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Quality of sleep in a sample of Egyptian medical residency

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Abstract

Background: Sleep disturbances among medical staff are common serious entities with devastating consequences. Numerous studies have analyzed the effects of residency on the quality of sleep of the medical trainees in various specialties, but only few studies were conducted in Egypt.

Results: One hundred fifty medical residents from various medical and surgical specialties who work in the hospitals of Ain Shams University, Egypt, agreed to participate in our study. Sociodemographic and work-related data were collected by a semi-structured sheet. Sleep quality was assessed by self-administered questionnaire—Pittsburgh Sleep Quality Index (PSQI). According to the PSQI, 96.7% of the residents had poor sleep quality with mean PSQI score of 10.4 ± 2.5. No statistically significant difference was detected among the different specialties. Poorer sleep quality was more frequent among senior residents who spent longer duration in residency. The number of hours of sleep before residency and the number of days off during residency were the main predictors of total PSQI score and determinants of sleep quality

Conclusions: Poor sleep quality is highly prevalent among medical residents and is associated with work-related factors. It is necessary to consider residents' sleep estate and conduct more analyses to diagnose, treat, and improve their sleep quality.

Keywords: Medical residents, Pittsburgh Sleep Quality Index, Sleep quality, Egypt, Psychiatry

Background

Sleep is an essential need which directly affects the individual's activity, function and quality of life. It is linked to the physical and mental wellbeing. The nature of the job of medical residents negatively impacts their life style, as it disturb sleep because of night shifts and extended hours of service [1].

Work shifts, particularly when prolonged and irregular, lead to disrupted circadian rhythm that was deemed responsible for multiple serious physical and mental health illnesses like daytime alertness, thinking, attention, learning, memory, judgement, decision-making, problem-solving, and coordination, as well as mood, motivation, coping with stress, controlling emotions, social relationships [1–4], and even cancer leading to raised risk of errors [5, 6].

Moreover, prolonged sleep deficiency was related to increased potential of physical health problems such as hypertension, diabetes, impaired lipid profile, obesity, cerebral, and cardiac vascular incidents [1, 7]. Resident who were not able to nap at least for 1 h during their night shifts were involved in riskier clinical decision [8].

The influence of sleep deficiency on the medical professionals has been increasingly analyzed [9, 10]. Many studies were conducted to assess the effect of length of work hours effect on medical residents' wellbeing, professional decisions, patient's care, and safety; nevertheless, the data were not conclusive [11–15]. In Egypt, only few researchers studied that topic with no data available

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regarding the effect of work-related variables on the sleep quality in medical residents.

Objectives

To assess sleep quality in a sample of Egyptian residents (medical registrars) from different medical specialties and identify its relationship with work-related variables.

Methods

Study design

This study is a descriptive cross-sectional study.

Study place

Ain Shams University Hospitals, Cairo, Egypt.

Sample population

Ain Shams University Hospitals included all clinical medical specialties which were categorized under two major entities: internal medicine and surgery. For research and sampling purposes, specialized surgeries were included in one group including neurosurgery, orthopedics, urology, vascular, and plastic surgeries, whereas medicine specialties as cardiology, pulmonology, dermatology, neuropsychiatry, tropical medicine, and oncology formed another group. General internal medicine, geriatrics, pediatrics, clinical pathology, general surgery, anesthesiology, obstetrics and gynecology, and radiology were separately presented. The former four together with medicine subspecialties were considered medicine-related specialties while the later added to specialized surgeries were surgery-related. Such classification was based on nature of work in these branches and the total number of residents working in each department.

Sample selection

A convenient sample of 150 residents was included in the study. Participating residents were of both genders. As the specialty training lasted for 3 years, junior, senior, and senior grades were represented in the sample.

Inclusion criteria

To share in the study, residents should be working as full-time trainees in Ain Shams University Hospitals.

Exclusion criteria

Residents who were using sedative medications and/or narcotics for any acute or chronic medical or psychiatric condition, pregnancy or childbirth within the last 3 years were excluded.

