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Analysis of factors affecting fatigue in emergency medicine residents: A nationwide, cross-sectional, descriptive study

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Abstract:

OBJECTIVES: Emergency physicians may experience intense fatigue and burnout due to factors related to occupational conditions. The group experiencing burnout most frequently among physicians is emergency medicine (EM) physicians, with 63%. They also endure high levels of fatigue. This study evaluated the fatigue levels and factors of fatigue in EM residents nationwide. It aimed to determine the factors affecting fatigue.

METHODS: The study includes EM residents working across the country between January 2024 and April 2024. It was conducted using a survey. The survey included the Maslach Burnout Inventory (MBI), the Chalder Fatigue Scale, and questions about demographic characteristics. Multivariate logistic regression analysis was used to analyze the data.

RESULTS: The median age of participants was 28 years (interquartile range = 3), and 203 (56.4%) were male. Factors affecting the level of fatigue were analyzed by multivariate logistic regression analysis. The gender (male) (odds ratio [OR] =0.322, 95% confidence interval [CI] =0.128–0.812) and the daily sleep duration (OR = 0.589, 95% CI = 0.423–0.822) variables had a negative effect on fatigue. Depression in medical history increased the likelihood of fatigue (OR = 3.515, 95% CI = 0.930–13.287). Emotional exhaustion (EE) (OR = 1.082, 95% CI = 1.037–1.130) and depersonalization (OR = 1.097, 95% CI = 1.015–1.186) increased the fatigue level. However, personal accomplishment had no significant effect on fatigue (OR = 1.019, 95% CI = 0.966–1.075).

CONCLUSIONS: Being female gender, having shorter daily sleep duration, having a diagnosis of depression in medical history, and having higher levels of depersonalization and EE from MBI subdimensions increase the level of fatigue. Optimizing the sleep duration of EM residents and supporting their psychological health will prevent fatigue and fatigue-related problems.

Keywords:

Burn-out, emergency department, fatigue, residency

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Introduction

Fatigue is a decrease in physical and mental energy capacity that negatively affects the individual's performance in daily life activities, causes impairment in cognitive functions, and creates an overwhelming feeling of exhaustion.[1] The frequency of fatigue in the general population is up to 45%.[2] Therefore, fatigue is a public health problem highly associated with poor health-related quality of life and disability.[2]

Fatigue increases in environments with long night shifts and disrupted circadian rhythms, such as emergency departments

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Box-ED

What is already known about the study topic?

- The highest burnout rate among physicians is observed in emergency medicine (EM) physicians (63%)
- Fatigue is inherent in the emergency department.

What is the conflict on the issue? Is it necessary for readers?

- Is intense work pressure the leading cause of fatigue in EM residents?
- Is there a relationship between increased fatigue levels and burnout?
- What are the factors affecting fatigue and burnout?

How is this study structured?

- This is a prospective nationwide cross-sectional descriptive study in which 360 of 3500 EM residents participated.

What does this study tell us?

- There is a significant relationship between fatigue and burnout. In order to reduce fatigue, psychological conditions such as burnout and depression should be prevented, and residents should have enough sleep time per day.

(EDs).[3,4] In addition to highly stressful working conditions, factors such as academic performance anxiety, lifestyle, occupational overload, and working schedule instability have also been found to increase the level of fatigue.[3-5] As a result, emergency medicine (EM) physicians with all these characteristics are expected to have a high level of fatigue. An increase in fatigue levels causes impairment in decision-making mechanisms and an increase in medical errors.[4,6]

In addition to its adverse effects on patients and patient management, fatigue puts physicians in psychologically difficult situations. Especially in EM clinics where factors that may trigger fatigue are abundant, the incidence of burnout syndrome (BOS) is 63%.[7] Burnout is a state of mental and physical fatigue related to care activities or work.[8] It has been found that fatigue, depression, and anxiety are at the center of burnout.[9] It is known that many health problems, such as depression and suicidal thoughts, may occur due to burnout. It is proof of how seriously burnout should be taken.

EM physicians, the leaders in terms of burnout, are expected to be at the top in terms of fatigue level due to stressful working conditions, long night shifts, occupational overload, and working schedule instability. In particular, patient management and physician health are at risk due to the possible strong link between fatigue and burnout. A physician with high fatigue and burnout will inevitably have reduced clinical decision-making ability, make medical errors, and eventually engage in behavior that will harm the patient and himself/herself. This study evaluated the mental and physical fatigue and burnout levels of EM residents nationwide. In addition, sociodemographic parameters that may have a preventive effect for both conditions were investigated. The study aimed to determine the relationship between fatigue and burnout levels of residents and to create data for measures to manage both conditions.

