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# Sleep quality and daytime sleepiness among Polish anaesthesiologists and intensivists

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ABSTRACT

*Purpose:* We aimed to investigate sleep quality (SQ), daytime sleepiness (DS), and their relation with subject- and work-related factors among Polish anaesthesiologists.
*Methods:* The study group comprised 786 anaesthesiologists. The Sleep Quality Scale (SQS) was applied in order to assess SQ, while excessive DS was evaluated using the Epworth Sleepiness Scale (ESS).
*Results:* The median score on the SQS was 31 (IQR 27–35) points. The median score on the ESS was 17 (IQR 13–20) points, with mild-to-moderate excessive DS found in 260 (33.1%) and severe excessive DS among 478 (60.8%) of those surveyed. Worse SQ was found in females; smokers; those who suffered from any chronic diseases; those who were receiving medication interfering with sleeping habits; those who were unsatisfied with their sleep; those who had a greater number of night shifts; and those who had a lower number of non-working days. A detrimental sleepiness pattern was determined by one's advanced age, the presence of any chronic diseases and lower satisfaction with one's sleep quantity.
*Conclusion:* Poor SQ and excessive DS are frequently occurring phenomena. Since sleep disturbances are also related to the nature of their profession, the problem could be reduced by introducing organisational changes at work.



## 1. Introduction

Sleep is an important physiological process of the body and mind [1]. In recent years, much attention has been focused both on the quality of care and the quality of patient's environment in the intensive care unit (ICU) setting. It has been confirmed that both sleep quality and quantity are severely reduced in critically ill patients, with the long-lasting risk of adverse consequences, including increased morbidity and mortality [2,3]. Therefore, several multi-faced pharmacological and non-pharmacological interventions have been suggested to promote sleep health [2,3]. While much focus falls on strategies to reduce unnecessary harm to the patient, little is still known about sleep behaviours of the personnel working in this specific environment [4-6].

The rising burden of work triggering mental fatigue and physical exhaustion reduces the possibility of appropriate sleep recovery and regeneration among ICU specialists. This, in turn, leads to compromised vigilance and memory, slower reactions, and impaired decision-making [7]. Sleep disturbances and excessive daytime sleepiness are associated with worse performance at work and an increased risk of medical errors [8]. Sleep deficiency is also associated with a reduced quality of life, a predisposition to metabolic syndrome, and coronary heart disease [9].

The aim of our study was to investigate sleep quality, daytime sleepiness, and their relationship with subject- and work-related factors among Polish anaesthesiologists and intensivists.

## 2. Material and methods

### 2.1. Participants

All Polish anaesthesiologists and intensivists registered in an electronic database of the Polish Society of Anaesthesiology and Intensive Therapy were invited by e-mail to participate in our study. The invitation, including the aim of the study, and an activation link were sent twice; in December 2017 and January 2018, with a 4-week gap, to a number of approximately 2800 persons. Due to the anonymous and non-interventional nature of this project, the approval of the university's ethics committee was not required. The responses were

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automatically recorded. The study group consisted of 786 participants (i.e. about 28% of current active members of the society), representing about 12% of working Polish anaesthesiologists and intensivists (according to current data provided by the Polish Chamber of Physicians and Dentists, approx. 7350 anaesthesiologists are registered in Poland, including 6800 active practitioners).

### 2.2. Questionnaire

Our cross-sectional study was based on an electronic questionnaire comprising three parts.

The first set of questions was focused on the following: demographics (age, gender); work-related issues (i.e. trainee/specialist position; number of working years in their profession; number of working hours in the previous month; number of night shifts in the previous month; number of days off in the previous month); comorbidities; received medications; and some other conditions with a possible impact on sleep quality or quantity (i.e. number of hours of sleep after a night shift; medication influencing sleep, including energizers; a smoking habit with the number of pack-years; a drinking habit with the number of units per week).

The second set of questions was strictly related to sleep behaviours, while applying the Sleep Quality Scale (SQS) [10]. The SQS is a proprietary and validated tool, based on diagnostic criteria of sleep disorders recognised by the Diagnostic and Statistical Manual of Mental Disorders (4th edition). It consists of 14 questions, rated on a 4-point scale (1–4). The higher the final score achieved, the worse sleep quality observed. This section was preceded by questions about self-perceived sleep disturbances and personal satisfaction with one's sleep quality and quantity.