Assessment and procedures

All residents who agreed to participate in the research completed a semi-structured data collection sheet including socio-demographic data as age, gender, specialty, duration of training, number and duration of shifts, number and frequency of days off, and history of any mental or physical illness including medications.

Pittsburgh Sleep Quality Index (PSQI) [16] was applied. This self-administered questionnaire assessed the quality of sleep during the previous month and consisted of 19 self-rated questions yielding seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Each component is scored from 0 to 3, resulting in a global PSQI score between 0 and 21, with higher scores indicating lower quality of sleep. The PSQI was useful in identifying good and poor sleepers.

Scoring

A global PSQI score more than 5 indicated that a person was a poor sleeper, having severe difficulties in at least two areas or moderate difficulties in more than three areas. The Arabic version of the questionnaire used in this study [17].

Data analysis

All analyses were carried out using IBM SPSS statistics software version 22.0 (SPSS) [18]. The results were tabulated and statistically analyzed using the suitable statistical parameters. Qualitative data were presented as number and percentages; quantitative data with parametric distribution were presented as mean, standard deviation (SD) and ranges. Student's t test to test for statistical significance of variance between the means of the two samples. ANOVA test was used for more than two independent groups with parametric data. In qualitative data, inferential analyses for independent variables were done using chi-square test for differences between proportions and Fisher's exact test for variables with small expected numbers, while correlations were done using Pearson's correlation for numerical parametric data. Linear regression analysis was used to assess the predictors of poor sleep. The confidence interval was set to 95% and the margin of error accepted was set to 5%. P value was considered significant when $p < 0.05^{*}$ and highly significant when $P < 0.001^{**}$

Results

Sample description

The total number of residents who participated in the current study was 150 residents. Out of them, 48% ($n = 72$) were male and 52% ($n = 78$) were female. The mean age of the sample was 26.7 ± 0.9 years. More than half of

Table 1 Age, gender, marital status, and duration of residency of the residents

Age (mean ± SD)		**26.7 ± 0.9**
Sex (number/frequency)	Male	72 (48%)
	Female	78 (52%)
Duration of residency (mean ± SD)	1st year	53 (35.3%)
	2nd year	78 (52%)
	3rd year	19 (12.7%)
Marital state (number/frequency)	Single	107 (71.3%)
	Married	43 (28.7%)

*indicates the presence of significance **indicates highly significance. *SD* standard deviation

More than half of the sample (52%) spent 2 years as duration of residency. More than two thirds of the sample (71.3%) were single

Table 2 Duration of sleep before and during residency

	Groups	**(Mean ± SD)**	***P* value**
Hours of sleep before residency (mean ± SD)	Medicine-related specialties	8.6 ± 1.7	0.508
	Surgery-related specialties	8.4 ± 1.4	
Hours of sleep last month (mean ± SD)	Medicine-related specialties	5.1 ± 1.6	0.691
	Surgery-related specialties	5.2 ± 1.3	

the sample (71.3%, $n = 107$) were single and 28.7% ($n = 43$) of them were married (Table 1).

The three levels of residency were included, where 35.3% ($n = 53$) of the residents were junior, 52% ($n = 78$) sub-seniors, and 12.7% ($n = 19$) were seniors. Residents who specialized in internal medicine and related specialties were 58.6% ($n = 88$), while 41.4% ($n = 62$) were from surgery and associated departments.

The average number of sleep hours for residents in different specialties before residency showed an average of 8.5 ± 1.5 h, which dropped to 5.2 ± 1.5 h actual sleep hours during the month preceding the interview. Medically oriented residents got slightly less sleep (5.1 ± 1.6 h) than residents in surgery and related specialties (5.2 ± 1.3 h). There was no statistically significant difference between the two groups in the average number of sleeping hours before and after residency (Table 2).

