

# Impact of shift work on sleep and daytime performance among health care professionals

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## ABSTRACT

**الأهداف:** لتقدير جودة النوم وشدة النعاس أثناء النهار بين العاملين في مجال الرعاية الصحية الذين يؤدون العمل بنظام المناوبات.

**الطريقة:** أجريت هذه الدراسة المستعرضة في 510 شخصاً من العاملين في مجال الرعاية الصحية في مدينة الأمير سلطان الطبية العسكرية ومستشفى الملك خالد الجامعي في جامعة الملك سعود في الرياض ، المملكة العربية السعودية بين ديسمبر 2015 وأبريل 2016 . وقد تم جمع البيانات باستخدام مقياس بتسربن لجودة النوم (PSQI) و مقياس إبورث للنعاس (ESS) . وتم تقسيم المشاركون إلى مجموعتين، العاملين بنظام المناوبات والعاملين بالدوام في النهار.

**النتائج:** قارنا المجموعتين ومدى تأثير العمل بنظام المناوبات على الدرجة الكلية لمقياس بتسربن لجودة النوم (PSQI) و مقياس إبورث للنعاس (ESS) . كان هناك فارق ذو دلالة إحصائية بين المجموعتين. حيث وجدنا أن درجة مقياس بتسربن لجودة النوم (PSQI) و مقياس إبورث للنعاس (ESS) كانت أعلى في المجموعة التي كانت تعمل بنظام المناوبات، ( $p<0.001$ ) في (PSQI) و ( $p=0.003$ ) في (ESS) .

**الخاتمة:** بينت هذه الدراسة أن العاملين في مجال الرعاية الصحية والذين يؤدون العمل بنظام المناوبات يعانون من رداءة جودة النوم ولكنهم لا يعانون من زيادة النعاس في النهار. اضطرابات النوم ينبغي أن تدرس أكثر في هذه الفئة وقد تكون المقاييس المستخدمة غير مناسبة لهذا الغرض.

**Objectives:** To evaluate sleep quality and daytime sleepiness in health care professionals who are performing shift work.

**Methods:** This cross-sectional study was conducted on 510 health care professionals at Prince Sultan Military Medical City and King Khalid University Hospital, King Saud University, Riyadh, Kingdom of Saudi Arabia between December 2015 and April 2016. Data were collected using the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness

Scale (ESS). Participants were divided into 2 groups: shift workers and non-shift workers.

**Results:** We compared both groups regarding the effect of shift work on the total score of PSQI and ESS. We found that the PSQI global score ( $p<0.001$ ) and the total ESS score ( $p=0.003$ ) were significantly higher in shift work health care professionals.

**Conclusion:** Shift work among health care professionals is associated with poor sleep quality but not excessive daytime sleepiness. Health care professionals performing shift work have PSQI and ESS scores slightly higher than non-shift work health professionals.

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Shift work is a common term in sleep medicine, but it lacks an accurate definition. Shift work has been broadly described as working hours involving 2 or more teams, which differ in starting and ending times of their work.<sup>1</sup> In health care professionals, shift work is defined as a recurring and alternating periods (shifts) in which an individual (worker) or multiple individuals (workers) work at different times to cover 24 hours. In our study, we also define shift work as any time outside the regular

working hours; the daily work in Saudi Arabia is from 7:30 a.m. to 4:30 p.m. Each specialty in health care have their own monthly working schedule (Rota) in which their staff are listed at different times per day/week to cover the whole service, so they alternate to cover a certain specialty. In Saudi Arabia, nurses for example work 2 alternating shifts, some nurses work day-shift from 7 a.m. to 7 p.m. and then the other nurses work a night-shift from 7 p.m. to 7 a.m. Physicians work the regular daily work and they also cover a 24 hours on-call shift at certain days ranging from 7 to 10 days per month. Emergency physician work 8 hours shift at 3 different times per day and they rotate accordingly. In our study, we included all these specialties and to differentiate shift workers from non-shift workers, we relied on participants' response if whether they do shifts in their daily work or not.