Methods

Study design

This study was a nationwide, descriptive, cross-sectional study. The Hacettepe University Ethics Committee granted ethical approval with decision number 2023/06-34 on November 7, 2023. The study population was all EM residents working in Türkiye between January 2024 and April 2024. Contact information of the participants was obtained from specialty associations. Physicians who did not permit the specialty association to share their contact information could not be reached. Participation in the study was voluntary. A survey conducted on Google Forms was sent to all physicians' phone numbers using the WhatsApp application. It consists of 22 questions about the Maslach Burnout Inventory (MBI) and 11 about the Chalder Fatigue Scale (CFS). After giving informed consent electronically, participants were allowed access to the survey, and the data were collected.

The size of the study population was not known. However, according to the information obtained from specialty associations, nearly 3500 EM residents were actively working between January 2024 and April 2024. According to the statistical analysis, the sample size should have been 347 with a 5% margin of error at 95% confidence interval [CI]. The data collection process was terminated when participants reached 370 due to possible data losses. Participants who were being treated for depression at the time of the survey were excluded from the study. Considering the repeated contact addresses, an estimated 2500 residents were invited. Ten participants were under treatment for depression and were excluded from the study. The study group consisted of 360 participants who completed the survey completely. The participation rate was calculated as 14.6%.

Inclusion and exclusion criteria

Participants should work as EM residents during the data collection period. Participants who were being treated for depression at the time of the survey were excluded from the study.

Specific measures

The MBI is a 22-item, 7-point Likert-type scale that evaluates individuals' burnout levels regarding emotional exhaustion (EE), personal accomplishment (PA), and

depersonalization.[10] The scale was modified in Turkish, and its psychometric properties were evaluated by assessing validity and reliability in 1992.[11]

The CFS is a two-dimensional scale used to measure physical and mental fatigue. It is a useful scale that assesses the extent and severity of fatigue the individual feels through self-reporting.[12] CFS is an 11-item, 4-point Likert-type scale, and each item is scored between 0 and 3. The individual can score between 0 and 33 on the scale, and a high score is considered severe fatigue. The scale was translated into Turkish, and the validity and reliability of the Turkish scale were proven (Cronbach's α = 0.863).[13] Written permissions were obtained from the developers for the use of both scales.

Participants were contacted via WhatsApp application, and the survey was terminated when the number of participants reached 360. Some sociodemographic information, such as age, gender, marital status, hobbies, and sleep patterns, were obtained. Each participant answered both CFS and MBI. The participant's scores on the scales and the relationship between the two conditions were analyzed. The relationship between the participants' sociodemographic characteristics and fatigue and BOS was investigated.

Statistical analysis

Frequency and percentage were used for demographic characteristics. The distribution of quantitative variables was analyzed using the Kolmogorov–Smirnov tests. The distributions did not fit the pattern of normal distribution. For this reason, the median and interquartile range (IQR) were used as measures of central tendency. For multiple group comparisons, the quantitative variables were analyzed with Kruskal–Wallis, and the categorical variables were analyzed with the Chi-square test and Fisher's exact test. Univariate logistic regression analysis was performed after the dependent variable was determined for all independent variables. Variables with $P < 0.25$ in the univariate logistic regression analysis were added to the multivariate logistic regression analysis. The significance level of the model was analyzed with the omnibus test. Hosmer and Lemeshow's test evaluated the model's compatibility with data. Correlations were analyzed using the Pearson correlation method. For Pearson correlation, linearity was evaluated by analyzing the scatter dot plot and R correlation coefficient. An α-value of 0.05 was assumed for all comparison tests. Analyses were performed using SPSS v23 (IBM Corporation, Armonk, New York, United States).

Results

The median age of the 360 participants was 28 years (IQR = 3), and 203 (56.4%) were male. Ninety (25%) participants had depression in their medical history, and 202 (56.1%) participants did not have any hobbies [Table 1]. The median daily sleep duration was 6 (IQR = 2) h, and the median monthly working time was 224 h (IQR = 40). The characteristics of the participants are shown in Table 2.