Pittsburgh Sleep Quality Index (PSQI) scores: (Table 3)

High total PSQI score (mean ± SD = 10.4 ± 2.5) was recorded from participating residents' responses, reviling that the majority (96.7%, $n = 145$) had poor sleep quality. No statistically significant difference of total PSQI score was detected among different specialties ($p = 0.615$). Medicine-related specialties scored marginally higher (mean ± SD = 10.6 ± 2.3) than surgery-related specialties (mean ± SD = 10.1 ± 2.6). Pediatricians and general surgeons demonstrated the lowest sleep quality (mean ± SD = 11.5 ± 2.1 and 11.5 ± 1.7 respectively), followed by

Table 3 Pittsburgh Sleep Quality Index (PSQI) among different resident's specialty

Variables (Mean ± SD)	**Sleep duration**	**Sleep disturbances**	**Daytime dysfunction**	**Sleep latency**	**Habitual sleep efficiency**	**Subjective sleep quality**	**Intake of medications**	**PSQI Total**
Internal medicine	1.4 ± 1.1	1.5 ± 0.7	2.4 ± 0.7	0.7 ± 0.8	3.0 ± 0.0	1.4 ± 1.0	0.1 ± 0.4	10.5 ± 2.6
Medicine specialties	1.7 ± 1.0	1.2 ± 0.5	2.1 ± 0.8	0.7 ± 0.7	3.0 ± 0.2	1.6 ± 0.8	0.1 ± 0.5	10.4 ± 2.3
Pediatrics	1.3 ± 1.4	1.5 ± 0.5	2.8 ± 0.4	0.5 ± 0.8	3.0 ± 0.0	2.3 ± 0.8	0.0 ± 0.0	11.5 ± 2.1
Geriatrics	2.3 ± 0.9	1.3 ± 0.5	2.3 ± 0.8	0.3 ± 0.7	3.0 ± 0.0	1.9 ± 0.3	0.0 ± 0.0	11.1 ± 1.6
Clinical pathology	0.4 ± 0.5	1.8 ± 0.8	1.6 ± 0.5	1.8 ± 0.8	3.0 ± 0.0	1.4 ± 0.9	0.0	10.0 ± 3.1
General surgery	2.5 ± 1.0	1.8 ± 0.5	2.3 ± 0.5	0.3 ± 0.5	3.0 ± 0.0	1.8 ± 0.5	0.0 ± 0.0	11.5 ± 1.7
Specialized surgeries	1.6 ± 0.8	1.4 ± 0.7	2.2 ± 0.7	0.6 ± 0.7	2.9 ± 0.6	1.5 ± 0.7	0.0 ± 0.0	10.2 ± 2.2
Obstetrics and gynecology	2.0 ± 1.0	1.1 ± 0.3	2.1 ± 0.6	0.7 ± 0.9	3.0 ± 0.0	1.9 ± 1.2	0.1 ± 0.3	10.9 ± 2.4
Anesthesiology	1.3 ± 0.9	1.4 ± 1.0	2.1 ± 0.9	0.6 ± 0.5	3.0 ± 0.0	2.0 ± 0.9	0.0	10.4 ± 3.0
Radiology	1.6 ± 1.3	1.3 ± 0.6	1.7 ± 0.8	0.8 ± 0.8	2.7 ± 1.0	1.2 ± 0.9	0.0	9.3 ± 3.1
P value	**0.045***	0.339	0.064	0.076	0.386	0.130	0.912	0.615
Medicine-related specialties	1.6 ± 1.1	1.3 ± 0.6	2.2 ± 0.8	0.7 ± 0.8	3.0 ± 0.1	1.6 ± 0.8	0.1 ± 0.4	10.6 ± 2.3
Surgery-related specialties	1.7 ± 1.0	1.3 ± 0.7	2.0 ± 0.7	0.6 ± 0.7	2.9 ± 0.6	1.6 ± 0.9	0.0 ± 0.1	10.1 ± 2.6
P value	0.652	0.983	0.180	0.557	0.113	0.694	0.174	0.300
All residents	1.6 ± 1.1	1.3 ± 0.6	2.1 ± 0.8	0.7 ± 0.8	2.9 ± 0.4	1.6 ± 0.8	0.1 ± 0.3	10.4 ± 2.5

geriatricians (mean ± SD = 11.1 ± 1.6). In contrast, the lowest total PSQI score was for radiologists (mean ± SD = 9.3 ± 3.1).

