^2), and obese (BMI ≥ 30 kg/m^2).[5] BP was measured following the Brazilian Guidelines for Arterial Hypertension.[9,10] BP (systolic/diastolic) was checked 3 times for each participant, with an interval of 1 to 2 minutes, with a digital sphygmomanometer (Omron HEM-7113) on the right arm, in sitting position after a 5-minute rest. The value considered was the average of the last 2 consecutive measurements.

Elevated BP values were considered according to the measurement obtained on the evaluation day, i.e., systolic BP > 120 mmHg and/or diastolic BP > 80 mmHg.[10]

Participants who informed that they were not involved in any physical activity more than twice a week were considered sedentary. Alcohol consumers were those who informed drinking, regardless of drink type, amount, or frequency. Smokers were those who smoked at least one cigarette per day. Diabetes was considered as previous diabetes mellitus history using oral hypoglycemic medicine or insulin. Dyslipidemia was considered as use of lipid-lowering medicine.

Data analysis

Data collected were entered in the Statistical Package for the Social Sciences (SPSS)® software, version 22.0.

The normal distribution of quantitative variables was confirmed using the Kolmogorov-Smirnov test. Categorical variables were presented as absolute and percent frequency distribution, while quantitative variables were presented as central tendency measures (average) and variability (standard deviation). Bivariate analysis was used to confirm the association of sociodemographic characteristics, clinical variables, and lifestyle habits with BP level variables, including measures of association in contingency tables (relative risk, odds ratios, and respective confidence intervals), followed by logistic regression, adjusting the other potentially relevant variables. The level of significance adopted in the statistical analyses was 5%.

Results

From the total number of eligible participants, 30 did not participate because of vacation, refusal, or sick leave during the study period.

The average age of the 172 participants was 42.7 ± 9.6 years; the majority were women (n = 149, 86.6%), and 80 (46.5%) self-identified as white. Participants' sociodemographic characteristics, clinical variables, and lifestyle habits are presented in Table 1 according to shift work.

Statistically significant associations between overweight and night shift and elevated BP values were observed while evaluating predictor variables (risk factors) using logistic regression test at $p < 0.05$ (Table 2).

Discussion

This transversal study of a representative sample from a nursing team of a high complexity hospital demonstrated that the night shift was associated with elevated BP levels. Overweight, a traditional risk factor, was also associated with elevated BP levels.

Contrary to our findings, another transversal study with a nursing team demonstrated that night shift was not associated with BP magnitude (odds ratio [OR]: 1.0, 95% confidence interval [CI]: 0.8 – 1.3).[11] In contrast, researchers who analyzed the effects of shift work over SAH observed that shift workers were more likely to have SAH than day laborers (OR: 1.31, 95% CI: 0.98 – 1.75); furthermore, the risk of SAH was increased in workers with longer time in shift work (OR: 1.51, 95% CI: 1.08 – 2.11), even after adjusting for age, BMI, alcohol consumption, exercise habits, and smoker status, which are variables that can interfere with BP.[12]

Another longitudinal study that used recorded data of exposure time to night shift suggests that the risk of SAH increases and remains high with increasing exposure to night shift in comparison to day work.[13] These findings are in agreement with the present study, which, despite its transversal design, reinforces that night work is associated with BP increase.

It is known that shift work leads to circadian rhythm desynchronization, influencing dipper BP variation to non-dipper, increasing the risk of hypertension in night workers.[14] Moreover, researchers have observed that

Table 1 – Sociodemographic characteristics, clinical variables, and lifestyle habits of day (n = 102) and night (n = 70) shift participants. Uberlândia, Minas Gerais, Brazil, 2019

	Day shift	Night shift	p
Female, n %	88 (59%)	61 (41%)	0.785
Age, years	42.5 ± 9.4	42.9 ± 10.0	0.469
White color, n %	48 (60%)	32 (40%)	0.853
BMI, kg m^{-2}	26.9 ± 4.8	27.3 ± 4.6	0.150
SBP, mmHg	118.2 ± 16.5	119.7 ± 13.3	0.254
DBP, mmHg	73.5 ± 10.0	75.6 ± 9.6	0.102
HR, bpm	79.0 ± 12.5	79.3 ± 10.8	0.916
Hypertension, n %	20 (57%)	15 (43%)	0.189
Diabetes, n %	8 (89%)	1 (11%)	0.828
Obesity, n%	60 (57%)	46 (43%)	0.150
Dyslipidemia, n %	14 (74%)	5 (26%)	0.754
Smoker, n %	4 (57%)	3 (43%)	0.197
Sedentary, n %	67 (63%)	40 (37%)	0.451
Alcohol consumption, n %	33 (72%)	13 (28%)	0.280

Data expressed in absolute and relative (percentage) values or average ± standard deviation. SBP: systolic blood pressure; DBP: diastolic blood pressure; mmHg: millimeters of mercury; HR: heart rate; bpm: beats per minute; BMI: body mass index.

