

Risk of fatigue among anesthesia residents in Saudi Arabia

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ABSTRACT

الأهداف: تحديد خطر الإجهاد بين الأطباء المقيمين في زمالة التخدير في المملكة العربية السعودية يعتبر أول خطوة لتضمن يقظة طبيب التخدير والحد من العوامل المؤدية للإجهاد.

الطريقة: أقيمت الدراسة على الأطباء المقيمين في زمالة التخدير في المنطقة الغربية والشرقية والوسطى بالمملكة العربية السعودية خلال الفترة من أبريل عام 2014 حتى أبريل 2015 عام. شمل الاستبيان معيارين مختلفين لقياس مدى الإجهاد وهما مرجع صحة الفرد والتقدير لخطر الإجهاد المطور من الجمعية الطبية الأسترالية. بالإضافة إلى مقياس مقياس ايپورت لتحديد فرط النعاس خلال النهار.

النتائج: شملت الدراسة على 102 طبيب مقيم في زمالة التخدير وأظهرت أن أكثر من نصف العينة يعانون من خطر الإجهاد حسب المعايير المستخدمة، بالإضافة إلى أن 70٪ منهم يعانون من فرط النعاس خلال النهار.

الخاتمة: تظهر الدراسة أن خطر الإجهاد منتشر بين الأطباء المقيمين في زمالة التخدير حسب المعايير المستخدمة. وحيث أنه لا يمكن تحديد الأسباب عن طريق هذه الدراسة، نرى ضرورة توجه الأبحاث المستقبلية لإيجاد الأسباب ومدى التأثير السلبي التي قد تؤدي إلى إجهادهم إن وجد.

Objectives: To quantify fatigue risk and sleepiness among anesthesia residents in Saudi Arabia (SA).

Methods: Between April 2014 and April 2015, all anesthesia residents training in western, central, and eastern regions in SA were invited to fill a survey. We conducted a cross-sectional self-reporting survey that included demographic data, the Epworth sleepiness scale (ESS), and 2 other scales to assess fatigue risk: a Checklist for Individual Strength (CIS) and a predefined comprehensive fatigue risk assessment previously developed by the Australian Medical Association (AMA).

Results: We received 102 responses, and more than half of the individuals in the sample were at elevated

risk of fatigue according to both fatigue scales. Approximately 70% reported being excessively sleepy during the day.

Conclusion: All 3 scales used in our survey suggested that local anesthesia residents in SA are sleepy and at risk of becoming fatigued. This could be multifactorial, explained by long shifts, or cultural and lifestyle habits.

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Anesthesia is a leading specialty in patient safety advocacy, owing to the development of new technological solutions, applications of patient simulation, and adopting systems and techniques for a safe practice.^{1,2} In addition, anesthesiologists must be vigilant during their shift to provide standard patient care safely. Despite this fact, anesthesiologists often work long hours, which leads to a negative impact on their mood, cognitive function, and alertness. This does not only adversely affect patient care, but could also result in harmful consequences on a personal level.²⁻⁸ Sleepiness and fatigue are terms frequently used interchangeably, but they have different meanings. Sleepiness is one's tendency to fall asleep, whereas fatigue is a result of mental and physical exertion and loss of sleep.⁹ If not treated early, profound acute fatigue may not be reversed using common compensating

mechanisms and can evolve into chronic fatigue. Thus, an extreme expression of fatigue can lead to burnout. Several forms of well-being, including physical, social, emotional, environmental and occupational aspects, are essential for a healthy balanced life.¹ In a systematic review evaluating how fatigue anesthesiologists may alter patient care, it was concluded that fatigue mitigation is vital to promote safe practice.¹⁰ To obtain an accreditation by The Joint Commission, a nonprofit organization based in the United States, which accredits and licenses health care organizations and clinical training programs, several measures must be adopted to ensure an anesthesiologist is alert and watchful before anesthetizing patients. Strict enforcement of measures to control physician fatigue by hospital administration is recommended, in order to decrease fatigue-related risk among healthcare workers.¹¹ Recent studies have identified stress and burnout among local residents. Three of these studies suggested that Saudi residents are experiencing a higher level of stress and burnout in comparison to other residents around the globe.¹²⁻¹⁴ We chose anesthesia residents as a target sample as they had not been evaluated in previous studies, as well as the potentially strong and direct impact of their fatigue on patient safety. Also, a closer scope into a specific specialty will help us understand the contributing factors elevating the risk. This insight can aid in implementing international standards in training safety and the well-being of trainees.

