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EFFECT OF SLEEP-DEPRIVED LIFESTYLE ON THE COGNITIVE FUNCTIONS OF SHIFT-WORKING NURSES.

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Abstract

Objectives: The current study aimed to assess how sleep deprivation brought on by nurses working night shifts affected their overall health and quality of life .

Methods : In this study, 58 staff nurses were enlisted. They completed questionnaires like the ESS, PSQ, SSS, and BDI. The individuals' cognitive performance was assessed for alterations brought on by sleep deprivation using the Montreal Cognitive Assessment (MoCA), the stroop test, and the Vigilance test. Subjects were split into three groups: fewer than 4 hours/night, classified as severely sleep deprived (SD), within range of 4 to 6 hours per night, classed as mildly to moderately sleep deprived (MD), and those with more than 6 hours of sleep per night were classified as non-sleep deprived (NonD).

Results: Seventy-one percent of nurses who worked shifts reported having sleep problems. Compared to the MD and NonD groups, the SD group had a higher ESS. 67% of nurses had a lower MocA score at night (24.62) than they did during the day (27.92). 33% made more arithmetic mistakes during the course of the night. It was found that the stroop's color test, vigilance test, and memory test results were lower for nurses at night for 72%, 84%, and 67% of them, respectively. Therefore, among nurses who worked shifts, cognitive impairment was statistically significant.

Conclusion: These findings suggested that sleep deprivation among healthcare professionals may have detrimental consequences on their productivity, well-being, and ability to handle stress, which may affect the caliber of patient treatment.

Introduction

Modern lifestyle and factors associated with work are the most frequent causes of sleep deprivation, a large number of people are affected by the sleep deprivation. A vital component of human health and wellbeing is sleep. While we sleep, a number of physiological and neuropsychological activities take place [1]. Several research conducted in the recent years have demonstrated the importance of sleep following learning for memory consolidation. According to recent epidemiological data, one in three workers presently sleep fewer than 6 hours each night on average [2]. At the moment, little is known about how sleep deprivation affects both cognitive and emotional functioning. It is crucial that science advances our understanding of how inadequate sleep affects cognitive and emotional performance as more and more people experience inadequate sleep. [3]. Sleep is crucial for memory formation, according to recent research on human memory [4]. The front line of the healthcare team is typically made up of health professionals (such as doctors, nurses, and community health workers) works for long shifts lasting more than 12 hours that severely impair sleep. It is widely accepted that the performance decline during extended wakefulness is the result of a complicated interaction between an endogenous circadian rhythm and a sleep-wake-dependent homeostatic process. Healthcare staff performance suffers specifically when they are sleep deprived. Additionally, it affects the efficacy of actual and simulated maintenance jobs by increasing complexities and error rates [5]. The severity and effects of sleep deprivation on the physical health, cognitive abilities, and job performance of staff nurses working in shift were examined in this study.

Materials & Methods

The staff nurses of Dr. Zakir Hussain MNC Hospital in Nashik, Maharashtra, India who worked in shifts participated in the current study. Subjects were split into three groups: fewer than 4 hours/night, classified as severely sleep deprived (SD), within range of 4 to 6 hours per night, classed as mildly to moderately sleep deprived (MD), and those with more than 6 hours of sleep per night were classified as non-sleep deprived (NonD).

Inclusion criteria

Staff nurses from all departments who worked an eight-hour shift each day without a sleep disorder and who had at least six months of prior experience with a rotating shift schedule were included.

Exclusion Criteria

Subjects who met any of the following criteria were disqualified: a presence of sleep disorder, such as sleep apnea, parasomnias , or a sleep-related family history.

The subjects were assessed using various tools for sleep deprivation including sleep questionnaire, the Epworth sleepiness scale (ESS) [6], the Pittsburgh Sleep Quality Index (PSQ)[7], the Stanford Sleepiness Scale (SSS)[8], and the Beck Depression Inventory (BDI)[9]. Participants in the study were evaluated on their sleep habits in relation to physical health issues such as menstrual abnormalities, gastrointestinal, musculoskeletal, and neurologic problems.

