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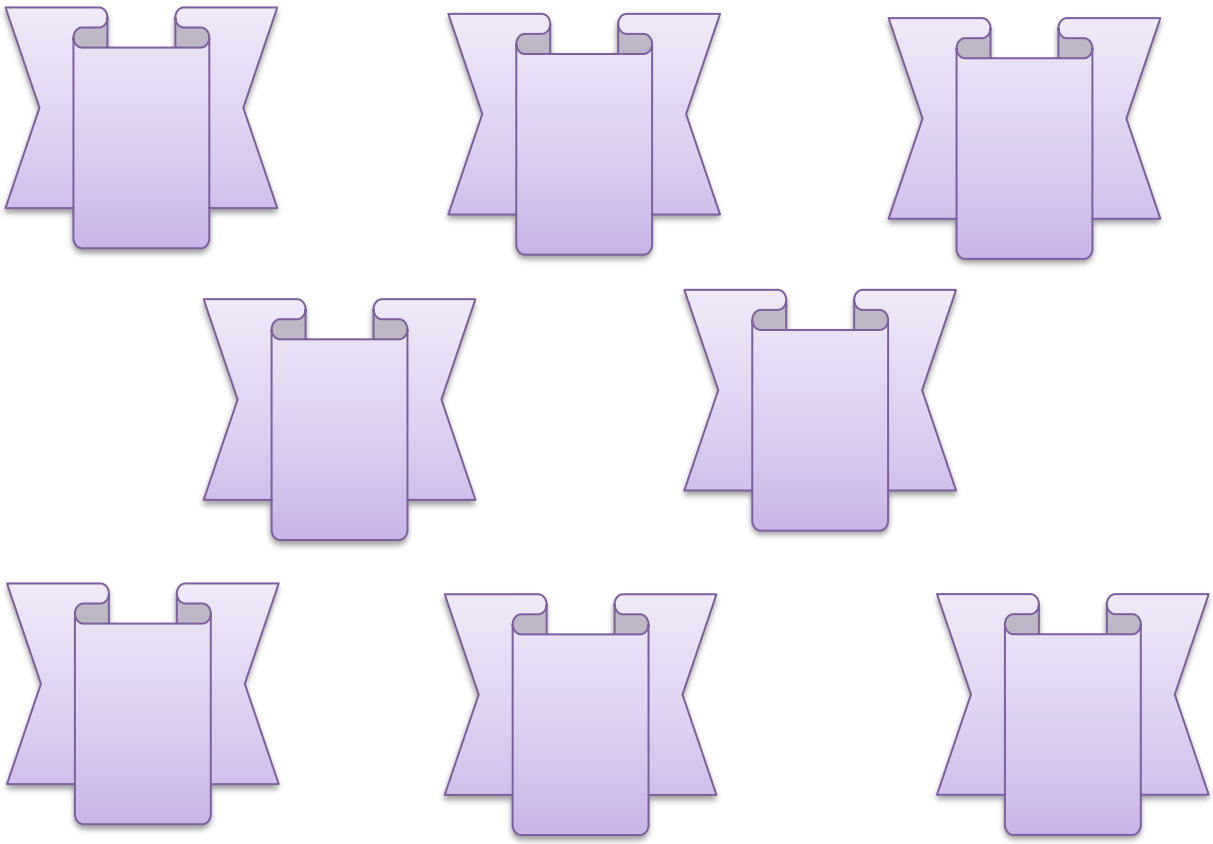

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Original Article

Occupational Risk Factors of Sleep Disorders among Resident Physicians in Al-Azhar University Hospitals in Cairo "Descriptive Analytical Cross-Sectional Study"

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ABSTRACT

Background: Sleep disorders and fatigue have significant effects on patient safety in various ways as physicians and nurses are always in need of a good vigilance level, sound judgment, and quick response and reaction time, especially in emergency situations. Attention, memory, or coordination level decrease may affect performance and lead to adverse events.

Aim of the work: To find out the proportion of daytime sleepiness in resident physicians and to identify the risk factors of developing sleep disorders among them at Al-Azhar university hospitals for men in Cairo.

Subjects and Methods: The study included 391 resident physicians at Al-Houssine and Sayed Galal hospitals where the examined resident physicians were classified into two groups: Juniors' group: defined as resident physicians who are working up to two years and seniors' group: defined as resident physicians who are working more than two years. A descriptive analytical cross-sectional study was conducted.