Shift work is an essential part of most specialties in health care. Health care professionals such as physicians, nurses, and technicians perform 2 to 3 different daily shifts as a part-time or a full-time job. They usually work different shifts as teams, which alternate to do a specific job. The teams can alternate in different working periods between early mornings, afternoons, and night shifts or they may work a permanent shift.<sup>2</sup> Shift work is a well-known factor that disrupts nighttime sleep and causes insomnia and affects daytime functioning by causing excessive daytime sleepiness and fatigue.<sup>2</sup> In addition, a recent study found that shift workers have shorter sleep duration and poor sleep quality, especially night shift workers.<sup>3</sup> The internal regulation of sleep takes place in the brain and regulated by the suprachiasmatic nuclei (SCN) which is located in the hypothalamus. Suprachiasmatic nuclei, which is also known as the circadian pacemaker; along with peripheral oscillators, regulates all circadian rhythms in the body. The circadian process reflects this activity and acts to regulate sleep/wake timing. Night shift work displaces sleep to the daytime and work to the night, which disrupts the internal regulation of sleep.<sup>2</sup>

Excessive daytime sleepiness (EDS) is defined as being sleepy when one is not expected to be sleepy. Shift work causes subjective daytime sleepiness and

interferes with daytime performance.<sup>2,4</sup> Several studies have reported that shift work causes significant sleep disturbances associated with EDS. Shift workers are more likely to have insomnia, poor sleep quality and are more likely to have EDS.<sup>4-8</sup> A number of reviews on shift work and the sleep/wake patterns have concluded that night shifts after midnight and early-morning shifts are associated with disturbances in the sleep/wake pattern causing poor sleep quality during and outside the shifts.<sup>6,7,9</sup> Poor sleep quality and excessive daytime sleepiness can interfere with a health care professional's performance causing more medical errors.<sup>2</sup> Studies have shown that night shift nurses have an increased risk of insomnia.<sup>10,11</sup> In addition, nurses sleep longer when they are on their day off, but they have shorter sleep duration when working a shift.<sup>10,11</sup> Nurses working mixed or permanent night shifts have low sleep quality.<sup>11</sup> Recent studies found that 70% of 3-shift working nurses often complain of EDS and fatigue.<sup>12,13</sup> Similarly, almost two-thirds of critical care nurses reported struggling to stay awake during a shift.<sup>14</sup> In New Zealand, an online survey on 3273 nurses aged 50 years and older regarding their experience with shift work; they found that shift work is associated with EDS and poor sleep quality.<sup>15</sup> Studies have also looked at doctors on shift work and its effect on sleep and daytime functioning. Due to the nature of physician duties (24 hour shift), most of these studies looked mainly at long duties and the direct or accumulated effects on sleep. Barger et al<sup>16</sup> found that long duties caused sleep deprivation in residents and interns and were associated with EDS and medical errors. In addition, a study by Belayachi et al<sup>17</sup> assessed sleepiness in a group of physicians training in emergency medicine using ESS and found that nearly two-thirds of them suffered from EDS. In Riyadh, Saudi Arabia, Wali et al<sup>18</sup> found that sleep disorders are common among health workers. In a recent published study in the Saudi Medical Journal, Alosaimi et al<sup>19</sup> studied residents in training programs. They found that residents who usually perform on-call duties have sleep deprivation.

The purpose of this study is to evaluate sleep quality and daytime sleepiness using standard questionnaires in health care professionals who are performing shift work as a part of their job.

**Methods.** We investigated the effects of shift work on sleep quality and daytime functioning in a group of health care professionals from different specialties. The study included workers who work fixed daily shifts from 7:30 a.m. to 4:30 p.m. and workers who work

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one, 2, or 3 shifts as well as those who work 24-hour shifts outside working hours. We divided them into 2 major groups shift workers and non-shift workers. Those who only work fixed daily shifts, from 7:30 a.m. to 4:30 p.m., were identified as non-shift workers and shift workers are identified as those who work night shifts or alternating day/night shifts or who cover 24 hours shifts.