The third set of questions measured excessive daytime sleepiness using the Epworth Sleepiness Scale (ESS) [11]. This tool is frequently applied for the subjective assessment of the probability of dozing off or falling asleep in various everyday life situations. The ESS consists of 8 questions. Respondents are asked to rate them on a 4-point scale (0–3). The final score ranges from 0 to 24 and is positively correlated with the intensity of daytime sleepiness. Values of 0–10 points are considered normal, 11–15 points indicate mild-to-moderate excessive daytime sleepiness while those of 16+ indicate severe excessive daytime sleepiness.

### 2.3. Statistical analysis

Statistical analysis was performed using licensed MedCalc v.16.1 (MedCalc Software bvba, Ostend, Belgium) software. Quantitative variables were presented as mean and standard deviations (those normally distributed), or median and interquartile ranges (IQR, i.e. 25pc-75pc) (skewed), whereas qualitative variables were depicted as crude values and/or percentage values. All continuous variables were tested for normal distribution using the Shapiro-Wilk test. Between-group differences for continuous variables were assessed using Student's t-test or the Kruskal-Wallis test, while for categorical variables the Chi-squared test was applied. Correlation was assessed using Pearson's r linear correlation coefficient or Spearman's rank correlation coefficient. Variables with a 'p' value $< 0.1$ in bivariate comparisons were consecutively subjected to a multiple regression model. Coefficients of regression with their standard errors were subsequently estimated. A p-value of $< 0.05$ was considered statistically significant in the final statistical model.

## 3. Results

### 3.1. Study group characteristics and sleep behaviours

The study group comprised 347 (44%) males and 439 (56%) females, with a median age of 42 (IQR 34 to 51) years. There were 171 (22%) trainees and 615 (78%) specialists. The median duration of work experience was 15 (IQR 8 to 25) years. A total of 202 (32%) persons suffered from a chronic disease (Table 1). Moreover, 90 (12%) persons were active smokers with a median number of 10 pack-years (IQR 4 to 20).

The median number of working hours in the previous month was 250 (IQR 200 to 300). The median number of night shifts in the last month was 7 (IQR 5 to 8). The median number of days out of work was 7 (IQR 5 to 10).

A total of 561 (72%) persons were not satisfied with their sleep quantity while 386 (49%) subjects were not satisfied with their sleep quality. In addition, 44 (6%) subjects were in receipt of medications interfering with their sleeping habits. Moreover, 135 (17%) participants declared drinking energizers regularly while 226 (29%) subjects declared drinking alcohol before going to sleep, with a median number of 3 (IQR 2 to 6) units per week.

### 3.2. Questionnaire findings

The median score on the SQS was 31 (IQR 27 to 35) points. The median score on the ESS was 17 (IQR 13 to 20) points. Referential ESS values were found in 48 (6.1%), mild-to-moderate excessive daytime sleepiness in 260 (33.1%) and severe excessive daytime sleepiness in 478 (60.8%) of those surveyed. There was positive correlation between the SQS and ESS scores ($R = 0.400$, $p < 0.01$).

Higher SQS scores were found for the following: females [median 32 (IQR 28 to 36) vs. median 31 (IQR 27 to 34), $p = 0.005$]; those suffering from any chronic disease [median 32 (IQR 28.5 to 37) vs. 31 (IQR 27 to 35), $p = 0.002$]; those who were smokers [median 35 (IQR 31 to 40) vs. median 31 (IQR 27 to 35), $p < 0.0001$]; those in receipt of medication interfering with sleeping habits [median 35 (IQR 32 to 40.5) vs. median 31 (IQR 27 to 35), $p = 0.0002$]; and those who were unsatisfied with the amount of sleep they were receiving [median 33 (IQR 29 to 36) vs. median 27 (IQR 24 to 31), $p < 0.0001$] or its quality [median 34 (IQR 31 to 38) vs. median 28 (IQR 25 to 32), $p < 0.0001$]. There was statistically significant correlation between the SQS and the number of working hours ($R = 0.157$, $p < 0.01$), the number of night shifts ($R = 0.129$, $p < 0.01$), and the number of non-working days ($R = -0.174$, $p < 0.01$). Those who had worked night shifts in the previous month had a higher SQS score [median 32 (IQR 27 to 36) vs. median 29 (IQR 26 to 33), $p = 0.02$]. By multivariate analysis, we verified that almost all variables, apart from the number of working hours in the previous month and possessing a habit of drinking energizers, independently influenced the SQS score (Table 2).