Results: According to the Epworth sleepiness scale, 82.31% of junior resident and 17.53 % of senior resident physicians have a sleep disorder. Seniors were had a sleep disorder less than juniors in departments of anesthesia [22.22%], Orthopedic [37.50%], Gynecology [40.00%], General Surgery [16.67%] and urology [33.33%]. The highest departments of sleep disorders in juniors were anesthesia [96.30%], Gynecology [95.45%], General Surgery [95.00%] and Orthopedic [93.33%], while the lowest departments were Ear, Nose and Throat department [44.44%]. The highest department of sleep disorders in seniors was Cosmetic, Pediatric, Neurosurgery and Neurology as seniors had sleep disorder by percent of 50%.

Conclusion: According to the Epworth sleepiness scale, 82.31% of junior resident physicians had a sleep disorder, there were 17.53 % of senior resident physicians had a sleep disorder.

Keywords: Sleep Disorders; Residents; Physicians; Al-Azhar.

INTRODUCTION

Sleeping is defined as a reversible un-consciousness state at which the brain has less degree of response to external stimuli. The difference between sleeping and un-consciousness is that sleeping is characterized by a cycle of sleep phases with physiological changes and specific Electro-encephalograph patterns [1].

There is no doubt that the sleep loss and fatigue problems are of a large impact on the professional and personal lives of healthcare professionals and of their patients. Healthcare delivery in hospitals is supposed to operate 24 hours a day; seven days a week. That is why management, as well as the elimination of fatigue if and whenever it possible to achieve that, should be the driving concept. Alertness management strategies should be reported by the increasing research and policy experience from other occupational settings. However, because of the major differences in the nature of the tasks of medical personnel, and that they are required to keep focused in the course of their daily work, the strategies of fatigue managing that have proved to be successful in other occupational settings may not be similarly applicable to the medical field [2].

Fatigue and sleepiness are significant problems that affect patients' safety in several ways as physicians and nurses need good vigilance, attention, comprehensive judgment, and quick reaction and response time, especially in emergency situations. For example, when a physician is required to evaluate an electro-cardiogram or monitor a patient during general anesthesia, a decrease in attention, memory, or coordination is expected to affect his/her performance and lead to adverse events [3].

Although the Accreditation Council for Graduate Medical Education [ACGME] has lately imposed limitations on the work hours of residents attempting to reduce fatigue and sleep disorders related medical errors, residents working for more than 24 hours remain the cornerstone of American postgraduate medical education. Additionally, a report published in 1999 from the Institute of Medicine proved that between 48,000 and 98,000 deaths each year occur as a result of medical errors [4].

The impact of sleep deprivation on motor task performance is not only important in the work place, but also in daily life outside work. There is clear evidence that physicians driving after long shifts, and particularly after night shifts, have an increased risk of accidents [5, 6].

Numerous articles and editorials in leading medical journals focused on the matter of junior doctors' long work hours. This large magnitude of focus is related to attempts to reduce sleepiness and fatigue among junior doctors by replacing traditional extended duties with shift work and limiting working hours as well as reducing on-call cover. Since 2002, physicians working in the European Union Member States became subjected to the provisions of the European Working Time Directive that limited shift durations to 13 hours, followed by a break of at least 11 hours [3].

AIM OF THE WORK

To find out the proportion of daytime sleepiness in resident physicians and to identify the risk factors of developing sleep disorders among them at Al-Azhar university hospitals for men in Cairo

PATIENTS AND METHODS

The present study included three hundred ninety-one resident physicians [all resident physicians] at Al-Houssine and Sayed Galal hospitals. The examined resident physicians were classified into two groups: The juniors' group: defined as resident physicians who are working up to two years, while senior group: defined as resident physicians who are working more than two years.

The study was conducted at Al-Houssine and Sayed Galal university hospitals of Al-Azhar University in Cairo. All departments of both hospitals were included in the present study. The study was conducted in the period from the first June 2021 till the end of May 2022.

