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SLEEP DEPRIVATION AND SLEEP QUALITY OF HEALTHCARE SHIFT WORKERS IN BANGLADESH

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Abstract

Shift work is an essential feature of industrialized society. Our present study was aimed at investigating the sleep deprivation and sleep quality of the healthcare shift workers in Bangladesh. In investigating so, we took 462 healthcare shift workers from five districts of Bangladesh. Among them 152 were male and 310 were female. The participants ranged from 19 to 65 years of age. We took the participants on the basis of convenience sampling technique from 30 hospitals and medical centers. To collect data we administered Bangla version of Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). Findings of our study revealed that sleep deprivation and shifts were marginally dependent ($\chi^2 = 11.56$, $p = 0.07$). However, sleep quality had been found independent of shifts ($\chi^2 = 4.31$, $p = 0.12$). Shift-wise analyses yielded that sleep deprivation was high ($\mu = 7.56$) and sleep quality was worse ($\mu = 3.78$) in rotating shift workers in comparison to fixed and regular shift workers. Sleep quality was found better outside of metropolitan city ($t = -3.258$, $p<0.01$). Findings have been discussed in terms of previous findings and contemporary theories. Recommendations are proposed in the light of our findings in conclusion.

Introduction

Sleep deprivation is a widespread issue that affects various aspects of an individual's life, including cognitive performance. It has been shown to have detrimental effects on cognitive performance, including impaired reaction time[1], accuracy[2], visual attention[3], and memory[4]. These effects can have negative implications for the quality of work performed by shift workers. When those shift workers are in the medical field, it can potentially compromise patient safety[5]. Healthcare professionals play a vital role in safeguarding public health. However, the demanding nature of their work, particularly for those involved in shift work, can lead to sleep deprivation. Sleep deprivation in medical shift workers has been linked to increased risks of accidents and errors[6], as well as decreased job performance[2] and overall quality of life[7]. Research suggests that sleep deprivation can also lead to mood disturbances, decreased motivation, and increased stress levels among medical shift workers[8]. Shift work disrupts the body's natural circadian rhythm,

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making it difficult to achieve adequate sleep duration and quality. This sleep disruption can negatively impact cognitive performance, potentially compromising patient care.

Medical shift work is a demanding and essential aspect of the healthcare industry, ensuring continuous patient care around the clock. However, the irregular and often long shifts that medical professionals work can take a significant toll on their health due to sleep deprivation[9]. Medical shift workers often face challenges in shift timings. This disruption to the body's internal clock, known as the circadian rhythm, can lead to chronic sleep deprivation and its associated health risks[10]. The irregular schedule can make it difficult for healthcare workers to obtain the recommended amount of sleep, as their shifts may interfere with normal sleep hours. Chronic sleep deprivation among medical shift workers can have profound effects on their physical and mental well-being. Studies have shown that healthcare professionals working irregular shifts are at a higher risk of developing health conditions such as cardiovascular disease, obesity, and diabetes[11]. Furthermore, inadequate sleep can also compromise cognitive function, leading to decreased alertness, impaired decision-making, and reduced job performance[12]. This has serious implications for the quality of patient care and the safety of both the healthcare workers and their patients. Recognizing the unique challenges faced by medical shift workers, it is imperative to implement strategies to mitigate the impact of sleep deprivation. This may include providing education and support for establishing healthy sleep habits, creating optimal sleep environments in healthcare facilities, and implementing scheduling practices that prioritize the well-being of medical staff. Additionally, access to resources such as nap rooms or designated rest breaks during shifts can provide opportunities for healthcare workers to replenish their energy and reduce the risk of sleep deprivation. Addressing the issue of sleep deprivation among medical shift workers is crucial for ensuring the health and safety of both the healthcare professionals and the patients under their care. By taking proactive measures to support healthy sleep patterns and mitigate the effects of irregular shift work, healthcare organizations can promote the well-being and performance of their valuable staff, ultimately contributing to the delivery of high-quality patient care.