Self-reported sleep habits include bedtime, wake up time, sleep latency, total amount of time asleep, and number of sleep interruptions. Questions about the subjective sense of sleep quality and daytime dysfunction like difficulty concentrating and subpar performance.

A number of tests were used to evaluate the participants' cognitive performance for changes brought on by sleep deprivation.

General intelligence

A variety of cognitive domains related to visuospatial competence, naming, memory recall, attention, language, abstraction, delayed recall, and orientation were evaluated using the Montreal Cognitive Assessment (MoCA) Version 7.3 [10]. The average test can be completed in 10 minutes. We compared results from the day shift with the night shift.

Mental Skills (working memory, response inhibitory skill and cognitive flexibility)

Cognitive functions including critical thinking, problem solving , working memory, planning, decision making , resisting temptation and attention are all included in executive function. Response restraint and working memory for images were evaluated in this study. Confusion of colors (stroop test) was a mobile application used for this. Utilizing a program based on the Stroop effect, response inhibition was found [11].

Attention (Vigilance)

Sleep deprivation is more frequently associated with attention deficit. Lack of vigilant attention impairs a person's capacity to promptly react to inputs. The "Vigilance Test" smartphone app, which works identically to the Mackworth clock test, was used to assess long-term focus. Only false alarms and the number of targets observed were accurately recorded by the application [12].

Simple Reaction Time

The objective of the basic reaction time test is to evaluate the subject's motor control and processing speed by having them react to a known stimulus. As soon as a color changes, the participant was instructed to hit a button. A mobile application (reaction time test) was used for this [13].

Numerical Cognition (mental speed)

Participants were given a worksheet with 25 math questions to complete; the participant's mental speed was evaluated. This worksheet dealt with the operations adding, subtracting, multiplying, and division of 2 integers. The amount of time needed to complete the worksheet at various shift times was recorded and compared [14].

Before the test, the subjects were told to abstain from alcohol and limit their caffeine intake for at least two days.

Results

Sleep parameters and demographics

The average age of the 58 subjects (eight men and fifty women) was 27.3 ± 2.2 years. Mean sleep duration was 5.1 ± 1.3 hours and mean work duration was 13.9 ± 2.6 hours for all 58 individuals.

Table 1 provides a summary of each group's demographic features. Except for job duration, there were no noticeable variations across groups.

In accordance with a sleep questionnaire, self-reported sleep factors

Based on survey results, self-reported sleep patterns were examined (Table 2). As expected, there were significant differences between groups in the amount of sleep each participants got while working nights and non working nights ($P < 0.01$). All sleep characteristics in the SD group were significantly worse during working nights when compared to non working nights ($P < 0.05$). Except for sleep latency, the MD group similarly demonstrated statistically significant variations in sleep characteristics between working and non working nights ($P < 0.01$). However, there was no difference in the sleep patterns between working and non-working nights in the NonD group. The mean ESS was significantly higher in the SD group (15.0±4.1) compared to the MD (11.9±3.4) and NonD (10.9±3.5) groups ($P< 0.05$), but the mean SSS did not differ significantly between the groups.

Health, employment, and social consequences of sleep deprivation

Table 3 showed daytime dysfunction on a frequency range of 1 to 5, where 1 represents never and 5 represents almost every day. Severe sleep deprivation has been linked to stress, trouble concentrating, and learning issues. More over 70% of each group expressed a variety of medical issues, including gastrointestinal problems, musculoskeletal pain, and neurological symptoms. However, there were no variations in the health complaints made by the various groups. After a Bonferroni correction, the difference between the SD group and the MD and NonD groups in the frequency of missing work or errors caused by sleepiness at work was no longer significant. SD considerably missed more family and social events than the other groups reported. No any significant differences were found in lateness and non-sleepiness related errors between the groups (Table 4).

Effects of sleep deprivation on cognitive processes

A maximum score was 29 and 30 was attained during nightshift and dayshift hours respectively in MoCA. The results showed that the lowest score was 21 at nighttime and 23 during daytime. While the mean scores for mental speed and reaction time enhanced at night, the mean scores for general intellect and attention dropped [Table 5].