Research tools: Interview sheet including personal data in the form of age, sex**,** marital status, residence, special habits, department, position [junior or senior] and worked hours/week, then the examined resident physicians were subjected to a questionnaire was modified to assess the sleep disorders risk factors among resident physicians. Another questionnaire was interviewing sheet to assess sleep disorders through the Epworth sleepiness

scale [E.S.S] [6]. Epworth sleepiness scale [E.S.S] is a daytime sleepiness scale, in which the subject is asked to rank the likelihood of falling asleep in 8 various scenarios. There are four possible answers, from 0 [never doze] to 3 [high chance of dozing]. A score of 24 is the maximum possible; higher scores indicate more severe tiredness. Scores > 10 are indicators of oversleeping [table 1].

Table [1]: Epworth sleepiness scale [E.S.S] [6]

[Epworth sleepiness scale]	Chance of dozing [0-3]			
	Would never doze	Slight chance	Moderate chance	High chance
Sitting and reading	0	1	2	3
Watching television	0	1	2	3
Sitting inactive in public place as meeting	0	1	2	3
As passenger in a car for an hour without break	0	1	2	3
Lying down to rest in the afternoon	0	1	2	3
Sitting and taking to some one	0	1	2	3
Sitting quietly after lunch	0	1	2	3
In a car while stopped in traffic	0	1	2	3
Total score				

The interview includes all residents. Every participant was subjected to the selected interview sheets. The researcher arranged with the residents to interview them at a suitable place and time. All departments and all residents of Al-Houssine and Sayed Galal Al-Azhar university hospitals were included in the present study. Every interview lasted for about 15 min.

Sample size: Sample size of the present study was calculated using Power Analysis in line with the Sample Size software program [PASS] version 11.0.4 for windows [2011]. A sample size of 391 patients needed to achieve 80% power to detect 0.3 differences between the alternative hypothesis and the null hypothesis is set to 0.5 using a two-sided hypothesis test with a significance level of 0.05.

Statistical analysis: Data analysis has been conducted by using the Statistical Program for Social Science [SPSS] version 24. Quantitative data was expressed as mean± standard deviation [SD]. The study used independent-samples t-test of significance when comparing two means, while Fisher-Freeman-Halton test was used when comparing two means [for abnormally distributed data], on the other hand, when comparing non-parametric data and probability [P-value], Chi-square test was used: P-value < 0.05 was considered significant

RESULTS

Table [2] shows that the range of age was 24-28 years among juniors while it was from 26-30 years among seniors. According to the average number of working hours per week among [juniors], it was between 54-96 h with mean ± SD = 77.126 ± 15.284 h while among seniors, it was between 30-50 h with mean ± SD = 39.385 ± 9.935. Regarding marital status, 60 juniors out of 294 [20.4%] were married while 60 seniors out of 97 [61.86%] were married [P value <0.001]. Regarding residence, there was no statistically significant difference between both groups [P value = 0.077].

Table [3] shows stepwise regression analysis of the most common risk factors of fatigue among the Junior and Seniors residents being studied. Factors was included as follows: [6 or more consecutive night shifts of 8 h], [absence of quality of sleep], [continuous hours of wakefulness more than 19 h], [working between 12 am and 6 am], [5 or more consecutive night shifts of 10 h], [less than 2 consecutive days off per week] and [shift exchanged without monument approval]. There was a statistically significance differences between both groups.

Juniors in most departments were having a sleep disorder by a high percentage as in Anesthesia [96.30%], Orthopedic [93.33%], Gynecology [95.45%] and General Surgery [95.00%], while in seniors, the percentage are less than that [p values are significant] and the lowest percentage was in departments of Ear, Nose and Throat [table 4].

All resident physicians were subjected to questions about the risk factors of fatigue which

they might expose. It was noted that there was higher proportion of the prevalence of all risk factors among juniors than seniors with statistical significance difference between both groups in all risk factors [table 5].

Regarding marital status in juniors in relation to fatigue, 45 married residents out of 60 [75 %] were fatigued, while in single residents, there were 145 out of 234 [61.97 %] had knowledge about fatigue [P = 0.403]. Regarding residence in juniors, there was no statistically significant difference in P value = 0.339. Regarding smoking in juniors, there was no statistically significant difference [Table 6].