We included health care professionals who are licensed and working in tertiary hospitals in Riyadh, the capital of Saudi Arabia. Prospective candidates were invited using an internal e-mail system announcement. Non-health care workers were excluded from the study. We compared the health care professionals who are working shifts to those who do not, and we compared sleep quality and daytime sleepiness. Consent was obtained from all participants and Institutional Review Board ethical approval was granted before data collection commenced. In addition to completing the questionnaires, subjects were asked to provide demographic information. Overall, 510 health care workers volunteered to participate in the study and were then divided into 2 groups: shift workers (n=351) and non-shift workers (n=159) (Table 1).

The Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS) were distributed to health care professionals by email and by direct hard copy distribution. The PSQI is a self-rated questionnaire that assesses sleep quality and disturbances over a 1-month time interval.<sup>20</sup> The ESS is a self-administered questionnaire with 8 items that provide measurements of daytime sleepiness.<sup>21</sup>

**Statistical analysis.** Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 21.0 software<sup>22</sup> to analyze the PSQI and ESS data. We calculated the minimum, maximum, median, mean and standard deviation for numerical variables (measurable variables). We calculated the frequencies and percentages for nominal variables. We used t-tests and *p*-values to compare these 2 independent groups with respect to numerical variables (age, weight and height).

**Results.** A total of 510 health care professionals completed the questionnaires. The study participants included 248 (48.7%) females with a median age of 32.7 years and 262 (51.3%) males with a median age of 33.8. The participants were divided into 2 groups: shift workers and non-shift workers according to their responses in the questionnaire. There were 351 (68.8%) shift workers (173 females and 178 males) and 159 (31.2%) non-shift workers (75 females and 84 males). There were

no significant differences between groups with respect to gender, age, body weight, height, and body mass index (Table 1). The participants represented various health care professionals such as nurses, physicians, and technicians working in different specialties. Not surprisingly, most health care workers in the intensive care and emergency units work more shifts than other specialties. Table 1 shows the demographic information and the nature of work for all participants. The PSQI global score was high in both groups; however, it was significantly higher in the shift work group (*p*=0.001). Table 2 shows the difference of PSQI scores between groups. Table 3 shows the difference of ESS scores between shift workers and non-shift workers. The total mean score of ESS in the shift work group is 8.5, which considered normal sleepiness. When compared to the non-shift work group (7.13), it was significantly higher (*p*=0.003); however, this does not indicate clinically significant sleepiness.

**Discussion.** The results identified how shift work affected the sleep quality and daytime functioning of health care professionals. Our primary aim was to examine sleep quality and daytime sleepiness using standard questionnaires in health care professionals who are performing shift work as a part of their job. We found that approximately 70% of health care professionals perform shift work as a part of their job among those who were surveyed in tertiary hospitals in Riyadh, Saudi Arabia. In addition, we found that shift work in health care professionals is an important cause of significant sleep disturbances, and health care professionals who perform shift work are sleepier during the daytime.

Shift work is an important factor that interferes with sleep and daytime functioning. In our study, the PSQI score was elevated in both groups but higher in shift workers (*p*=0.001). All parameters were elevated in shift workers compared to non-shift workers. Some of these parameters were slightly higher like having long sleep latency, short sleep duration, and the use of sleeping medications. In the past month, 29.8% of health care shift workers take 31-60 minutes to fall asleep, and 24% take more than one hour, which indicates long sleep latency. Health care shift workers reported that they sleep less than 5 hours (18.8%) and 5-6 hours in (26.9%), which indicates short sleep duration; 7.4% use sleeping medications at least once a week for the past month. In addition, the sleep disturbance parameter is significantly higher in shift-worker groups (*p*<0.0001). These findings explain why PSQI is higher in shift workers and suggests that shift workers have worse sleep