In the context of Bangladesh, where the medical profession is very demanding, and often requires long and irregular hours, understanding the impact of sleep deprivation on the cognitive performances of medical shift workers is crucial for assessing their well-being and ensuring patient safety. This study aims to explore the current state of sleep deprivation and sleep quality of the healthcare shift workers in Bangladesh, shedding light on potential interventions and policies to mitigate these effects. Given the demanding nature of the medical profession and the prevalence of shift work in Bangladesh, it is imperative to investigate the specific challenges faced by medical shift workers in this context. This study aims to delve into the unique experiences of Bangladeshi medical professionals, examining the intersection of sleep deprivation and sleep quality within the local healthcare landscape. By shedding light on these issues, the findings of this study can inform the development of targeted interventions and policies to support the well-being of medical shift workers and ultimately enhance the quality of healthcare delivery in Bangladesh.

Rationale of the Study

Sleep is a fundamental physiological need, crucial for maintaining homeostasis and cell repair. Insufficient sleep can lead to significant impairments in brain function, especially those associated with the frontal lobe, which is involved in critical cognitive processes such as alertness, attention, decision-making, and executive functions. Shift workers are particularly vulnerable to sleep deprivation due to irregular work hours that conflict with natural circadian rhythms. This can result in decreased cognitive performance, affecting their ability to perform tasks safely and efficiently. The consequences of impaired cognitive performance due to sleep deprivation extend beyond individual health, potentially impacting public safety, productivity, and overall quality of life. This research is justified by the need to understand the current status of sleep deprivation and sleep quality of healthcare shift workers, which has implications for individual health, occupational safety, and societal well-being.

Objectives

The objectives of the study were

1. to explore current status of sleep deprivation and sleep quality of the healthcare shift workers in Bangladesh.

2. to investigate the relationship between sleep deprivation and sleep quality of the healthcare shift workers in Bangladesh.

Materials and Methods

Participants

We conducted this study on the healthcare shift workers. These included doctors, nurse, midwives, and administrative healthcare staffs. Healthcare workers who were healthy, adult, shift workers, available and were willing to participate were included in the study. However, those who had chronic medical conditions, on medications that may interfere sleep patterns, had sleep disorders, used substances and were in psychiatric conditions were excluded from the study. We took a total number of 462 healthcare workers from five (05) different districts of Bangladesh. Those participants were included from 30 hospitals and clinics. The five districts of Bangladesh are Dhaka, Madaripur, Narayanganj, Sirajganj, and Tangail. Among them 152 participants were male and 310 participants were female. They were ranged from 19 years to 65 years of age.

Table 1. Area and gender-wise distribution of participants

		Area		Total
		Inside Dhaka	Outside Dhaka	
Gender	Male	55	97	152
	Female	78	232	310
	Total	133	329	462

Study design and Sampling technique

The data of the study were collected following cross-sectional survey research design and convenience sampling technique.

Psychometric tools

We used several psychometric tools to collect data from the shift workers. Following are the list of tools that we used for the study.

1. Personal Information Form (PIF)
2. Pittsburgh Sleep Quality Index (PSQI)
3. Epworth Sleepiness Scale (ESS)
4. Paper & Pencils etc.

1. *Personal Information Form (PIF)*. The personal information form consists of participants' demographic and personal information. These include name (optional), gender, age, height, weight, designation, institute name, district, shifts, total experiences, experiences in in current position, use of sleeping aids, use of stimulants, sleep disorders etc.

2. *Pittsburgh Sleep Quality Index (PSQI).* The Bangla version of Pittsburgh Sleep Quality Index was used to collect data regarding sleep quality of the shift workers. The Bangla version of PSQI was adapted by Singha (2018)[13]. The overall index has a Chronbach Alpha of 0.71. The split-half reliability coefficient of the Bangla version was found 0.69. A 15-days test-retest reliability was found 0.84. Component Matrix Analysis showed that the items have high degree of construct validity. This indicates that the Bangla version of PSQI is a reliable and valid tool to assess sleep quality.

PSQI is a self-report instrument that consists of 18 individual items. It generates 7 component score namely, subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component has a score range from 0-3 points. In all components "0" indicates no difficulty and "3" indicates severe difficulty in sleep. The total score range from 0-21 where high score means higher difficulties in sleep and low score means lower difficulties in sleep. The PSQI has a cut off score of 5. The original PSQI was developed by Buysse et al.[14] of the University of Pittsburgh.