Although local residency programs in Saudi Arabia have been growing, a formal well-being and fatigue mitigation plan is yet to be established. This study will give us a scope of the measurement of fatigue risk in our residents and their sleepiness in 2014 to 2015.

Methods. After obtaining local ethical approval, anesthesia residents in Saudi Arabia who were training for the Saudi Board in Anesthesia and Critical Care license were invited to participate. Participation was voluntary and anonymous, and each participant had a particular identification number in the study. The study was launched in April 2014 and data were collected up until April 2015. We included all anesthesia residents who had completed at least 6 months of the 5-year training program. In 2014-2015, the number of registered anesthesia trainees in Saudi Arabia was 168

residents. We excluded all residents training less than 6 months. This is an observational cross-sectional study. We assessed fatigue subjectively using self-reporting surveys, due to their feasibility. A self-reporting questionnaire with previously validated tools was constructed and divided into 2 parts.

The first part included demographic data (age, marital status, number of children, commute time to work, residency level, region of rotation and type of rotation). Sleepiness over the past 6 months was assessed using the Epworth sleepiness scale (ESS). Risk of fatigue was assessed using the Checklist for Individual Strength (CIS).

The ESS, an 8-question self-reporting system, was validated to evaluate sleepiness during the daytime in both patients and healthy subjects.¹⁵ Scoring of answers is between 0 and 3 (0 = Never and 3 = High chance of dozing). The scores for the 8 situations are summed and a total of 9 or more indicates excessive daytime sleepiness. The second scale we used was a checklist individual strength (CIS) questionnaire, which is a multidimensional scoring system of 20-statements assessing 4 aspects of fatigue over the past 2 weeks: fatigue experience, concentration, motivation, and physical activity. It was designed to measure several aspects contributing to chronic fatigue. Furthermore, the CIS questionnaire was validated for use in a working population, being a strong predictor of consequent permanent work disability with 90% specificity and 72% sensitivity. Scores greater than 76 suggest fatigue hazard.¹⁶⁻¹⁸

The second part of our survey was a predefined comprehensive fatigue risk assessment that was previously developed by the Australian Medical Association (AMA). This method of risk assessment enabled us to obtain a closer insight of the working pattern of anesthesia residents. Total risk score was calculated for one week based on several factors: hours worked, shift length, extended shifts, number of on-call days, night duties, number of 24-hour breaks, schedule changes, number of nights wherein individuals obtained eight hours of sleep and number of nights when participants thought they had enough sleep.¹⁹ A 7-day table diary was distributed to participants to minimize recall bias. Contact information was attached to allow postage of the survey after it had been completed. The maximum possible score in this assessment method was 20. Scoring was divided into 3 categories: low risk = 0-6, significant risk = 7-9, and high risk = 10-20.

This study was analyzed using IBM SPSS Statistics, version 22 (IBM Corp., Armonk, NY, USA). Simple descriptive statistics were used to define the

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characteristics of the study variables through a form of counts and percentages for the categorical and nominal variables, whereas continuous variables were presented by mean and standard deviations (SD). This study used a chi-square test to establish a relationship between categorical variables, whereas an independent t-test and one-way Analysis of Variance were used to compare 2 or more group means. These tests were carried out with the assumption of normal distribution. Lastly, a p -value <0.05 was the criterion for rejecting the null hypothesis.

Results. We received 121 responses, which were estimated to be within the 5% precision level (95% CI, $p=0.05$).²⁰ Male residents represented 67% of the sample. Of the 121 respondents, 58.3% were married and 40.5% were parents, with a mean age of 29 years (SD of 3.1). Moreover, half of the sample required more than half an hour to reach their working place from their residence. More than half of the sample (78%) were in their junior year and 22% were in their senior year at the time of the study.

Epworth Sleepiness Scale (ESS) results showed that nearly 70% of our participants reported being excessively sleepy during the day. Gender was the only variable that significantly affected ESS: more females reported being sleepy than males (87.5% versus 60.5%; $p=0.01$).