Table [2]: General characteristics of studied physicians

General characteristics		Subjects		Test	P-value
		Juniors [n=294]	Seniors [n=97]		
Age	Range Mean ± SD	24-28 25.54±0.454	26-30 28.11±1.870	**t=21.7**	**<0.001***
Work hours/week **Normal=40 h/w**	Range Mean± SD	54-96 77.126±15.284	30-50 39.385±9.935	**t =-22.77**	**<0.001***
Marital status	Married Single	60 [20.41%] 234 [79.59%]	60 [61.86%] 3 7 [38.14%]	**X^2 =56.91**	**<0.001***
Residence	Urban Rural	90 [30.61%] 204 [69.38%]	20 [20.62 %] 77 [79.38%]	**X^2 =3.1**	0.077

Table [3]: Stepwise regression analysis of the most common risk factors of fatigue between junior and senior residents

Risk factors	B-coefficient	F-test	P-value
6 or more consecutive night shifts of 8 hours	0.008	3.1	**0.01***
Absence of quality of sleep	0.003	2.9	**0.01***
Continuous wakefulness more than 19 hours	0.002	2.8	**0.01***
Working between 12 am and 6 am	0.005	0.9	**0.03***
5 or more consecutive night shifts of 10 hours	0.002	1.1	**0.02***
Less than 2 consecutive days off per week	0.006	0.9	**0.02***
Shift exchanged without monument approval	0.001	0.7	**0.04***

Table [4]: The distribution of departments of hospitals and the relation of departments to the E.S.S

Departments	Juniors [n=294]	Sleep problems		Seniors [n=97]	Sleep problems		Chi-square	
	No.	No.	%	No.	No.	%	X^2	P-value
Anesthesia	27	26	[96.30]	9	2	[22.22]	21.429	**0.000***
Gynecology	22	21	[95.45]	8	3	[37.50]	12.315	**0.000***
Orthopedic	15	14	[93.33]	5	2	[40.00]	6.667	**0.010***
General surgery	20	19	[95.00]	6	1	[16.67]	15.954	**0.000***
Cosmetic Surgery	7	6	[85.71]	2	1	[50.00]	1.148	0.284
Pediatric surgery	9	8	[88.89]	2	1	[50.00]	1.664	0.197
Neurosurgery	7	6	[85.71]	2	1	[50.00]	1.148	0.284
Vascular surgery	10	9	[90.00]	4	1	[25.00]	5.915	**0.015***
Urology	16	15	[93.75]	3	1	[33.33]	6.935	**0.008***
Oncology	10	9	[90.00]	3	1	[33.33]	4.174	**0.041***
Cardiology	22	19	[86.36]	5	1	[20.00]	9.343	**0.002***
Chest	10	9	[90.00]	4	1	25.00]	5.915	**0.015***
Neurology	6	5	[83.33]	2	1	[50.00]	0.889	0.346
Tropical	15	13	[86.67]	5	0	[00.00]	12.381	**0.000***
Internal medicine	21	19	[90.48]	8	0	[00.00]	20.990	**0.000***
Pediatric	19	17	[89.47]	9	0	[00.00]	20.498	**0.000***
Ear, Nose and Throat	9	4	[44.44]	3	0	[00.00]	2.000	0.157
Ophthalmology	13	7	[53.85]	5	0	[00.00]	4.406	**0.036**
Clinical pathology	14	8	[57.14]	4	0	[00.00]	4.114	**0.043***
Radiology	5	3	[60.00]	5	0	[00.00]	4.286	**0.038***
Dermatology	7	5	[71.43]	3	0	[00.00]	4.286	**0.038***

Table [5]: Risk factors of fatigue among the juniors and seniors under study

Risk factors	Junior N=294		Senior N=97		Chi-square	
	No.	%	No.	%	X^2	P-value
Total hours of shift exceeding 14-16 hrs.	210	71.43	27	27.84	20.293	**0.000***
Continuous a wakefulness exceeding 19 hrs.	260	88.45	12	12.37	57.740	**0.000***
Working between 12 am and 6 am.	255	86.74	13	13.40	142.719	**0.000***
Less than six hours of continues sleep in 24 hrs.	230	78.23	22	22.68	0.543	0.461
Rest time <8 hrs./24 hours	210	80.27	27	27.84	131.218	**0.000***
Continuous work beyond 64 hours in seven-days.	212	72.11	25	25.77	118.876	**0.000***
Less than two consecutive nights of good sleep	210	71.43	26	26.80	58.374	**0.000***
Continuous five hours work with <30 minutes break	223	75.85	21	21.65	9.117	**0.003***
Are theirs good Quality of sleep?	265	90.14	12	12.46	142.719	**0.000***
Un refreshing and /or interrupted sleep	195	66.33	32	32.98	89.406	**0.000***
Rosters include 5 or more-night shifts of 10 hours	193	83.91	17	17.53	8.058	**0.005***
Rosters include 6 or more-night shifts of 8 hours	278	94.55	4	4.71	381.396	**0.000***
Breaks between shifts less than 12 hours	203	69.05	29	29.90	134.045	**0.000***
Work performed without regular breaks	196	66.67	32	34.02	102.322	**0.000***
Less than 2 consecutive days off per week	227	77.21	26	26.80	104.667	**0.000***

