



## ORIGINAL ARTICLE

# Assessment of Sleep Quality Among Doctors with On-Call Duties in Bahrain Defence Force Hospital

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### Abstract

**Background:** Sleep quality is influenced adversely or favorably by various intrinsic and extrinsic factors and sleep deprivation is a common problem facing doctors.

**Objectives:** To assess the sleep quality and estimate the prevalence of excessive daytime sleepiness among physicians with on-call duties.

**Methods:** This cross-sectional seven-month study included a total of 62 doctors working at the Bahrain Defense Force Hospital (BDF) with on-call duties. Data were collected using the Pittsburgh Sleep Quality Index (PSQI) questionnaire and the Epworth sleepiness scale (ESS).

**Results:** The mean Global Score of PSQI in the analyzed sample was 8.34 (95% CI: 7.35 – 9.33). The prevalence rate of poor sleep quality (PSQI >5) was 77.4%. Logistic regression analysis showed that poor sleep quality was associated with female gender and doctors' ranks, as 54.2% of female doctors and 62.5 % of junior doctors reported poor sleep quality. No significant association was seen between number of calls per month and sleep quality. The mean of ESS scores among participants was 8.87 out of 24. No significant correlation was found between ESS scores and sociodemographic factors.

**Conclusion:** Sleep disturbance was mostly seen among female and junior resident doctors. More studies are warranted to highlight this issue.

**Keywords:** Doctors; Excessive daytime sleepiness; Mental health; On-call duties; Sleep

### Introduction

Sleep is a physiological, reversible, unconscious state, highly regulated by complex neurological pathways, and consists of two types: the non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep.<sup>1,2</sup> It is known that sleep quality is influenced adversely or favorably by

various intrinsic and extrinsic factors.<sup>1</sup> It is also well established that sleep quantity and quality can affect work performance, general health and psychological functioning.<sup>2,3</sup>

A review of sixteen published papers concluded that on-call shift in different careers, including the medical field, adversely affect workers' sleep

patterns, mental health and personal life.<sup>4</sup> Moreover, a study done in the United States of America in 2015 stated that sleeping less than seven hours on a regular basis will affect a person's life adversely, making them more prone to diabetes mellitus, cardiovascular incidents, depression, and decreased immunity.<sup>5</sup> A more recent study explained the characteristics of healthy sleep as the following: enough hours of sleep, regularity and absence of any disturbance.<sup>5</sup> Studies have also revealed a clear correlation between sleep disorders and the night work shift.<sup>6</sup> Several studies conducted on residents have reported that long working hours and chronic sleep deprivation correlates with a lower level of cognitive function and a higher rate of daytime sleepiness and medical errors.<sup>7,8</sup> A study illustrated how acute sleep loss resulted in reduced daytime alertness and mood disturbance.<sup>9</sup> Moreover, another study that evaluated the sleep quality among the staff working in a pediatric ICU found that night shift workers had poorer sleep quality compared to workers who had fixed shifts.<sup>10</sup>

To the best of our knowledge, this is the first study in Bahrain that aimed to evaluate the sleep quality among physicians with on-call duties. Our hypothesis was that if on-call duties are for longer than 20 hours and cause sleep disturbance, then many BDF doctors will have poor sleep quality. In this paper, we present the sleep quality of doctors on call at BDF hospital.

## Methods

This cross-sectional study was conducted from February 2019 to October 2019 at BDF hospital, the second largest hospital in Bahrain, established in 1968, with a total bed capacity of 481 beds.<sup>11</sup> Participation in this study was voluntary, and all subjects signed an informed consent sheet at enrolment.

Demographic data was obtained, including age, gender, marital status, number of children, and the physician's specialty and rank (junior resident, senior resident, and chief resident). Out of 230 doctors working at BDF at the time of the study, only 100 were eligible and 130 were excluded. The inclusion criteria included all BDF physicians who worked for at least six months in the hospital, with

on-call duties where they were required to stay in the hospital after the normal duty hours for a minimum 20 hours at the hospital, reaching up to 24 hours in some departments. All consultants were excluded as they had house on-call duties. Emergency physicians and general health practitioners were excluded as they had shifts. Also, laboratory doctors, intensive care doctors, dentists and interns were excluded. Out of the 100 eligible doctors, 26 cases were excluded as they were on leave at the time of the study or studying abroad. Further, 12 cases were excluded as they refused to participate or did not complete the questionnaire. Thus, only 62 participants met the inclusion criteria and were included in the final analysis.