The CIS questionnaire demonstrated that 54% of residents were labeled as at risk of fatigue. A detailed analysis of CIS questionnaire subscales showed that the mean score for subjective fatigue was 78 ± 9.2 . Also, analysis showed a weak negative correlation between fatigue and age ($r = -0.225$, $p=0.02$).

As for fatigue-related risk, the response rate was 64% ($n=77$). Based on overall risk score, 69% of our sample possessed at least 7 points, which put them at significant risk of fatigue. Within this group, 27.3% of individuals were at high risk of fatigue, scoring 10 points or more.

Table 1 - Sleeping patterns for all residents for a week.

Variables	Total n=83	Males n (%)	Females n (%)	P-value
<i>8 hours sleep overnight</i>				0.866
6-7 days	6	4 (66.7)	2 (33.3)	
4-5 days	15	11 (73.3)	4 (26.7)	
3-0 days	62	41 (66.1)	21 (33.9)	
<i>Days woke up refreshed</i>				0.730
6-7 days	3	2 (66.7)	1 (33.3)	
4-5 days	13	10 (76.9)	3 (23.1)	
3-0 days	67	44 (65.7)	23 (34.3)	

Table 2 - One-week diary for residents reported to be excessively sleepy during April 2014 up to April 2015.

Variable	Total	Males n (%)	Females n (%)	P-value
<i>Hours worked</i>				0.305
<50	37	22 (59.5)	15 (40.5)	
50-70	34	25 (73.5)	9 (26.5)	
>70	10	8 (80.0)	2 (20.0)	
<i>Frequency night shifts</i>				0.305
0-1 night	68	47 (69.1)	21 (30.9)	
2 nights	11	6 (54.5)	5 (45.5)	
≥3 nights	3	3 (100.0)	0 (0.0)	
<i>Full days off (24 hours)</i>				0.091
≥2 days	37	30 (81.1)	7 (18.9)	
1 days	39	23 (59.0)	16 (41.0)	
0	7	4 (57.1)	3 (42.9)	

Results from reports of those who reported to be excessively sleepy. No unified total between variables

Approximately 56% of the sample obtained more than 10 hours of break before the start of their work day and only 8.4% did not receive any 24-hour break during that week. The scoring system also evaluated their sleeping pattern through 2 questions: the number of days which they slept for 8 hours straight and the number of days when they woke up feeling that they had obtained enough sleep (Table 1). The working pattern among those who reported being excessively sleepy is shown in Table 2.

Lastly, a reliability analysis was also performed. Looking at the 3 scores for further analysis, the ESS interpreted a high stake consistency (0.675), whereas both the CIS fatigue measurement and AMA possessed only a moderate level of consistency.

Discussion. Since the AMA diary was filled daily by participants before being sent to us, we lost subjects' follow-up. Responses went down from 121 to 77 participants. Moreover, when estimating fatigue and sleepiness in anesthesia residents using the previously mentioned scales, we found that 69.4% of the population reported being excessively sleepy, according to the ESS. Our selected sample mean of excessive daytime sleepiness (10.7 ± 4.1) was higher than the mean from a similar study²¹ among general Saudi health care workers (9.4 ± 3.6). Our population also had a higher score in being excessive sleepy compare with the population of the previous study (69.4% versus 39.3%). Such a difference could be rationalized based on differences between the populations studied, as the other study population included all hospital staff