Table [6]: Distribution of general characteristics of the junior resident physicians being studied according to fatigue

Junior residents [n=294]		Fatigued		Non-fatigued		Chi-square	
		No.	%	No.	%	X^2	P-value
Marital status	Married [n=60]	45	75.00	15	25.00	0.700	0.403
	Single [n=234]	145	61.97	89	38.03		
Residence	Urban [n=90]	75	83.34	15	16.66	0.913	0.339
	Rural [n=204]	180	88.24	24	11.76		
Smoking	Smoker [n=54]	46	85.19	8	14.81	0.017	0.897
	Nonsmoker [n=240]	200	83.33	40	16.66		

DISCUSSION

The study was conducted at Al-Houssine and Sayed Galal university hospitals of Al-Azhar University in Cairo. All departments of both hospitals were included in the present study. 391 resident physicians [all resident physicians] at Al-Houssine and Sayed Galal hospitals were included in the present study.

As regards smoking, the present study shows that it is not significant in juniors but more significant in seniors as the sleep disordered smoking seniors equal [66.66%] and the sleep disordered nonsmoking seniors equal [34.72%] with a significant p value 0.012. The present study disagrees with **Zeng *et al.*** [7] who found that smoking has great harm to the health of residents.

As regards work hours /week our results show that juniors work hour range [54-96] hours /week with mean ± SD [77.126±15.284] and seniors work hours range [30-50] with Mean± SD [39.385±9.935] with significant p value 0.001 and this exceed normal [40 h /week]. The present study agrees with **Howard *et al.*** [8] study who found that long working hours and variable working times are common during careers of physicians resulting in inadequate sleep, disorders in daily activities and fatigue. Also, the present study agrees with the [EWTD] limits work to 58 hours a week for physicians in training [9]. New Zealand has mandated a 72-hour range [10]. Also, **Gaba and Howard** [3] found that the maximum of weekly working hours had to be limited to 58 hours in 2014 and to 48 hours by 2013. Also, in New Zealand [11] it was found that junior doctors working hours have been bound by a contractual maximum of 72 hours per week since 1985. Also, **Landrigan** [4] has found that the national implementation of 80 hours-per-week on residents' works have been sought as a response to resident burnout linked to decreased job performance. Also, he recognized the strong connection between medical errors and residents' work hours. Interns shifting in intensive care units have been shown to be substantially involved in more serious medical errors upon working in 24 hours shifts more than when they worked shorter shifts [4].

Our study agrees with **Tucker** [12] study that found that truck drivers are permitted to work no more than 10 hours at a time and not more than 60 hours a week. The present study

disagrees with the **Australian Medical Association** [13], which provides that healthcare providers working for 40 hours per week are not immune to sleep disorder and cognitive impairment, if they work for extended [>10 hours] or must work in early morning hours without adjusting circadian timing.

Regarding arrangement of risk factors, our study shows that the risk factors of sleep disorder among the residents were ordered by stepwise regression analysis as [6 or more consecutive night shifts of 8 h], [absence of quality of sleep] ,[continuous hours of wakefulness more than 19 h], [working between 12 am and 6 am], [5 or more consecutive night shifts of 10 h],[less than 2 consecutive days off per week] and [shift exchanged without monument approval] with statistically significance difference.

As regard-interrupted sleep and sleep deprivation, our results show that the risk factors [mal refreshing and/or interrupted sleep] was significant as junior agrees by 66.33% and seniors agree by 32.98 % and p value = 0.000. The present study agrees with **Howard *et al.*** [14] who provide that most adults achieve 1 to 1.5 h less than their requirement, and if the sleep duration is more than two hours less than that, required performance is impaired. Also, **Barger *et al.*** [5] found that the impact of sleep deprivation on motor task performance is not only important in the work place, but in real life outside work. There is clear evidence that physicians driving after staying up in long shifts, and particularly at night shifts, have an increased risk of accidents. Also, **Taoda *et al.*** [15] found that a Japanese study on resident doctors in one university hospital correlated less hours of sleep and increased numbers of patients under the doctor's supervision with the possibility of the resident falling asleep at work. Thus, in this study, the busiest doctors were most anticipated to be prone to fatigue related. Also, **Baldwin and Daugherty** [16] found that residents sleeping 5 hours or less are more likely to report working in an "impaired condition" and having committed medical errors. The ACGME's duty-hour standards manifested that residents felt that their loss of sleep was detrimental to their performance and learning and affected their well-being [17].