Since physicians working in BDF hail from different nationalities, the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS) were distributed in the English language, as all participants had reasonable proficiency in English. The PSQI questionnaire is a self-administered instrument that can be used to assess an individual's sleep quality and it covers seven categories over a one-month duration: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction. A total score more than five indicates poor sleep quality.<sup>12</sup> The ESS contains eight questions which represents the chance of daytime sleepiness while performing different daily life activities. The answer to each question is graded from 0 (indicating no chance of dozing) to 3 (indicating a high chance of dozing).<sup>11</sup> The score of ESS ranges between 0-24, a total score >10 indicating excessive daytime sleepiness, which can be further classified into mild, moderate and severe daytime sleepiness.<sup>13</sup>

Data were statistically analyzed using Microsoft Excel 2010 and SPSS1 21.0 software. The level of significance was set at  $P < 0.05$  and the confidence level was set at 95%. Data were reported as mean (standard deviation, SD) and frequency (percentages). Descriptive analysis to correlate sleep quality with the independent variables was done using Chi-square test. Ethical approval was obtained from the Research and Research Ethics Committee at the Bahrain Defense Force Hospital (BDF) hospital.

## Results

A total of 62 out of 74 physicians who fully answered the questionnaires and fit the inclusion criteria were included in the final analysis. The study sample comprised 53.2% (33) males and 46.8% (29) females, with a mean age of  $32.71 \pm 7.09$ . Subjects had frequent number of calls per month, with a mean of  $6.36 \pm 1.60$ . Junior residents 59.7% (37) constituted the largest proportion of the sample, while 27.4% (17) were senior residents and only 12.9% (8) were chief residents. Number of participants from both medical and surgical wards were equal 22.6% (14). Number of participants from cardiology, orthopedic and pediatric departments were also equally distributed at 11.3% (7) each. The number of participants from obstetrics and gynecology and radiology departments were 8.1% (5) and 16.5% (4) respectively. Only 4% (3) of participants were from the plastic surgery specialty and only one participant was from anesthesia specialty. Married and single participants constituted 58.1% (36) and 41.9% (26) of the study sample, respectively. Subjects with no children were more than those with children [58.1% (36) and 41.9% (26), respectively].

The scores of each domain of PSQI are presented in Table 1. A total score of  $>5$  defines poor sleep quality. The mean global score of PSQI was 8.34 (95% CI: 7.35 – 9.33). The prevalence of sleep quality (PSQI  $> 5$ ) was 77.4% (N=48). The overall sleep quality of physicians in the month prior to conducting this study was as follows: 43.5% (27) reported fairly good sleep quality, 29.0% (18) reported fairly bad sleep quality, 14.5% (9) reported a very bad sleep quality, while 12.9% (8) reported a very good sleep during the last month.

The different factors contributing to poor sleep quality are summarized in Table 2. A significant correlation was observed between gender and sleep quality, as 54.2% (26) of females reported poor sleep quality [Crude OR 4.33 (1.072, 17.523)  $P=0.04$ ], compared to 45.8% (22) of males. Another significant correlation was found between doctors' ranks and sleep quality, as 62.55% (30) junior residents had poor sleep quality (PSQI $>5$ ), [Crude OR 7.143 (1.37, 37.228),  $P=0.03$ ], followed by 31.3% (15) of senior residents [(Crude OR 12.5

**Table 1:** Self-reported sleep quality measures (PSQI)

Sleep Quality assessment	Mean± Standard Deviation
Pittsburg sleep quality index (PSQI) total score	8.31 ± 3.89
<b>Pittsburg sleep quality Index (PSQI) subscales</b>	
Sleep quality	1.48 ± 0.89
Sleep latency	1.40±0.98
Sleep duration	1.82±0.84
Habitual sleep efficiency	0.77±1.10
Sleep disturbance	1.32±0.70
Use of sleep medications	0.18±0.53
Daytime dysfunction	1.48±0.94

Data are displayed as mean and standard deviation

PSQI total scale range from 0 to 21; sub score range from 0 to 3

(1.60, 97.647)], while the least number of doctors with poor sleep quality (PSQI $>5$ ) were noted among chief residents 6.3% (3). Physicians in the medical specialty reported the highest number of poor sleep quality 25.0% (12), followed by the surgical specialty 16.7% (8). However, no statistical difference in sleep quality was observed between them ( $P>0.05$ ). Additionally, no significant correlation was found between sleep quality and age, number of calls per months and marital status (Table 2).