Participants with severe excessive daytime sleepiness (i.e. ESS > 15) were younger than subjects with mild-to-moderate excessive daytime sleepiness [median 40 (IQR 34 to 50) vs. median 44 (IQR 36 to 52)

**Table 1**
Comorbidities.

| Variable | Value |
|---|---|
| Arterial hypertension | 102 |
| Thyroid gland disease (any) | 58 |
| Asthma, allergy (any) | 36 |
| Other chronic diseases of bones and joints (any) | 18 |
| Other chronic heart diseases (any) | 14 |
| Coronary artery disease | 10 |
| Diabetes (any type) | 10 |
| Other metabolic disease (any) | 9 |
| Psychiatric or psychosomatic disorders (any) | 8 |
| Osteoarthritis | 7 |
| Other gastrointestinal chronic disease (any) | 6 |
| Other pulmonary disease (any) | 5 |
| Gastro-oesophageal reflux disease | 5 |
| Obesity | 3 |
| Irritable bowel syndrome | 3 |
| Chronic obstructive pulmonary disease | 1 |
| Peptic ulcer disease | 1 |
| Other chronic diseases (any) | 26 |

**Table 2**
Determinants of sleep quality scale score in multiple regression.

| Independent variable | Coefficient of regression ± standard error | $R_{partial}$ | P |
|---|---|---|---|
| Any chronic disease (1 = no / 2 = yes) | 0.92 ± 0.38 | 0.09 | 0.02 |
| Satisfaction with sleep quantity (1 = no, 2 = yes) | −2.99 ± 0.41 | −0.25 | <0.001 |
| Satisfaction with sleep quality (1 = no, 2 = yes) | −4.67 ± 0.37 | −0.41 | <0.001 |
| Smoking habit (1 = no / 2 = yes) | 3.67 ± 0.55 | 0.23 | <0.001 |
| Any medications interfering with sleeping habits (1 = no / 2 = yes) | 2.49 ± 0.76 | 0.12 | 0.001 |
| Gender (1 = female / 2 = male) | −1.15 ± 0.36 | −0.12 | 0.001 |
| Number of non-working days in the previous month | −0.11 ± 0.05 | −0.08 | 0.02 |
| Number of night shifts in the previous month | 0.23 ± 0.06 | 0.15 | <0.001 |

years, p = 0.01], with no difference compared with those with normal ESS findings [median 43 (IQR 36 to 52) years]. Gender distribution differed among ESS classes, while daytime sleepiness was more frequent in females (p = 0.06). Resident doctors more frequently had severe excessive daytime sleepiness compared with specialists (68.4% vs. 58.7%) and less frequently had a normal ESS score (3.5% vs. 6.8%) (p = 0r.05). Accordingly, subjects with severe excessive daytime sleepiness were characterised by possessing fewer years of work experience than those with mild-to-moderate excessive sleepiness [median 13 (IQR 7 to 25) vs. median 18 (IQR 10 to 26) years, p = 0.01], with no difference compared with doctors with normal ESS findings [median 16 (IQR 10 to 25) years]. There was a trend for more deleterious sleepiness pattern among those surveyed who had declared more working hours (p = 0.06) and fewer non-working days (p = 0.08) in the previous month. Subjects who had worked night shifts in the previous month more frequently had severe excessive daytime sleepiness (61.4% vs. 44.8%) and less frequently had a normal ESS score (5.7% vs. 17.2%) (p = 0.01). Participants who declared any chronic disease more frequently had severe excessive daytime sleepiness (65.1% vs. 58.8%) and less frequently had a normal ESS score (3.6% vs. 7.3%) (p = 0.03). Those who drank energizers also more frequently had severe excessive daytime sleepiness (69.6% vs. 59%) and less frequently had a normal ESS score (3% vs. 6.8%) (p = 0.01). Finally, those who were dissatisfied with their sleep quantity or quality had more deleterious sleepiness pattern shown in the ESS (p < 0.01 for both). In a multivariate analysis, we verified that the pattern of sleepiness as indicated by ESS classes was determined by one's age, the presence of chronic diseases and satisfaction with one's sleep quantity (Table 3).

## 4. Discussion

In this e-based survey we sought to determine the sleep quality and quantity of Polish anaesthesiologists. Chronic lack of sleep and fatigue are considered major factors that aggravate one's everyday functioning, both in one's professional and private activities [12]. Sleep deficit occurs when sleep is too short, is not compatible with one's chronobiology, or its quality is disturbed [1]. Unfortunately, the nature of anaesthesiologists' work may affect their sleep due to all the above reasons. To be more exact, although the specific population were anaesthesiologists, there is no reason to suppose that results would be different among similar medical professions. This suggests that the entire medical workforce is significantly sleep deprived and at risk of fatigue-related health problems of their own.