As regard break between shifts our results shows that the risk factor [Breaks between shifts less than 12 h] was significant as junior agree by 69.05 % and seniors agree by 29.90 % and p value = 0.005. The present study agrees with **Bensimon** [18] study that found that the most effective way to get over sleepiness is to sleep 2-to 8-hour nap before having 24 h of sleep loss can improve vigilance and minimize sleepiness for 24 h. short naps of at least 15 min can significantly ease the performance decrements if provided at 2-to 3-hour intervals during 24 h of sleep deprivation [19], Two-hour naps every 12 hours improve performance decrements across 88 hours of sleep deprivation [20]. Naps shall be no longer than 2 hours to limit sleep inertia [21]. The time of the day most refractory to countermeasures is the circadian nadir, 2 AM to 9 AM [22]. Bright light therapy during these hours to activate the circadian system has been studied and may improve vigilance performance [19].

As regards work hours/shift, the present study shows that the risk factors [are the total hours of the work/ shift exceeding 14-16 hrs.] was significant as junior agree by 71.43% and seniors agree by 27.84 %and p value = 0.000. The present study agrees with **Powell** [11] study that provides that the maximum length of a shift shall not exceed 16 hours with breaks of at least 8 hours between shifts. Also, **Levine *et al.*** [23] found that a review on interventions reducing or eliminating shifts less than 16 hours found that 64% resulted in improved safety or quality. Also, the Directive of European Working Time decreases shift durations to 13 hours followed by a break of at least 11 hours [3].

Regards continues hours of wakefulness the present study shows that the risk factor [is the continuous hours of wakefulness exceeding 19 hrs.] was significant as junior agree by 88.45% and seniors agree by 12.37% and p value is significant = 0.000. The present study agrees with the Institute of Medicine which concluded that resident physicians should not work for more than 16 consecutive hours without sleeping. Moreover, the Institute of Medicine recommended a five-hour sleep period between the hours of 10 pm and 8 am, and that no new patient care duties shall be allowed after 16 hours**.** The present study disagrees with a national survey in a 1991 on second-year residents, which reported that the average of the largest number of hours without sleep was 37.6 hours between residents during their first postgraduate year, while 25% of them reported being on call in the hospital over 80 hour per week [24]. Also, in disagree with this study, we

see developed universal guidelines for residents' working conditions to stave off federal regulations no more than 80 h per week, no more than 24 consecutive hours, and on call no more often than every third night [25].

As regard working between 12 am and 6 am the present study shows that the risk factor [Working between the hours of 12 am and 6 Am] was significant as junior agree by 86.74% and seniors agree by 13.40% and p value = 0.000. The present study agrees with **Taoda *et al*.** [15] who found that night working can cause sleep deprivation and fatigue, because night workers must sleep in different times 'against the flow' of their circadian rhythm**.** In addition, increased drowsiness and a major drop in alertness are expected between midnight and dawn, with the lowest level of alertness occurring between about 2:00 a.m. and 5:00 a.m. [26]. Also, **Josefson** [27] found that working outside normal hours as a result of extended day and night shifts, is a world-wide phenomenon within the medical profession. Also, **Shen *et al*.** [28] found that ten hour's night shifts produced fewer adverse responses on patient safety than did eight-hour night shifts.

Regarding rest time, the present study shows that the risk factor [Rest time <8 hrs. /24 hours] was significant as junior agree by 80.27 % and seniors agree by 27.84 % and p value = 0.000. The present study agrees with the ACGME introduced standards from which a minimum 10-hour rest period between duty periods [29].

Conclusion: According to the Epworth sleepiness scale, 82.31 % of junior resident physicians had a sleep disorder, there were 17.53 % of senior resident physicians had a sleep disorder.

Conflict of Interest and Financial Disclosure: None.

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