Most subjects 43.5% (27) experienced a higher normal daytime sleepiness, with ESS score 6-10. On the other hand, the lowest number of subjects 8.1% (5) had ESS scores 11-12 and 16-24. The mean ESS among the participants was 8.87 (SD=4.72, 95% CI: 7.67-10.10). No significant relationship was found between mean ESS and variable demographic factors ( $P>0.05$ ). Refer Table 3.

Regarding the sleep pattern among physicians, most of them 69.35% (43) slept after 11 pm and took 25-35 minutes to fall asleep 30.65% (19). Notable, only 35.48% (22) of them were observed to sleep for 6-8 hours every night. Furthermore, 30.6% (19)

**Table 2:** Factors associated with poor sleep quality

Characteristics	Sleep Quality		Univariate analysis	P value
	Poor (>5)	Good (≤5)	Crude Odd Ratio (OR)	
<b>Age</b>				
20-29	23 (47.9%)	4 (28.6%)	3.28 (0.64, 16.66)	0.348
30-39	18 (37.5%)	6 (42.9%)	1.71 (0.36, 7.97)	
≥40	7 (14.6%)	4 (28.6%)	1	
<b>Gender</b>				
Male	22 (45.8%)	11 (78.6%)	1	0.040*
Female	26 (54.2%)	3 (21.4%)	4.33 (1.07, 17.52)	
<b>Specialty</b>				
Anesthesia	1 (2.1%)	0	*	0.840
Cardiology	6 (12.5%)	1 (7.1%)	2.0 (0.09, 44.35)	
General Surgery	8 (16.7%)	6 (42.9%)	0.44 (0.04, 5.40)	
Medical	12 (25.0%)	2 (14.3%)	2.0(0.13, 30.16)	
Obstetrics and gynecology	4 (8.3%)	1 (7.1%)	1.33 (0.05, 31.12)	
Orthopedics	4 (8.3%)	3 (21.41%)	0.44 (0.03, 6.70)	
Pediatric	7 (14.6%)	0	*	
Plastic	3 (6.3%)	0	*	
Radiology	3 (6.3%)	1 (7.1%)	1	
<b>Rank</b>				
Chief	3 (6.3%)	5 (35.7%)	1	0.030*
Junior resident	30 (62.5%)	7 (50.0%)	7.14 (1.37, 37.23)	
Senior resident	15 (31.3%)	2 (14.3%)	12.5 (1.60, 97.65)	
<b>Number of on-calls</b>				
1-6	26 (54.2%)	9 (64.3%)	1	0.503
7-11	22 (45.8%)	5 (35.7%)	1.52 (0.44, 5.22)	
<b>Marital status</b>				
Single	21 (43.8%)	5 (35.7%)	1.4 (0.41, 4.80)	0.593
Married	27 (56.3%)	9 (64.3%)	1	
<b>Have children</b>				
No	29 (60.4%)	7 (50.0%)	1.6 (0.41, 6.80)	0.437
Yes	19 (39.6%)	7 (50.0%)	1	

\*p value<0.05: statically significant

doctors reported waking up in the middle of the night or early in the morning, once or twice a week during the last month. Based on the questionnaire responses, 20.9% (13) doctors had difficulty feeling enthusiastic while doing their work for three or more times per week, compared to 14 doctors who

did not face any difficulty feeling enthusiastic while doing their work during the last month. Moreover, most doctors 91.9% (57) did not use medication to aid them to sleep during the last month, while 8% (5) doctors used medications less than three times a week to help them sleep during the last month.

**Table 3:** Association with mean ESS score and different factors

	Number	Mean	Standard Deviation (SD)	P value
<b>Age</b>				
<30	27	9.74	4.94	0.100
30-39	24	9.33	3.92	
40-49	10	5.90	5.07	
>=50	1	4.00	.	
<b>Gender</b>				
Male	33	8.27	4.76	0.291
Female	29	9.55	4.65	
<b>Specialty</b>				
Anesthesia	1	7	.	0.067
Cardiology	7	11.14	4.49	
General surgery	14	10.79	4.54	
Medical	14	7.57	5.12	
Obstetrics and gynecology	5	7.2	4.97	
Orthopedics	7	4.71	3.73	
Pediatric	7	9.86	3.34	
Plastic	3	7	1	
Radiology	4	12.25	4.57	
<b>Position</b>				
Chief	8	6.50	4.00	0.159
Junior resident	37	9.73	4.37	
Senior resident	17	8.12	5.45	
<b>Marital status</b>				
Single	26	9.62	4.67	0.295
Married	36	8.33	4.74	
<b>Have a child</b>				
Yes	26	7.50	4.28	0.051
No	36	9.86	4.82	
<b>Number of on-calls</b>				
1-6	35	9.20	5.03	0.536
7-11	27	8.44	4.33	

\*p value<0.05 considered as statistically significant.