**Table 3**
Determinants of epworth sleepiness scale categories in multiple regression.

| Independent variable | Coefficient of regression ± standard error | $R_{partial}$ | P |
|---|---|---|---|
| Age (each 1 year) | −0.007 ± 0.002 | −0.12 | <0.001 |
| Any chronic disease (1 = no / 2 = yes) | 0.13 ± 0.05 | 0.09 | 0.006 |
| Satisfaction with sleep quantity (1 = no, 2 = yes) | −0.26 ± 0.05 | −0.20 | <0.001 |

It is estimated that about 80% of work-related accidents are related to fatigue and inattention, secondarily to sleep deficits [6,8,12]. Extended work shifts pose a substantial risk of motor vehicle crashes, near-miss incidents, and incidents involving involuntary sleeping [13]. Tiredness and sleep deprivation have a number of health-related consequences, including cardiovascular, metabolic and mental disorders, stress and burnout [9,12,14,15]. Poor sleep quality increases the risk of addiction to psychoactive substances, including alcohol, coffee, tobacco, energy drinks, and amphetamine [12], which raises alertness but makes it difficult to fall asleep and reach deep sleep phases, meaning that the architecture of sleep is disturbed [16,17]. These damaging effects may modify the connection between sleep habits and mortality [18]. Interestingly, factors affecting sleep have been investigated predominantly in the general population. However, as little is known about the specific nature of the work of the ICU professionals across Europe, and its relationship with sleep behaviours, the comparison of our findings is difficult.

Working time and its optimal layout influence the quality of one's sleep [4,6]. Many occupations, in which there is danger of committing a significant error, have been subject to detailed administrative regulations. Due to organisational reasons and staff shortages, the medical profession is often not subject to such strict standards as other professions (e.g. drivers, pilots, train drivers), despite the publication of a European Union Directive concerning the matter [19]. For example, over 40% of practising physicians in the US work >320 h per month [12]. A similar problem has been observed for years among Polish doctors performing on-call duties, regular duties at hospitals or having unusual working hours to compensate for low earnings. Possessing an excessive workload and working several jobs result in a deficit of free time and a limited number of sleeping hours [4,20]. These problems give rise to a discussion on optimising doctors' working time, bearing in mind the need to provide 24-h care for patients' safety [12,15].

Significant sleep disturbances are observed in clinicians working over four night shifts per month [4]. Insufficient rest-time between rotas may lead to cognitive dysfunction resulting in an increased risk of medical errors [4,12,14]. In their experimental study, researchers from Canada revealed that during prolonged continuous wakefulness of medical residents, clinical performance in the management of a simulated critically ill patient deteriorated [21]. Landrigan et al. found that eliminating extended work shifts and reducing the number of hours interns work per week can reduce serious medical errors in the ICU [22]. On the other hand, free-time is rarely spent on leisure while working-hours reduction results in only minor changes of lifestyle [20]. A discussion about the possible harm due to sleep disturbances of medical personnel and its clinically related consequences should be conducted during standard journal club sessions, which are regarded as highly effective tools for one's continued medical education [23].

One should bear in mind the possible limitations of this study. First of all, our final analysis involved only 12% of anaesthesiologists in Poland. Indeed, the low percentage of questionnaire returns could have influenced the results, which may not be representative of the entire population. We tried to mitigate this shortcoming by sending our electronic invitation twice to all practitioners registered by the society. Secondly, as the questionnaire was anonymous and self-completed by

the respondents, subjectivity affecting the responses is inevitable. Although much more accurate results would be obtained from a survey with the participation of a professional interviewer, in this case, reaching such a large population would be very expensive and rather unfeasible. Finally, only a limited number of the available determinants of sleeping behaviours were investigated. We focused mostly on those related to working conditions and those used in previous research in this field. However, the more complex series of questions implemented, the greater the aversion to filling in the questionnaire by the interviewees.

## 5. Conclusions

Poor sleep quality and excessive daytime sleepiness are frequently occurring phenomena among Polish anaesthesiologists. We may also assume that the entire medical workforce is significantly sleep deprived and at risk of fatigue-related health problems of their own. Because sleep disturbances are also related to the nature of their profession, they can be reduced by introducing organisational changes at work, including the proper distribution of rotas maintaining time for rest, the introduction of clear working time limits for all workplaces, as well as promoting the health benefits of leisure.

## Conflicts of interest

None.

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