Participants answered the CFS and the MBI. The Cronbach's alpha of CFS was 0.923, and the MBI was 0.803. Both scales were found to be valid for the study population. The median CFS score was 20 (IQR = 10), and 313 (86.9%) participants had a CFS score above 12. The number of participants in the high-level group in any of the three dimensions of MBI was 346 (96.1%). CFS and MBI scores and subgroup distributions are given in Tables 1 and 2.

Table 1: The characteristics of the participants

Characteristics	*n* (%)
Gender	
Male	203 (56.4)
Female	157 (43.6)
Being married	189 (52.5)
Being a parent	72 (20.0)
Depression in medical history	90 (25)
Having a hobby	158 (43.9)
Organization	
Public	156 (43.3)
University	204 (56.7)
Emotional exhaustion	
Low	24 (6.7)
Moderate	77 (21.4)
High	259 (71.9)
Depersonalization	
Low	19 (5.3)
Moderate	68 (18.9)
High	273 (75.8)
Personal accomplishment	
Low	42 (11.7)
Moderate	86 (23.9)
High	232 (64.4)

Table 2: Medians obtained from the scales and characteristics related to work organization

Characteristics	Median	Q1–Q3	Minimum–maximum
Age (year)	28	27–30	20–48
Length of working time (month)	24	12–36	1–60
Average monthly working time (h)	224	200–240	60–350
The number of patients treated in one shift (*n*)	80	40–150	10–550
Daily sleep duration (h)	6	5.25–7	2–11
Physical fatigue (score)	14	11–18	2–21
Mental fatigue (score)	6	4–8	1–12
Total fatigue (score)	20	16–26	4–33
Emotional exhaustion (score)	40	28–47	8–54
Depersonalization (score)	17	12–22	0–30
Personal accomplishment (score)	30	24–36	0–48

According to the MBI subdimensions, participants were divided into low, moderate, and high groups. The medians of physical, mental, and total fatigue scores obtained for each subgroup were calculated. Fatigue scores increased significantly from low group to high group in all subdimensions [Table 3].

Participants with a CFS score above 12 were defined as fatigued. Univariate logistic regression analysis evaluated data, and variables with $P < 0.025$ were added to the multivariate logistic regression analysis (omnibus test $P < 0.001$; Hosmer and Lemeshow test $P = 0.698$). It was determined that the independent variables used in the model explained the variance in the fatigue variable at a moderate level (45.5%) (Cox and Snell $R^2 = 0.245$ and Nagelkerke $R^2 = 0.455$).

The significance of the independent variables in the model and their effect on fatigue are given in Table 4. The gender (male) had a negative effect on fatigue (odds ratio [OR] =0.322, 95% CI = 0.128–0.812). Men were 68% less likely to be in the fatigue group than women. Depression in medical history increased the likelihood of fatigue (OR = 3.515, 95% CI = 0.930–13.287). A history