These non-parametric values were compared using a Wilcoxon Signed-Ranks test. With regard to the MoCA test, findings of this study shown that results of daytime shift were significantly higher than results obtained during the nighttime shift ($Z=-5.651$, $p<0.001$). Additionally, the results of the execution ($Z=-5.145$, $p< 0.001$) and memory ($Z=-5.132$, $p<0.001$) tests were significantly higher during the day shift than they were at night. Daytime completion times for the math assignment were considerably shorter than nighttime completion times ($Z=-5.561$, $p<0.001$). The vigilance test reaction times during the day were statistically significantly faster than those during the night ($Z=-7.132$, p<0.001). During the day shift, target detection rates were significantly higher (Z=7.098, p<0.001), while during the night shift, false alarm rates were significantly higher (Z=--7.262, p<0.001) [Table 5].

Discussion

Present study was conducted to investigate pattern of sleep deprivation due to night shift work of nurses. Sleep deprivation due to night shift work disturbs circadian rhythms and affects on general health and cognitive functions. A total of 70.6% of staff nurses reported getting less than 6 hours of sleep each night, and 19.0% of participants reported their average daily sleep time was less than 4 hours. These findings matched findings among medical professionals working comparable shift schedules [15]. Exposure to partial and total sleep deprivation impairs human cognitive functions such as sustained attention and working [16].

Regarding physical health complaints, the data show that complaints are common in all groups (weekly or more often) and these were related to working environment . In this study, sleep deprivation was linked to problems with learning, focus, and social interactions. The cognitive abilities of the nurses who worked in shifts at the conclusion of the day shift and night shift were compared. Lower levels of scores was observed in cognitive domains, mental skills, vigilance, simple reaction time and working memory . Recent studies suggest that the possibility that sleep loss impacts on parietal function may play a particularly significant role in influencing later cognition[17]. Dorsolateral prefrontal cortex is known to be linked to working memory and episodic memory[18]. Number of data confirmed the connection between memory processes and sleep [19,20]. During the day shift, we observed better visual working memory compared to the night shift. Thus, as a result, sleep deprivation also enslaves memory [21, 22].

In keeping with the findings of a study conducted among medical interns in the United States[23], it was found that mathematical tasks were solved more slowly during the night shift. Additionally, it was found that the slower mean simple reaction time of the night shift due to Sleep Deprivation [24]. Additionally, lack of sleep seems to be linked to a general decrease in target recognition and an increase in false alarms, although it's likely that these findings are just the result of diminished attention and vigilance. By altering vigilance state transitions and sleep states, sleep deprivation can affect the hypothalamic suprachiasmatic nucleus's activity [25].

Working memory issues, delayed cognitive processing, and poor outcomes on the psychomotor vigilance test (PVT) have all been found in studies on sleep deprivation [26]. Studies have demonstrated that lack of sleep reduces reaction speeds generally, which boosts the time spent on task and produces more errors of execution and absence. Vigilance tests performed during sleep deprivation have also been shown to be susceptible to both circadian and homeostatic drives [27]. Additionally, several studies have shown that working the night shift increases the likelihood that cognitive impairment will occur compared to working the day shift[28] Despite working the same amount of time as a day shift, it is crucial to remember that persons who experience sleep deprivation are more vulnerable to its many negative effects [29].

Limitation

Concerns have been raised over the validity of ESS's subjective estimation of sleep duration compared to an actigraph or actimetry sensor in identifying sleep deprivation. Although subjective health problems were used, it is important to note that they are fundamentally subjective. We lacked empirical data on sleep disruption, which is even another limitation. In this case, no physiologic research was done. Additionally, not all cognitive domains were examined in this study. Also due to resource limitations, mobile application software used to measure cognition was internally validated. Actigraphy-based research on a wider population are required to determine the incidence of sleep deprivation and its impacts on every domain of cognition.

Conclusion

These findings offer hints about how sleep affects cognitive function and brain function. Staff nurses who are sleep deprived experience significant losses in basic alertness, attention, and psychomotor vigilance, among other measures of cognitive functioning. However, it is unclear to what degree these declines are attributable to just being less vigilant and paying less attention.

Sleep deprivation among healthcare workers may have negative effects on their health, emotions, and productivity, which may have an impact on the standard of patient care.

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