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How do the officials sleep? The assessment of sleep of the public administration workers using objective and subjective methods

Abstract

Sleep impacts our functioning, both on a physical and mental level. This study aimed to assess the officials' sleep using objective (actigraphic examination) and subjective evalutation methods (self-administered questionnaire and sleep diary).

The analysis revealed that among the officials, sleep deprivation was common. The average actual sleep time in this group was 1-hour shorter than recommended. Officials holding managerial positions more frequently presented worse sleep outcomes affecting their sleep efficiency than lower-level office workers. Workplace stress was associated with reduced sleeping hours and household stress with more frequent night waking.

Keywords: official, sleep, sleep disorders, actigraphy.

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INTRODUCTION

Sleep remains one of the most underrated everyday activities of man's life. Not rarely, it is considered by many as an unproductive action we waste our time for. It is estimated that on average, every century circadian length of our sleep is becoming 1-2 hours shorter [1].

In practice, we usually start paying attention to sleep only when its lack begins to impact our daily functioning, causing, for instance, excessive sleepiness. Research clearly states sleep is essential for normal body functioning, influencing:

- hormonal and energy balance [2-5];
- memory processes and neuroplasticity [6,7];
- body's defense mechanisms [8-10];
- clearance of toxic solutes from the central nervous system [11];
- physiological results of stress [12,13].

A multidimensional impact of sleep on body functioning is unquestionable, not to mention numerous behavioral disorders rising due to sleep deprivation. Most frequently observed are impaired judgment, difficulty concentrating, fluency disorder, increased number of errors made, or even willing to take unnecessary risks [14]. The abovementioned disorders, affecting one's quality of life and effectiveness at work, constitute a serious problem for many professional groups. Most research investigating the impact of sleep disorders on mistakes and accidents at work concentrates on the professional drivers [15-17], shift workers [18,19], and medical professionals [19-23].

AIM

This paper aimed to assess the sleep parameters in a group of officials. For many

of them, a significant part of their daily work is associated with undertaking numerous decisions, affecting others' life. Moreover, for officials holding managerial positions, decision-making responsibility may constitute an additional stress source.

Sleep disorders are considered to be one of the symptoms of professional burnout – to which officials are prone at higher risk; therefore, it is crucial to conduct the research and assess this particular problem also in this population [24,25].

MATERIAL AND METHODS

The cross-selectional study was conducted on a group of 100 officials working full-time in the local governments as director/ head of department (11%), inspector (62%), and administrative worker: a specialist, referent, or administrative assistant (27%).

The Ethics Committee of the Medical University of Silesia approval was obtained (KNW/0022/KB1/112/I/17). Every study participant was acquainted with the study protocol: instructions regarding parameters to be collected and operating the sleep recorder were given.

Indications on how to fulfill a sleep diary and questionnaire were provided.

Inclusion criteria were: age > 18 years old and provision of written informed consent. Exclusion criteria included confirmed insomnia and/or other diagnosed sleep disorder, undergoing treatment due to the abovementioned conditions.

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The study consisted of two parts: the first was based on the objective examination using an actigraph, the second – on the subjective assessment of one's sleep.

An actigraphy is a safe, recognized, and applied worldwide method of modern scientific research. Despite its large potential and many benefits however, it is not widely used in Poland. The selection of this particular sleep recording method for this study was also dictated by the will to popularize the value of data deriving from such measurement.

Actigraphy is performed by placing on the participant's wrist of the non-dominant hand a motion/sleep recorder. For this study, an actigraph Motion Watch 1.2.5 of camNtech was used. Participants were asked to wear the recorder for three consecutive nights on the working days. They put the recorder on at bedtime and took it off after waking up. In the analysis, arithmetic means of parameters deriving from three measurements were used. Selected analyzed sleep parameters were presented in Table 1.

TABLE 1. Selected sleep parameters analyzed with Motion Watch 8.

Selected sleep parameters	Description	Unit of measurement
Assumed sleep	The total elapsed time between the 'Fell Asleep' and 'Woke Up' times.	minutes
Sleep latency	The time between 'Go to Bed' and 'Fell Asleep'.	minutes
Actual sleep time	The total time spent in sleep according to the epoch-by-epoch wake/sleep categorization.	minutes
Sleep efficiency	Actual sleep time expressed as a percentage of time in bed.	percentages
Fragmentation Index**	Fragmentation Index: The sum of the 'Mobile time' (%) and the 'Immobile bouts <=1min' (%).	percentages
Actual wake time	The total time spent in wake according to the epoch-by-epoch wake/sleep categorization.	minutes
Time in Bed	The total elapsed time between the 'Light Out' or 'Go to Bed' and 'Got p' times.	minutes

*Normal sleep latency in adults aged <65 years is <30 min [26].
**Indicates the degree of fragmentation of the sleep period. It is useful as sleep quality indicator

Authors' own elaboration based on the The Motion Watch User Guide, edition 1.2.5 [17].