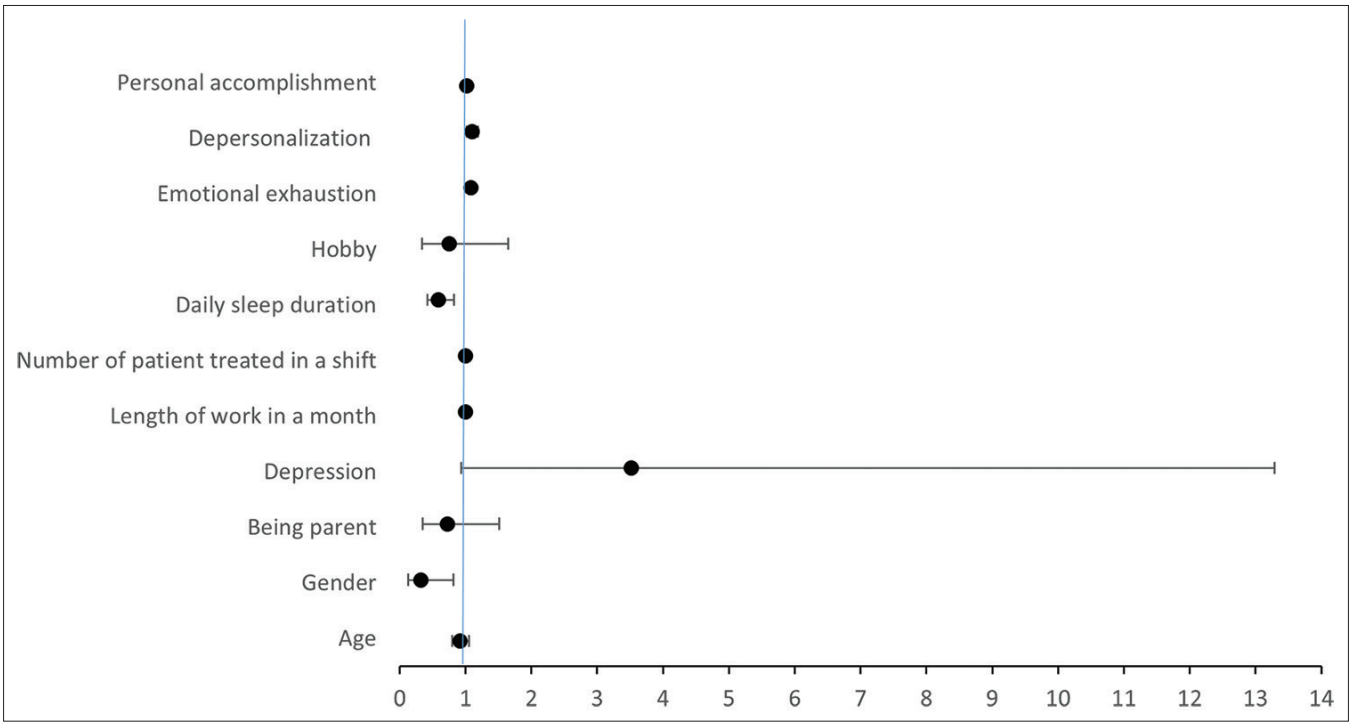

Figure 1: Odds ratios of independent variables

Table 3: The relationship between burnout subdimensions and fatigue levels

	Physical fatigue (median/Q1–Q3)	Mental fatigue (median/ Q1–Q3)	Total fatigue (median/ Q1–Q3)
Emotional exhaustion			
Low (*n*=24; 6.7%)	7 (5–10)	4 (2.25–4)	11 (7.25–14)
Moderate (*n*=77; 21.4%)	11 (8–14)	6 (4–7)	17 (13–19.5)
High (*n*=259; 71.9%)	15 (13–19)	7 (5–9)	22 (19–27)
*P**	<0.001	<0.001	<0.001
Depersonalization			
Low (*n*=19; 5.3%)	8 (7–14)	4 (3–6)	11 (11–20)
Moderate (*n*=68; 18.9%)	13.5 (9–15)	6 (4–8)	19 (13.25–22.75)
High (*n*=273; 75.8%)	14 (11–18)	7 (5–9)	21 (17–26)
*P**	<0.001	<0.001	<0.001
Personal accomplishment			
Low (*n*=42; 11.7%)	11 (7–14)	5 (4–8)	17 (11–22)
Moderate (*n*=86; 23.9%)	13 (9.75–16)	6 (4–8)	19 (14.75–23.25)
High (*n*=232; 64.4%)	14 (12–18)	7 (5–9)	21 (18–26.75)
*P**	<0.001	<0.001	<0.001

*Kruskal–Wallis test

Table 4: Multivariate logistic regression analyses with fatigue as the dependent variable

Variable	*P*	OR	95% CI	
			Lower	Upper
Age	0.210	0.914	0.793	1.052
Gender	0.016	0.322	0.128	0.812
Number of children	0.391	0.726	0.348	1.510
Depression in medical history	0.064	3.515	0.930	13.287
Length of work in a month	0.973	1.0	0.974	1.025
Number of patients treated in a shift	0.280	1.002	0.998	1.007
Daily sleep duration	0.002	0.589	0.423	0.822
Hobby	0.472	0.749	0.341	1.646
Emotional exhaustion	<0.001	1.082	1.037	1.130
Depersonalization	0.019	1.097	1.015	1.186
Personal accomplishment	0.489	1.019	0.966	1.075

CI: Confidence interval, OR: Odds ratio

of depression tended to increase the risk of fatigue approximately 3.5 times [Figure 1]. Even though it was not statistically significant ($P = 0.064$), the fact that depression increased fatigue 3.5 times was found to be clinically significant. The daily sleep duration variable was negatively associated with fatigue (OR = 0.589, 95% CI = 0.423–0.822). Each 1-h increase in sleep duration was found to cause a 41% reduction in fatigue levels. Longer sleep duration reduces fatigue. Among the subdimensions of BOS, a sense of PA had no significant effect on fatigue ($P = 0.489$). However, the EE (OR = 1.082, 95% CI = 1.037–1.130) and depersonalization (OR = 1.097, 95% CI = 1.015–1.186) were found to increase the feeling of fatigue significantly. Each unit increase in EE and depersonalization increases the fatigue level by 8.2% and 9.7%, respectively.