**Table 1** - Demographic information of shift work and non-shift work health care professionals.

Demographic information	Total (N=510)	Shift workers (N=351)	Non-shift workers (N=159)
<b>Gender</b>			
<b>Male</b>	n=262 (51.3)	n=178 (68)	n=84 (32.0)
Age range	22-65		
Mean±SD		33.8 ± 9.68	33.0 ± 8.27
<b>Female</b>	n=248 (48.7)	n=173 (69.8)	n=75 (30.2)
Age range	22-59		
Mean±SD		32.7 ± 7.009	31.6 ± 8.246
Weight (Kg) (mean±SD)		73.8 ± 18.01	71.2 ± 16.93
Height (cm) (mean±SD)		166.2 ± 12.03	165.7 ± 9.83
Body mass index (mean±SD)		26.7 ± 5.8	25.9 ± 5.4
<b>Nature of job</b>			
Nurses	205 (40.3)	152 (43.3)	53 (33.5)
Physicians	256 (50.3)	172 (49.0)	84 (53.2)
Technicians	36 (7.1)	24 (6.8)	12 (7.6)
Others	12 (2.4)	3 (0.9)	9 (5.7)
<b>Specialty</b>			
Internal medicine	43 (8.4)	31 (8.8)	12 (7.5)
Surgery	56 (11.0)	29 (8.3)	27 (17.0)
Pediatrics	45 (8.8)	31 (8.8)	14 (8.8)
Obstetrics and gynecology	10 (2.0)	7 (2.0)	3 (1.9)
Emergency	167 (32.7)	159 (45.3)	8 (5.1)
Oncology	1 (0.2)	1 (0.3)	0 (0)
Orthopedic	8 (1.6)	6 (1.7)	2 (1.3)
Primary Health Care	14 (2.7)	3 (0.9)	11 (6.9)
Radiology	13 (2.5)	4 (1.1)	9 (5.7)
ICU - CCU -NICU	63 (12.4)	52 (14.8)	11 (6.9)
Psychiatry	41 (8.0)	13 (3.7)	28 (17.6)
Anesthesia	5 (1.0)	5 (1.4)	0 (0)
Dermatology	1 (0.2)	0 (0)	1 (0.6)
Ear, Nose, and Throat	7 (1.4)	3 (0.9)	4 (2.5)
Ophthalmology	2 (0.4)	0 (0)	2 (1.3)
Dentistry	4 (0.8)	0 (0)	4 (2.5)
Laboratory	6 (1.2)	2 (0.6)	4 (2.5)
Others	24 (4.7)	5 (1.4)	19 (11.9)

Values are number and percentage (%), ICU - intensive care unit, CCU -coronary care unit,  
NICU - neonatal intensive care unit

quality. The elevated PSQI scores in this group may indicate the presence of sleep disorders.

One would assume that the PSQI score should be normal ( $\leq 5$ ) in the non-shift work group; however, the average PSQI global score was 6.271 in non-shift workers. This finding could be because non-shift workers might also have sleep disorders. Another possible explanation is that this group might have prior exposure to shift work, which could be creating their

current sleep problems.<sup>23</sup> This finding is supported by the fact that health care non-shift workers sleep less than 5 hours (11.9%) and 5-6 hours in (24.5%) per night; 3.1% of this group reported using a sleeping medication. We also found that 27.7% of non-shift workers take 31-60 minutes to fall sleep, and 19.5% take more than one hour.

These findings may indicate that sleep disorders are common in health care professionals. They confirm Wali et al<sup>18</sup> who investigated sleep in 163 health care

**Table 2** - Pittsburg Sleep Quality Index (PSQI) score for shift workers and non-shift workers.

Parameters	Shift worker (n=351) Mean ± SD	Non-shift worker (n=159) Mean ± SD	P-value
Subjective sleep quality	1.21 ± 0.735	1.02 ± 0.716	0.008
Sleep latency	1.61 ± 1.024	1.42 ± 1.069	0.048
Sleep duration	1.51 ± 0.946	1.34 ± 0.864	0.053
Habitual sleep efficiency	0.579 ± 0.973	0.497 ± 0.885	0.369
Sleep disturbances	1.17 ± 0.536	0.86 ± 0.604	<0.0001
Use of sleeping medications	0.32 ± 0.778	0.21 ± 0.669	0.129
Daytime dysfunction	1.06 ± 0.785	0.91 ± 0.852	0.064
PSQI global score	7.409 ± 3.406	6.271 ± 3.374	0.001