Table 2 – Bivariate analysis and logistic regression for participants' BP levels, sociodemographic variables, and lifestyle habits. Uberlândia, Minas Gerais, Brazil, 2019

Variables	Normal BP n (%)	Elevated BP n (%)	OR[A] (CI)	OR[B] (CI)	p
Age group					
Elderly	7 (53.8)	6 (46.2)	1.273 (0.761 – 2.129)	1.750 (0.530 – 5.773)	0.358
Adult	109 (68.6)	50 (31.4)			
Physical activity					
Sedentary	70 (65.4)	37 (34.6)	1.082 (0.878 – 1.332)	1.256 (0.623 – 2.530)	0.524
Not sedentary	46 (70.8)	19 (29.2)			
Alcohol consumption					
Yes	28 (60.9)	18 (39.1)	1.147 (0.886 – 1.486)	1.600 (0.759 – 3.372)	0.217
No	88 (69.8)	38 (30.2)			
BMI					
Altered	64 (60.4)	42 (39.6)	1.305 (1.070 – 1.592)	2.187 (1.060 – 4.509)	0.034
Normal	52 (78.8)	14 (21.2)			
Shift					
Night	41 (58.6)	29 (41.4)	1.255 (0.999 – 1.578)	2.100 (1.061 – 4.158)	0.033
Day	75 (73.5)	27 (26.5)			

BMI: body mass index; CI: confidence interval; OR[A]: gross or non-adjusted odds ratio; OR[B]: adjusted odds ratio; BP: blood pressure. Significance level ($p < 0.05$). p value is attributed to OR[B].

night workers have less control of SAH (OR: 0.74, 95% CI: 0.68 – 0.80) in comparison to day workers regarding this pathology.[15]

A systematic review and meta-analysis demonstrated that 3 in 5 adults over the age of 50 years have elevated BP, with hypertensive proportion increasing gradually between 2005 and 2018, which can be explained by the increased obesity proportion observed in this population.[16] Obesity mechanisms related to hypertension are complex and are centered around a greater activation of the sympathetic nervous system, leading to increased reabsorption of renal tubular sodium, induction of kidney disease development, increased vascular oxidative stress, adipokine deregulation, and increased insulin resistance.[17] In 2020, Tiruneh et al. observed that the probability of developing hypertension among people who are obese or overweight was 3 times greater than in people with normal weight (OR: 3.34, 95% CI: 2.12 – 5.26).[18] These data corroborate with our findings, where overweight exhibited a 2-fold greater risk of elevated BP levels.

Limitations

One limitation of this study is its small sample size. As a transversal study, the lack of establishing cause-effect relation between risk factors and elevated BP levels is acknowledged. Another limitation of this study is the inclusion of hypertensive workers, which is considered as a bias that can negatively affect the outcomes.

Conclusion

The altered variables, BMI and night shift, were statistically significant, representing expressive risk factors for elevated BP levels in the nursing team. We indicate the need to provide regular occupational health services, including screening of cardiovascular disease risk factors for all night shift workers.

Author contributions

Conception and design of the research, acquisition of data, analysis and interpretation of the data, statistical

analysis, writing of the manuscript: Coelho VM, Sinhoroto CO, Magnabosco P, Raponi MBG, Oliveira MAM, Almeida Neto OP, Figueiredo VN; critical revision of the manuscript for intellectual content: Magnabosco P, Raponi MBG, Oliveira MAM, Almeida Neto OP, Figueiredo VN.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Uberlândia under the protocol numbe 61307816.5.0000.5152 and statement 1.908.169. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Erratum

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In Original Article "Factors Associated With Elevated Blood Pressure in Nursing Workers", with DOI number: https://doi.org/10.36660/ijcs.20220001, published in International Journal of Cardiovascular Science, 36:e20220001. Correct the author's name "Patrícia Magnaboso" to "Patrícia Magnabosco".

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