Discussion

Every year, the shortage of physicians in ED becomes more acute, a trend driven not only by the increasing need for physicians but also by rising resignation rates. A review found that the frequency of resignations among emergency physicians ranged between 11.8% and 22%.[14] The desire to resign has been linked to various organizational and psychological factors, many closely related to fatigue and burnout. These factors include performance anxiety, lifestyle, occupational overload, work schedule instability, long working hours, poor sleep quality and duration, shift work, and depression.[15-17] In conclusion, the main challenge in EM is the inevitable shortage of physicians due to burnout and fatigue, a problem that is all too common among emergency physicians. Our study is a step toward addressing this issue and promoting the complete well-being of emergency physicians.

The highest burnout rate among physicians is observed in EM physicians (63%).[7] The rates of depression, divorce, alcohol and drug use, suicide, medical errors, and patient dissatisfaction increased in emergency physicians in whom burnout was frequently observed.[18] In the current study, the rate of high burnout levels in any subdimension of the BOS was 96.1%. This result showed that the frequency of burnout in EM residents nationwide was much higher than predicted.

While general fatigue is 20.4% in adults worldwide, it increases to 42.3% in certain occupations.[2] EDs work actively 24 h a day. While medical care continues uninterruptedly, work intensity is unpredictably variable. The high-risk decision-making process and the complexities that may arise in managing emergencies involving critical diseases and injuries constitute the main challenges of EM. In this process, the EM physician pushes all his/her cognitive capacity to the end. EDs are the entryway to the healthcare system for all patients. Increasing patient applications, physician and equipment inadequacies, shift working system, disruption of sleep patterns, and management of many critical patients simultaneously cause EM physicians to work with physically high capacity. Due to all these reasons, the frequency of fatigue in emergency physicians should be expected to be high. In a previous nationwide study, CFS scores were evaluated, and a cutoff point of 12 points was determined for fatigue.[13] The current study evaluated participants with a CFS score above 12 points as fatigued. The frequency of fatigue in EM residents across the country was found to be 86.9%.

The results revealed that EM residents were much worse than expected regarding burnout and fatigue. Studies show physician burnout and fatigue may lead to adverse clinical events, errors, unprofessional behaviors, and lower quality of patient care.[19,20] However, it should not be forgotten that the well-being and health of the physician need to be corrected. Physicians who struggle with burnout and fatigue have a high risk of suicide and self-harm and become risky in terms of mental and cardiovascular diseases.[21] The current study observed that the level of fatigue increased significantly as the burnout status increased for all subdimensions. It was concluded that fatigue and burnout were closely related.

In a qualitative study on EM physicians, the participants stated that fatigue is inherent in the ED and that EM has a strong relationship with fatigue.[17] The leading causes of fatigue include long night shifts, disrupted circadian rhythm, academic performance anxiety, occupational overload, imbalances in the work schedule, and intense stress.[3-5] In our study, we aimed to determine the factors that affect fatigue and to create a basis for developing methods that can be used to ensure the general well-being of EM residents through these factors. For this reason, effective parameters on fatigue were determined in

multivariate logistic regression analysis. Gender, daily sleep duration, having a diagnosis of depression in medical history, EE, and depersonalization were found to affect fatigue. Contrary to expectations, age, monthly working time, number of patients treated per shift, having a hobby, and PA had no effect on fatigue. The main reason why work intensity does not significantly affect fatigue can be explained by the fact that burnout level is a stronger predictor that emerges as a result of all variables that are indicators of work intensity.

EDs provide 24-h continuous service and work-in shifts. The circadian rhythm of emergency physicians is disrupted due to dynamic work plans. It has been proven that circadian rhythm is disrupted due to night shifts, consecutive working days, and long working shifts.[3] Disruption of circadian rhythm and decreased sleep duration cause fatigue.[3] In our study, EM residents' median daily sleep duration was 6 h. It was found that the fatigue level increased as the daily sleep time decreased. Prolonging the daily sleep time of EM physicians will decrease their fatigue levels. It can be achieved by not having 24-h shifts or providing sufficient sleep time during shifts.