employees in Saudi Arabia and found that sleep disorders are common but unrecognized in health care workers. Our results also support Alosaimi et al<sup>19</sup> who investigated sleep duration for 938 residents in Saudi Arabia and found that almost two-thirds of the participants sleep less than 6 hours but do not feel refreshed after sleep. One could argue that long sleep latency, short sleep duration, and use of sleeping medications are not the only factors that contribute to poor sleep quality in health care workers. It could also result from circadian misalignment and conflict between commitments to sleep, work, and one's social life.

Both groups had ESS scores indicative of normal daytime sleepiness. The total mean score of ESS in the shift work group was (8.5), which is considered normal sleepiness; an ESS score of ≥10 represents excessive daytime sleepiness (EDS).<sup>21,24,25</sup> When compared to the non-shift work group (7.13), it was significantly higher ( $p=0.003$ ); however, this does not indicate clinically significant sleepiness. This finding could be explained by assuming that shift workers may take naps between their shifts or they might drink caffeinated beverages during their shifts. In addition, health care institutes in Saudi Arabia follow the international standards for working hours of the health care workers, which may explain why their work shifts are within these standards to prevent excessive or long work duties, which may lead to EDS and medical errors.<sup>26</sup> The ESS is rarely used to assess sleepiness in shift workers, and it is not as standard as the Multiple Sleep Latency Test (MSLT) to measure sleepiness in this population.<sup>2</sup>

**Study limitations.** The first limitation is that our study reflects a short period of shift work, and it does not reflect a longitudinal period. The second limitation

**Table 3** - Epworth Sleepiness Scale (ESS) score for shift workers and non-shift workers.

Situation	Shift worker (n=351) Mean ± SD	Non-shift worker (n=159) Mean ± SD	P-value
Sitting and reading	1.27 ± 0.949	0.99 ± 0.834	0.001
Watching television	1.2 ± 0.941	0.9 ± 0.828	<0.0001
Sitting, inactive in a public place	0.76 ± 0.818	0.7 ± 0.898	0.460
As a passenger in a car for an hour without a break	1.18 ± 1.027	0.97 ± 0.984	0.032
Lying down to rest in the afternoon when circumstances permit	1.7 ± 0.955	1.52 ± 1.036	0.053
Sitting and talking to someone	0.37 ± 0.676	0.31 ± 0.628	0.353
Sitting quietly after a lunch	1.42 ± 0.979	1.18 ± 0.973	0.013
In a car, while stopped for a few minutes in the traffic	0.59 ± 0.847	0.56 ± 0.760	0.702
Total ESS Score	8.5 ± 4.771	7.13 ± 4.458	0.003

is that we did not specify the time, length, and frequency of shifts. These are indicators of the impact of shift work. The third limitation is that there is no clear definition of shift work in health care professionals; however, we tried to define it as a recurring period (shift) in which an individual (worker) works at different times to cover a 24-hour period, but this definition may not be accurate. The fourth limitation is that our study may not be representative of all healthcare professionals in regard to sleep quality and daytime performance. The fifth limitation is that we did not ask about naps and caffeine intake in shift workers, this might have affected our study and result in particular daytime sleepiness. The sixth and last limitation is that PSQI and ESS may not be the best tools to study sleep quality and daytime sleepiness in health care professionals performing shift work. Another important limitation is that the data may not be reflective of all health workers in Saudi Arabia because the response rate and bias could not be determined.

In conclusion, shift work in health care professionals is associated with poor sleep quality and excessive daytime sleepiness. Health care professionals need more education regarding getting adequate sleep and insuring healthy sleep habits. Health care professionals who perform shift work have a higher PSQI score than non-shift workers, which indicates that sleep disorders are more common in this population. Health care professionals should receive consultations with a sleep

specialist when they experience sleep disturbances and/or excessive daytime sleepiness, which interferes with their daily work. These results indicate that sleep disorders should be studied in more detail in this population.

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