Habitual sleep efficiency and daytime dysfunction were the severest affected subscales with mean scores 2.9 ± 0.4 and 2.1 ± 0.8 in order. On the other hand, the score on intake of sleep medication was the lowest (0.1 ± 0.3) followed by sleep latency (0.7 ± 0.8).

The different sub items of PSQI showed no statistical difference, except for the sleep duration among the different specialties ($p = 0.045$*). General surgery and geriatrics residents were the uppermost regarding sleep duration score (mean ± SD = 2.5 ± 1.0 and 2.3 ± 0.9 consecutively), as opposed to clinical pathologists who scored the lowermost (mean ± SD = 0.4 ± 0.5).

By comparing means of scores of subjective sleep duration quality among different specialties, there is statistically significant difference (*P* value = 0.045).

The highest mean of scores of subjective sleep duration quality, is among general surgeons (2.5). The lowest mean of scores of subjective sleep duration quality, is among clinical pathologists (0.4).

Correlation between PSQI items scores and work-related variables: (Table 4)

The total PSQI did not show any statistically significant correlation with the duration of residency, off work days or the number of the monthly shifts. Meanwhile, various sub-items were significantly related to one or more of the mentioned variables.

Sleep latency was positively related to both duration of residency and days off ($r = 0.185$, $p = 0.024$* and $r = 0.164$, $p = 0.045$* successively), but inversely related to the number of monthly shifts ($r = -0.236$, $p = 0.004$*). In the meantime, sleep duration ($r = 0.205$, $p = 0.012$), day dysfunction ($r = 0.258$, $p = < 0.001$**), sleep quality ($r = 0.208$, $p = 0.011$), and medication intake ($r = 0.176$, $p = 0.031$*) were all significantly correlated with the number of monthly shifts.

For the number of days off each month, a significant negative correlation was realized with daytime dysfunction ($r = -0.207$, $p = 0.011$*), compared to statistically significant positive correlations sleep disturbance ($r = 0.205$, $p = 0.012$*) and sleep latency as previously mentioned.

There is a significant positive correlation between duration of residency and sleep latency. There is a significant positive correlation between days off and sleep disturbances and sleep latency. There is a significant positive correlation between number of monthly shifts and sleep duration, day dysfunction, sleep quality, and medication intake. There is a significant negative correlation between number of monthly shifts and sleep latency

Table 4 Correlation between PSQI items and job-related variables

Variables	Duration of residency		Days off		Monthly shifts	
	R	*P value*	*R*	*P value*	*R*	*P value*
PSQI-duration	− 0.140	0.089	− 0.054	0.508	**0.205**	**0.012***
PSQI-disturbance	0.082	0.317	**0.205**	**0.012***	− 0.121	0.139
PSQI-latency	**0.185**	**0.024***	**0.164**	**0.045***	**− 0.236**	**0.004***
PSQI-day dysfunction	− 0.108	0.187	**− 0.207**	**0.011***	**0.258**	**< 0.001****
PSQI- Habitual sleep efficiency	− 0.002	0.979	− 0.076	0.357	− 0.024	0.770
PSQI-quality	− 0.078	0.343	− 0.103	0.210	**0.208**	**0.011***
PSQI-medication intake	− 0.105	0.200	0.039	0.637	**0.176**	**0.031***
PSQI-total	− 0.044	0.597	− 0.030	0.715	0.157	0.055

*indicates the presence of significance **indicates highly significance. *R* correlation coefficient