Simultaneously, study participants were asked to keep a sleep diary and write down all the data related to their sleep, according to their subjective perception: time of their bed- and wake-up time. They also performed a self-assessment of their sleep quality, using 5-point Visual Analogue Scale (VAS) (where 1 meant very bad quality sleep, 2 – bad quality sleep, 3 – moderate quality sleep, 4 – good quality sleep, and 5 – very good quality sleep). The methodology of study using actigraph assumes using a sleep diary as a complementary method of assessment.

Moreover, participants were given a self-administered questionnaire consisting of the Epworth Sleepiness Scale, a tool to assess daytime sleepiness, and validated author SEN questionnaire with Sleep Quality Scale [28]. Participants were also asked about their demographic data, such as sex, age, the occupied position, worktime, workplace, and household stress level. Stress was assessed using 5-point VAS (where 1 meant a very low level of stress, 2 – low, 3 – moderate, 4 – high, and 5 – very high).

Data collected from the recorders was anonymized (individual codes were given) and uploaded to MotionWare 1.2.5. software, enabling its interpretation and analysis. It was then transferred to one study Excel database to correlate it with other study results – a diary and questionnaire results.

For the statistical analysis purposes, various tests were applied: the normality of the data, sex, and work-position were assessed using the Shapiro-Wilk test. To investigate whether there is a statistically significant difference depending on the particular work position, the Kruskal-Willis test was applied. Spearman's correlation coefficient was indicated to determine the correlation between sleep quality among the general study population and particular officials' cohorts. Statistical analysis was performed using STATISTICA program v. 13.36.0 (StatSoft, Cracow, Poland). P-value of 0.05 (p=0.05) was considered statistically significant.

RESULTS

The study group consisted of 100 officials; 87% were women. The mean age was 41 years (SD=9.9; range 23-64). Participant characteristics, including demographic data and work position, are presented in Table 2. The declared 40-hour working week (SD=3.1; min.35, max.55) implicated that for most of the officials (both inspectors and administrative workers), an 8-hour workday system was a dominant one. Working overtime was more frequently reported by managerial staff ($p<0.05$). Variables significantly associated with work position (age, worktime, workplace stress, sleep efficiency) were presented in Figure 1.

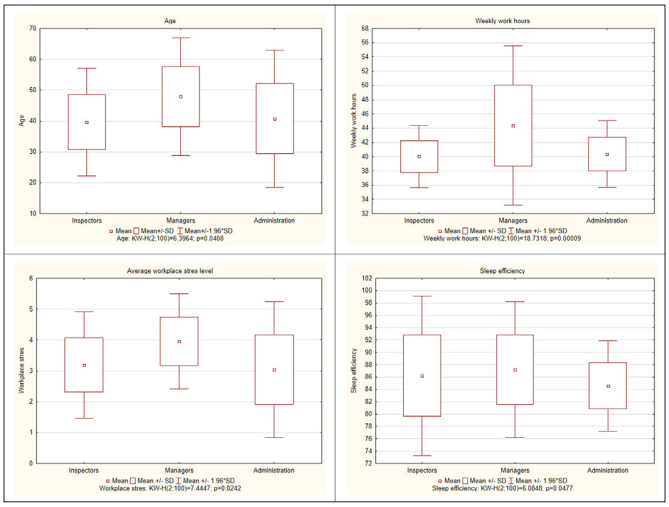

FIGURE 1. Comparison of significantly different distributions of values of measured parameters between officials in different work positions.

The mean assumed sleep time was 415 minutes (approx. 6.9 hr.; min. 266.7 min., max. 511.7 min.). Mean time in bed was 354 minutes (approx. 5.9 hr.), mean actual sleep time – 308 minutes (5.1 hr.). Mean sleep efficiency was 85.9%, mean fragmentation index – 23.3%. The mean actual wake time was 46 minutes (0.8 hr.). The average sleep latency was 18.6 minutes (0.3 hr.; min. 1 min., max 70 min.). Analyzed sleep parameters and participants' subjective perception of their sleep, taking into account their work position, are presented in Table 3.

The analysis revealed that participants' feelings regarding the quality of sleep differed depending on the occupied work position. Sleep self-assessment results, including work

TABLE 2. The distribution of study participants by gender and age taking into account the work position held.

	Women		Men		Age			
	n	% of analyzed group	n	% of analyzed group	Mean (years)	Minimum (years)	Maximum (years)	Std dev
Total population	87	87	23	23	40.88	23.00	64.00	9.90
Administration	25	25	2	2	40.78	23.00	63.00	11.32
Inspectors	55	55	7	7	39.68	27.00	62.00	8.87
Managers	7	7	4	4	47.91	36.00	64.00	9.71

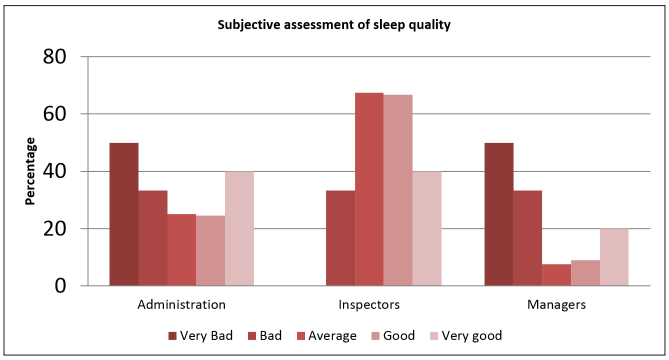

FIGURE 2. Membership of work groups into subjective assessment of sleep quality groups. Five-point Visual Analogue Scale (VAS).

position, were presented in Figure 2. Among officials holding managerial positions, a proportion of participants evaluating their sleep as good (8.9%) and very good (20%) was lower in comparison to the administrative workers (24.4% and 40%, respectively) and inspectors (66.7% and 40%, respectively). Differences were statistically significant ($p<0.05$).