3. *Epworth Sleepiness Scale (ESS).* We used the Bangla version of Epworth Sleepiness Scale (ESS) to collect data on sleep deprivation of the shift workers. The ESS is a simple, self-administered questionnaire to measure participants' daytime sleepiness. The Bangla version of ESS was adapted by Habibullah & Hossain[15]. The scale rate the likelihood of falling asleep in eight different daily life situations, such as sitting and reading, sitting inactive in public place, or watching TV. A "0" to "3" point rating is taken with "0" indicating "no chance of dozing" and "3" indicating "high chance of dozing". The total score ranges from "0 to 24". The higher score in ESS indicates higher daytime sleepiness and the lower score

indicates lower daytime sleepiness. The Bangla version of ESS has a Chronbach alpha of 0.71 and a split-half reliability of o.76. It has also good internal consistency. The scoring of the ESS is calculated by adding up the numbers of each item. The total score of ESS is interpreted as follows.

a. Lower chance of dozing off: 0 - 5

b. Moderate chance of dozing off: 6 – 10

c. High chance of dozing off: 11 - 12

d. Very high chance of dozing off: 13 - 24

4. *Paper & Pencils.* To collect the data of sleep deprivation and cognitive performances of the shift workers, we used paper-pencils and questionnaire. For each participant there were separate set of questionnaire. They filled it up using pencil.

Ethical Approval

We applied for the review and approval of our study to the ethical review committee of the Faculty of Biological Sciences of University of Dhaka. After a thorough review the study was approved by the faculty. The reference number of the ethical approval is *229/ Biol. Scs*.

Procedures

Collecting data from the healthcare shift workers was a challenging part. These professionals are very much busy in their duties. After preparing the tools we appointed six (06) enumerators. The enumerators approached the healthcare workers for data collection. However, as it was a lengthy process the participants in most of the cases didn't participate in first trial. Then the test administrators took appointment from the participants and they visited them on the scheduled day and time. It took around 15-20 minutes to collect data from individual participants. Once the data collected, the administrators thanked the participants and assigned a unique identification number for each data set. In few cases, the participants couldn't complete the entire set due to office emergencies or so. In such cases we had to drop that data set. After checking the data the administrators entered the data in MS Excel.

Results and Discussion

To analyze the data obtained from our cross-sectional survey we carried out several statistical operations. We analyzed the data using Microsoft Excel and Statistical Packages for Social Sciences (SPSS V. 20). To test the normality and randomness of the data we employed Kolmogorov-Smirnov test (K-S test) and Runs test. K-S test ensures the normality of the normality of the tested variables. Runs test for the sequence of the values for gender indicates the randomness of the data ($p > 0.05$). Different descriptive and inferential statistics like mean, standard deviation, variances, correlation, Chi-square value were calculated.

Shift-wise descriptive statistics of sleep deprivation has been presented in the Table No. 2.

Table 2. Shift-wise descriptive statistics of sleep deprivation

Shift	*N*	Mean	*SD*
Fixed	101	6.87	2.95
Regular	238	7.06	2.37
Rotating	123	7.56	3.13
Total	462	7.15	2.73

From above Table No. 2. we can see that Rotating shift health workers have the highest level of sleep deprivation.

Data has been categorized to see whether there is any difference of shifts on sleep deprivation of the shift workers. In the following Table No. 3. we have presented the percentages of healthcare shift workers who have lower to very high level of sleep deprivation.

Table 3. Percentages of Shift-wise sleep deprivation (ESS)

Shift	Low	Moderate	High	Very High	Total
Fixed	32 (31.7%)	54 (53.5%)	11 (10.9%)	4 (4%)	101
Regular	65 (27.3%)	157 (66%)	15 (6.3%)	1 (0.4%)	238
Rotating	30 (24.4%)	76 (61.8%)	13 (10.6%)	4 (3.2%)	123
Total	127 (27.4%)	287 (62.1%)	39 (8.4%)	9 (2%)	462

The data report that around 10% shift-workers suffer from high to very high sleep deprivation. Both the fixed healthcare shift workers and rotating healthcare shift workers have more percentages than the regular healthcare shift workers in terms of sleep deprivation. We investigated whether there is a link between shifting and level of sleep deprivation. A chi-square test of independence showed moderate association between shifting and sleep deprivation, $\chi^2 = 11.56$, $p = .07$.