Table 5 Linear regression models for factors influencing sleep (PSQI scores)

Scale	Factors	*B*	SE	*P* value	95% CI	R^2
PSQI- total score	Sleep before residency	0.196	0.006	< 0.001**	0.184–0.209	0.970
	Days off	0.054	0.013	< 0.001**	0.028–0.081	
	Male sex	0.190	0.055	< 0.001**	0.081–0.298	

*indicates the presence of significance **indicates highly significance

Linear regression models for factors influencing PSQI score: (Table 5)

Using linear regression analysis, it was found that the number of hours of sleep before residency (β = 0.196), the number of days off during residency (β = 0.054), and the male gender (β = 0.190) were the main predictors of total PSQI score and determinants of sleep quality.

Discussion

Medical training was frequently associated with changes in sleep/wake cycle due to work stress, extended working hours, and night shifts [12, 18]. The current study revealed that the quality of sleep was negatively impacted during residency, as 96.7% of the participating residents had poor sleep quality. Their score in PSQI was 10.4 ± 2.5 which indicated higher disturbance of sleep. The results were in accordance with previous studies [19–22].

We found average 3 h drop of sleep time in the participating residents compared to their sleep duration prior to start of training. Linear regression analysis suggests a predictive association between number of sleep hours before residency and sleep quality as assessed by PSQI. In a prospective study of sleep in first year residents [23], following up night sleep duration in fresh residents over 9 months showed statistically significant decline of their baseline sleep and increase of PSQI score.

Furthermore, in the present study, although residents of medicine-related specialties manifested slightly poorer sleep as they scored higher on PSQI (10.6 ± 2.3) than surgically oriented specialties (10.1 ± 2.6), no statistically significant difference among different specialties was detected ($p = 0.615$). This agrees with Tür et al.'s study [21] which failed to find a significant difference in the average PSQI values between the emergency, internal medicine physicians, and surgeons.

In contrast, Lashkaripour et al. study [20] spotted statistically significant better sleep in radiologists and ophthalmologists compared to other specialties ($p < 0.05$), while Esen et al. [24] found that surgeon demonstrated the poorest sleep ($p = 0.015$). In Alsaif's study [22], 96% of anesthesiologists demonstrated poor sleep quality compared to 68.7% of pathology residents.

Our study resembled the first two studies [20, 24] in that radiologists had the relatively best sleep among included specialties (mean ± SD = 9.3 ± 3.1) and general surgeon battled poorest sleep (mean ± SD = 11.5 ± 1.7) which was matched with the pediatricians' score and (mean ± SD = 11.5 ± 2.1) in the current research pediatricians. However, the variance was not significant.

In the same context, the only subscale that showed statistically significant difference between the included specialties was sleep duration ($p = 0.045$*). General surgery and geriatrics residents were the uppermost regarding sleep duration score (mean ± SD = 2.5 ± 1.0 and 2.3 ± 0.9 consecutively), opposed to clinical pathologists who scored the lowermost (mean ± SD = 0.4 ± 0.5).

The quality of night shifts in surgery words and departments caring for patient of highly vulnerable patients in extreme age might explain the results. In contrast, radiologists and clinical pathologists worked under less stressful circumstance and they did not need to take major decisions related to patients' lives.

Habitual sleep efficiency and daytime dysfunction were the highest scores among the PSQI parameters in our sample. All residents scored an average of 2.1 ± 0.8 in daytime dysfunction with highest daytime dysfunction among medically oriented residents especially pediatricians.

Many studies associated poor sleep quality to decline in second day functioning [3, 25, 26]. Accumulating research negatively correlated long shifts and lack of regular rest to the performance of medical residents, though results were controversial and not conclusive [10, 27–29].