## Discussion

Our study investigated the sleep quality and daytime sleepiness among physicians who have on-call duties. The main findings of this study showed that doctors with on call duties had a high prevalence rate of poor sleep quality reaching up to 77.4%, which was defined by PSQI score >5 while only 43.5% (27) reported fairly bad or very bad sleep quality.

The difference between the two figures (77.4% vs 43.5%) indicates the difference between the subjective and objective estimation of sleep quality and this may be due to the doctors being habituated to chronic sleep disturbance for many years, or may be attributed to recall bias that may have played a role in underestimating or overestimating the true picture.

Being unaware of having poor sleep quality is a serious problem that might prevent physicians from taking further action to develop new coping mechanisms to maintain healthy sleeping habits.<sup>14</sup> In addition, female doctors had a higher score of poor sleep quality in comparison to males [54.2% (26), 45.8% (22) respectively]. This is consistent with previous studies,<sup>15</sup> and might be related to the different physiological periods that females are exposed to, such as menstruation and pregnancy.<sup>8</sup> Additionally, previous studies noted that females tend to have more sleep related complaints in general.<sup>8,16</sup>

The findings of the present study reveal that the sleeping pattern is significantly worse among junior residents, followed by senior residents and chief residents respectively, as 62.55% (30) of junior residents scored >5 in the PSQI scale. This can be explained by the workload that junior residents encounter, especially since they are the first group to deal with emergency cases and previously admitted sick patients as well. Moreover, junior residents have more frequent on-call duties and they may have still not developed effective coping mechanisms. Our results also showed that the highest number of physicians with poor sleep quality hailed from the medical department 25.0% (12), and this might be due to the frequent sleep interruptions by the significant number of admitted patients who need frequent monitoring and adjustments in drug doses.

In line with other studies, our findings showed that 33.97% (21) of our participants scored ESS >10 and 8.1% (5) of them had excessive severe daytime sleepiness. Although the figure of 8.1% (5) is relatively small, the severe daytime sleepiness may be associated with underlying medical conditions such as obstructive sleep apnea, urological problems, migraine and other systemic diseases that need further investigation.<sup>17</sup> Furthermore, excessive daytime sleepiness can be explained due to frequent sleep fragmentation during the night, especially when the physician is on an on-call shift and needs to be up all night and available for patient care.

Numerous studies have concluded that insufficient amount of sleep leads to a reduction in daytime alertness and performance, putting patients at risk of medical errors and injuries.<sup>9,18,19</sup> Unfortunately, sleep

loss also places the doctors' health at risk of various diseases including functional gastrointestinal disorder.<sup>14</sup> Sleep loss also puts a doctors' life at risk as it is well established that sleep deprivation is a leading risk factor for motor vehicle accidents. A study done on 2737 interns showed that extended shifts each month increase the risk of car accidents while driving back home by 16.2%.<sup>20</sup> Although in this study, the number of calls was not significantly associated with excessive daytime sleepiness, frequent on-call duties and poor sleep quality and quantity have been noted to have a negative impact on a person's social and personal life,<sup>10,21</sup> and have been associated with depressive symptoms.<sup>22</sup>

Some limitations in the present study must be acknowledged. Our findings are based on a cross sectional study which cannot demonstrate a definitive causal relationship between the findings. Our results are limited by the small number of doctors that had been recruited in this study, as explained. Also, as the questionnaires used were self-reported, bias affecting the accuracy of the answers cannot be excluded. Moreover, as mentioned earlier, recall bias may have existed and reported answers might depend on the mood of the participant on the day of answering the questionnaires.

## Conclusion

In summary, many BDF doctors with on-call duties reported poor sleep quality. Poor sleep quality was mostly seen among females, junior residents, and doctors from the medical department. It is important to increase awareness of the importance of having healthy sleeping habits and reduce all unnecessary sources of sleep disturbance. Bigger studies are required to re-evaluate the sleep quality, with further reduction of the post call working hours in all departments. Also, comparing on-call duties with shift duties might aid us in estimating the most adequate sleeping patterns for our physicians.

## Conflict of Interests

The authors declare that there is no conflict of interest.

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