medical, paramedical and administrative personnel. Thus, participants in the other study had a different working pattern than that of our residents. Similar data were also observed in a local study looking at acute sleep deprivation in medical residents,²² closer inspection of participants' sleeping patterns revealed that 74.7% of the sample were sleeping for 8 hours straight only 3 nights or less per week, and some did not sleep for 8 hours straight at all. This pattern of sleep provides an individual high scores in risk of fatigue in regards to AMA. Additionally, we found a significant relationship between obtaining at least 24 hours off and previous patterns of sleep ($p=0.04$). This apparent relationship was also observed with excessive sleepiness on the ESS ($p=0.01$). According to the Ministry of Health in Saudi Arabia, healthcare providers are expected to work 47 hours per week. Since residents are on unique training programs, their working hours are limited to 208 hours per month; that is, 52 hours per week in a 4-week month. Variations are still allowed so as to meet the requirements of each residency program.²³ In our sample, almost 12.3% of individuals exceeded 70 working hours per week. This does not contradict the 2013 standards of the Accreditation Council for Graduate Medical Education (ACGME), however, which allow residents to work up to 80 hours per week for overall in-hospital activities, on condition that there are 10-hour breaks between daily duties. Accreditation Council for Graduate Medical Education standards also state that in order for a residency program to be accredited, the program must include an awareness program to identify fatigue and sleep deprivation, and provide decent sleeping facilities, proper naps and back up plans for patient care in case a resident cannot carry out assigned duty.²⁴ While reviewing previous related studies, we have found similar results demonstrated the existence of a significant association between female gender and sleepiness, depression scores and depressive symptoms.^{12,14,22,25,26} Burnout, also, was evident in young females.¹² However, the survey tool we used was not designed to detect reasons for increased sleepiness reporting and gender discrepancy. Further study designs to explore contributing factors for this difference would be recommended and modify them. In addition, 54% on CIS and 69% on AMA scale in our sample were labeled at high risk of fatigue. Thus, more than half of our anesthesia residents can be labeled as both sleepy and at risk of fatigue. With regards to demographic data and the work pattern diary, we could not find any significant statistical association. With the exception of the CIS scale, we found that longer years of training were associated with average level of fatigue

($p=0.03$). This finding was also supported by a weak negative correlation between fatigue and age ($r=-0.225$, $p=0.02$). In other words, chances of fatigue decreased as training and experience increased. This was supported with a positive correlation between age and residency level ($p<0.01$ in 2-tailed test). This finding fits with the recommendation of ACGME to limit the working hours of first-year-post-graduate residents to fewer than those of senior residents.²⁴

Study limitations. We cannot firmly label our sample to be fatigued or at risk of fatigue. This would require subjective and objective measurement with a tightly structured tool and personal interviews. Currently, there is no single most accurate method, which can confirm fatigue and stress. We therefore used 3 different tools to give an estimated scope for identifying fatigue. Another limitation we faced was a lower response rate of the third scale in comparison to the ESS and CIS scale. Since daily schedules and working hours of anesthesiologists can vary and we wanted daily recording of the diary for accurate results, we received incomplete surveys of the fatigue-related risk diary or occasionally none at all. The difference in response rate with this tool likely decreased precision by only 5-10%.²⁰ This precision level was successfully achieved by minimizing the number of non-compliant participants by sending reminders to participants to complete the diary and forward it back to us. Lastly, we were unable to study any relationship between number of night shifts and risk of fatigue and sleepiness effectively, since at the time of the study the local anesthesia residency program had a minimum of 3 on-calls per month. Consequently, we captured one on-call per week for most of the residents during the one-week diary.

In conclusion, more than half of our sample was at risk of fatigue. Residency by itself; however, may not be directly exhausting the residents and causing their lack of sleep with the reported number of on calls and working hours. There was no significant relationship between our scales and residency training; hence, there is a knowledge gap for what makes our residents fatigue. This may be explained by local social and behavioral habits (namely, social gatherings in some areas occur only at night and can extend until after midnight), improper sleep hygiene or lack of education on coping strategies for the stressful daily life that individuals face in our medical society. It is necessary to study this theory. We believe that the best approach for alertness management and fatigue mitigation is to implement a residents' well-being program, educating them with tools to recognize stress and fatigue, and methods to manage stress and reduce fatigue. Alertness can be sustained by

proper sleep hygiene, strategic consumption of caffeine, planned naps, and a balanced nutritious diet.²⁷ Since nearly half of our sample required more than 30 minutes to reach home, we also highly recommend providing an optional sleeping facility and safe transportation option for those who are too exhausted to drive.

In conclusion, all 3 scales suggested the presence of fatigue risk among anesthesia residents. This could be multifactorial, affected by long shifts or cultural and lifestyle habits. Further studies are advised to determine correlations between other factors and residents' fatigue. After that, we recommend starting a residents' well-being program to manage stress and decrease fatigue risk among anesthesia residents, as well as increasing awareness of healthy sleeping habits and highlighting the importance of sleep hygiene. This program could ensure that residents remain physically and mentally healthy during their training while providing patient care safely. This could be the first step in establishing a comprehensive plan to mitigate fatigue in all healthcare settings.

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