The present study found statistically significant positive correlations between the number of monthly shifts and sleep duration ($r = 0.205$, $p = 0.012$), day dysfunction ($r = 0.258$, $p = < 0.001$**), subjective sleep quality ($r = 0.208$, $p = 0.011$), and medication intake ($r = 0.176$, $p = 0.031$*) reflecting the degree of disturbance developed especially with frequent shifts. In prior research, extended shifts negatively impacted sleep, alertness, performance, increased errors [30, 31], and was linked to wide range of physical impairments [30]. Disruption of circadian rhythm led to biological imbalance such as chronic sleep disturbance and was associated with a variety of health risks [32].

On the other hand, number of monthly shifts was inversely correlated to sleep latency ($r = -0.236$, $p = 0.004$*), intake of sedating medications by residents who work more shifts could be the cause of reduced sleep latency.

There was a significant negative correlation between the number of days off and daytime dysfunction ($r = -0.207$, $p = 0.011$*), indicating the detrimental effect of lack of rest on the residents' performance. Further to that, the number of days off during residency was one of the predictive factors of the PSQI score as confirmed by linear regression analysis. Previous studies recommended that sufficient time off duty was mandatory for recovery sleep especially after longer shifts [3] and improve quality of performance [28, 33] and reduce errors [34].

However, other studies did not detect a significant effect of restriction of duty hours on the burnout, performance, and wellbeing of the residents [13]. Interestingly, the number of days off showed positive correlation with

sleep latency and sleep disturbance ($r = 0.164$, $p = 0.045$* and $r = 0.205$, $p = 0.012$* correspondingly). In comparison, earlier studies showed unexpected stability [35] or decline in sleep hours in spite of restriction of shift durations [36].

In consistence with number of former studies that found advanced years of training a risk factor for subjective sleep disturbance and sleep dissatisfaction [19, 37] or related to decline of total sleep quality [20, 38], our results revealed significant positive correlation between duration of residency and sleep latency ($r = 0.185$, $p = 0.024$*) that denotes decline in sleep amount and poor sleep efficiency and quality with advance of years of residency.

Stress was associated with detrimental effects on sleep [39, 40]; therefore, we agree with Lashkaripour et al. [20] that the increasing occupational, economic and social responsibilities could contribute to the poor sleep. Moreover, the stress of the final Master's degree exams and the thesis defense which happen during the last year of residency add another trigger of stress during that period of training.

Study limitations

This study has some limitations. First, the measurement of sleep disturbance was subjective as it was self-reported, which might made it prone to recall bias. However, we tried to overcome that by using a validated and widely used scale (PSQI). Secondly, our study was a cross-sectional study which did not allow for inferences on cause and effect. Thirdly, generalization of our results would be difficult, since we conducted this study at a single center.

Therefore, future longitudinal multicenter studies are suggested to evaluate the possible causal relationship between residency and poor sleep quality in individual specialties who carry out inpatient and outpatient duties. Moreover, a special focus on organizational characteristics of the jobs is required as a step for development of physician's wellness-oriented work conditions.

Conclusions

Our data demonstrated that poor sleep quality was a common serious problem among medical residents. Moreover, the findings indicated that poor sleep quality was significantly correlated with duration of residency, number of shifts/month and number of days off.

More research is needed in individual medical specialties to identify the factors that impair sleep quality in order to prevent the sleep disturbances, aiming at improvement of the medical residents' wellness.

Abbreviations

PSQI: Pittsburgh Sleep Quality Index; SD: Standard deviation.

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None

Authors' contributions

Authors including FH, AO, SG, ES, MN, and HK shared together the steps of design, background review, statistical analysis, results representation, and discussion. All authors read and approved the manuscript.

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Availability of data and materials

Applicable

Declarations

Ethics approval and consent to participate

Approval from the local ethical committee of the Institute of Psychiatry in Faculty of Medicine, Ain Shams University was obtained. Reference number is not available as at the time of conducting the study, the ethical approval was a necessity on departmental level without other pre-requisites from the university. Written informed consent was given by participants to participate.

Consent for publication

Written informed consent was given by participants for publication.

Competing interests

The authors declare that they have no competing interests.

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