Table 4. Chi-Square test of independence between shifts and sleep deprivation

	Value	*df*	p
Pearson Chi-Square	11.56	6	0.073
Likelihood Ratio	12.29	6	0.056
Linear by Linear Association	0.58	1	0.446
N	462		

The following table shows that rotating healthcare shift workers have the highest score in sleep quality. This means that they have the worst sleep quality in comparison to other two groups of healthcare shift workers.

Table 5. Shift-wise descriptive statistics of sleep quality

Shift	*N*	Mean	*SD*
Fixed	101	3.39	1.414
Regular	238	3.60	1.585
Rotating	123	3.78	1.468
Total	462	3.60	1.521

We categorized the data in terms having sleep difficulties or not. A total score of 5 or more in PSQI has been considered as having sleeping difficulties.

Table 6. Shift-wise sleep quality (PSQI) in healthcare shift workers

Shift	No sleep difficulty	Sleep difficulties	Total
Fixed	79 (78.2%)	22 (21.8%)	101
Regular	162 (68%)	76 (32%)	238
Rotating	82 (66.7%)	41 (33.3%)	123
Total	323 (70%)	139 (30%)	462

We can see from the Table No. 6. that, the highest percentages of sleeping difficulties occurred in rotating healthcare shift workers (33.3%) whereas, 32% of regular healthcare shift workers reported sleep difficulties and only 21.8% fixed healthcare shift workers reported so. We investigated whether there is a link between shifting and sleep difficulty. A chi-square test of independence showed that there was no significant association between shifting and sleep quality ($\chi 2$= 4.31, p = .12).

Table 7. Chi-Square test of independence between shifts and sleep quality

	Value	*df*	p
Pearson Chi-Square	4.31	2	0.116
Likelihood Ratio	4.51	2	0.105
Linear by Linear Association	3.26	1	0.071
N	462		

To investigate the relation between sleep deprivation and sleep quality, we calculated Pearson product moment correlation coefficient. The findings of the correlation coefficient are as follows in Table No. 8.

Table 8. Correlation between sleep deprivation and sleep quality

		Sleep Quality
Sleep deprivation	Pearson Correlation	.143**
	Sig. (2-tailed)	.002
	N	462

**Correlation significant at 0.05 Alpha level

Results of correlation coefficient indicate that there is a significant correlation between sleep deprivation and sleep quality of the healthcare shift workers ($r = 0.143$, $p < 0.05$).

Sleep deprivation is a common issue among shift workers[16] and its impact on cognitive performance is a matter of concern. The long and irregular working hours of shift workers often disrupt their natural sleep-wake cycles, leading to insufficient and poor-quality sleep[17]. This can result in a range of cognitive deficits affecting memory, attention, decision-making, and overall mental acuity. The impact of sleep deprivation on cognitive performance is multifaceted and can manifest differently in individuals. For example, some shift workers may experience decreased alertness and slower reaction times, while others may struggle with impaired memory and reduced problem-solving abilities(18). Understanding these variations in cognitive impact is crucial for addressing the specific needs of shift workers and implementing effective interventions to mitigate the negative effects of sleep deprivation. Factors such as the duration and timing of shifts, inadequate rest periods between shifts, and the physical and mental demands of the job can all contribute to the level of sleep deprivation experienced by shift workers.

The research findings clearly indicate that shift work has a significant impact on the sleep quality and overall well-being of workers. The prevalence of sleep deprivation among shift workers, particularly rotating shift workers, is a cause for concern. The data shows that a substantial portion of shift workers experience sleep difficulties, with rotating shift workers being the most affected. These findings highlight the need for employers to address the challenges faced by shift workers in maintaining good sleep quality. Implementing measures such as providing education on sleep hygiene, offering flexible shift schedules, and creating optimal working environments can help mitigate the negative effects of shift work on sleep patterns. Furthermore, the disparities in sleep difficulties between fixed shift workers, rotating shift workers, and regular shift workers emphasize the importance of tailored interventions that take into account the specific challenges faced by each group. Addressing these disparities can lead to improved overall well-being and productivity among shift workers. Further studies can be carried out on the interventions that can mitigate the sleep deprivation issues and improve sleep quality of the shift workers.

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