Women are under more intense responsibility in social life. The higher level of work-home conflicts and the fact that most of the family and child responsibilities are undertaken by women have been associated with burnout and fatigue.[22,23] In this study, being male was found to be a variable that decreased the level of fatigue.

Fatigue is one of the most common symptoms of depression and is frequently associated with impaired concentration, irritability, decreased productivity, and decreased mental endurance.[24] The fatigue symptoms persist in one-third of patients diagnosed with major depression.[25] In our study, it was found that the level of fatigue increased in participants with depression in their medical history.

The apathy that occurs with fatigue and the blurring of some important emotions may help explain its relationship with burnout. Burnout is a state of EE, physical fatigue, and cognitive weariness that frequently occurs due to environmental and occupational factors.[26] Burnout is evaluated in three subdimensions. The PA is often ignored, and analyses focus on EE and depersonalization. A meta-analysis examined the relationship between variables in the work environment and burnout subdimensions. Unlike the other two subdimensions, it was found that PA was not affected by variables such as high work demands and high workload, which may cause fatigue.[27] In our study, depersonalization and EE were found to increase the level of fatigue. However, PA did not affect fatigue alone. The PA is defined as a lack of individual professional self-esteem and a tendency to evaluate the value of one's work negatively. It is acceptable that the PA subdimension does not affect fatigue.

A study of factors on fatigue in physicians showed that being over 30 years of age, working more than 40 h per week, and working in night shifts caused fatigue.[4] Another study showed that marital status, long weekly working hours, and work intensity increase fatigue.[28] Furthermore, pain, sleep duration, insomnia, sleepiness, anxiety, and depression are effective in fatigue.[29] Another study showed that age, gender, being a parent, marital status, length of time worked per week, and night shifts were not effective on fatigue.[29] In these studies, participants are usually divided into groups according to demographic characteristics and fatigue levels between groups are investigated. However, in multivariate logistic regression analyses in which fatigue was the dependent variable, it was concluded that demographic characteristics were not effective on fatigue. The results of the current study should also be evaluated in this direction. In light of these results, it is predicted that female residents with burnout, shortened sleep duration, and depression in their medical history will have the highest risk of fatigue.

Limitations

The results of this study determine the factors affecting fatigue levels in EM residents. However, it is essential to consider the limitations when interpreting the findings. Since the study data are self-reported, there may be a risk of false recall. In addition, the cross-sectional study design makes it difficult to reach a definite causal conclusion. The results obtained are expected to differ due to periodic sociodemographic variables. Longitudinal studies should be designed to evaluate the sample in various psychological and sociological dimensions. In this way, more precise results can be obtained.

The study obtained sociodemographic information that may be related to fatigue. However, many parameters that may cause fatigue, such as medical problems, nutritional problems, or stress levels, were not included. More extensive studies, including such factors, will provide more accurate results. In addition, the fact that individuals with high levels of fatigue or feelings of burnout were highly motivated to participate in the study may have caused a possible bias.

In the current study, data on daily sleep duration were collected, but data on daily working time were not collected. It was done to avoid using two closely related variables in multiple regression analyses. At the same time, if the participants had the opportunity to sleep during the shift, prolonged shifts would have caused erroneous analyses. Although many studies have shown

that shift duration is effective on fatigue, the variability of shift conditions could have led to incomplete results.

Finally, since the survey used in the study was not completed by face-to-face interview, it cannot be guaranteed that the volunteers were actively working as EM residents. However, considering that the study population was generally reluctant to participate in survey studies, it should be assumed that the participants were EM residents.

Conclusions

Based on the current results, the leading cause of fatigue is unrelated to work intensity or occupational conditions. EM residents who can quickly adapt to the current work tempo and intensity may not experience fatigue. The leading causes of fatigue are the lack of sleep required for rest and the deterioration of physicians' psychological well-being.

EM residents who have been diagnosed with depression in their medical history and who already feel burnout should be identified. Supporting them with support and mentoring programs and providing access to psychological counseling services will reduce their fatigue levels. In addition, appropriate sleep time and sleep pattern planning will decrease fatigue levels.

Future research should include objective/clinical measurements of all family, social, and work–life factors, including all sociodemographic variables of EM residents. Longitudinal studies illuminating the temporal relationship between these variables will also help advance the field.

Author contribution statement
AB: Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, and writing – review and editing.

Conflicts of interest
None Declared.

Ethical approval
The Hacettepe University Ethics Committee granted ethical approval with decision number 2023/06-34 on November 7, 2023.

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