In the study population, an average workplace stress level was higher than average household stress (3.2 points vs. 2 points, respectively, where 1 point – minimum, 5 points – maximum). Results were presented in Table 3.

Sleep time (both assumed and actual) and sleep fragmentation (length of sleep interruptions in minutes and sleep fragmentation index in %) were correlated with the greatest number of objective and subjective sleep parameters. The general study population's total values are presented in Figure 3, while Figures 4, 5 and 6, contain the spread and values of correlation coefficients in a particular cohort of professionals (administrative workers/inspectors/managers).

TABLE 3. Summary of measurement data in total study group and in terms of the work position held.

Variable	Total population n=100				Administration n=27				Inspectors n=62				Managers n=11			
	Mean	Minimum	Maximum	Std dev.	Mean	Minimum	Maximum	Std dev.	Mean	Minimum	Maximum	Std dev.	Mean	Minimum	Maximum	Std dev.
*Weekly work hours	40.58	35.00	55.00	3.10	40.37	35.00	50.00	2.37	40.00	35.00	50.00	2.22	44.36	35.00	55.00	5.70
*Average workplace stress level in 5-point scale (VAS)	3.24	1.00	5.00	0.97	3.04	1.13	1.00	5.00	3,19	0.88	1.00	5.00	3.95	0.79	3.00	5.00
*Average household stress level in 5-point point scale (VAS)	1.99	1.00	5.00	1.12	1.81	1.08	1.00	4.00	2.06	1.14	1.00	5.00	1.95	1.15	1.00	4.50
***Average sleep quality in 5-point scale (VAS)	3.60	1.33	5.00	0.73	3.62	1.33	5.00	0.87	3.62	2.33	5.00	0.59	3.45	1.33	5.00	1.10
**Assumed sleep time (minutes)	415.00	266.67	511.67	43.65	406.99	311.67	500.00	43.20	415.59	266.67	511.67	45.52	431.30	391.67	484.67	30.01
/*Average latency (minutes)	18.16	1.00	70.00	14.43	18.47	1.00	70.00	16.41	18.30	2.00	66.67	13.24	16.64	1.00	58.33	16.95
**Time in bed	354.77	229.00	446.00	41.21	348.44	274.00	431.00	39.16	356.77	229.00	446.00	41.97	359.00	291.00	420.00	43.90
**Actual wake time (minutes)	46.27	14.00	126.00	18.36	46.23	21.00	97.00	15.10	46.12	14.00	126.00	19.68	47.21	20.00	89.00	19.56
**Sleep efficiency (percentages)	85.88	48.70	98.80	5.86	84.56	75.00	91.10	3.74	86.23	48.70	98.80	6.58	87.19	74.70	93.60	5.62
**Actual sleep time (minutes)	308.45	170.00	413.00	41.37	304.15	230.00	380.00	41.54	311.02	170.00	413.00	42.87	304.55	249.00	356.00	33.68
**Fragmentation index (percentages)	23.26	4.60	58.60	9.28	24,12	8.40	44.00	9.01	22.82	4.60	58.60	9.09	23.67	14.40	50.80	11.61

* data from questionnaire, ** data from the recorder, *** data from sleep diary. In case latency value was not detected by the recorder, data was taken from sleep diary

TABLE 4. The values of the Spearman's rank correlation coefficients between the parameters measured in the entire study group. Statistically significant differences (p<0.05) are shown in red.

Total study population										
Variable	Workplace stress	Household stress	Assumed sleep time	Sleep quality	Sleep latency	Time in bed	Actual wake time	Sleep efficiency	Actual sleep time	Fragmentation index
Workplace stress	1.00	0.09	0.05	-0.25	0.00	-0.01	-0.01	0.06	-0.09	-0.01
Household stress	0.09	1.00	0.06	-0.11	0.05	0.15	0.20	-0.10	0.07	0.18
Assumed sleep time	0.05	0.06	1.00	-0.24	0.41	0.63	0.18	-0.04	0.54	0.05
Sleep quality	-0.25	-0.11	-0.24	1.00	-0.19	-0.14	-0.07	0.02	-0.11	-0.16
Sleep latency	0.00	0.05	0.41	-0.19	1.00	0.16	0.07	-0.12	0.17	0.10
Time in bed	-0.01	0.15	0.63	-0.14	0.16	1.00	0.24	0.00	0.81	-0.06
Actual wake time	-0.01	0.20	0.18	-0.07	0.07	0.24	1.00	-0.79	-0.10	0.57
Sleep efficiency	0.06	-0.10	-0.04	0.02	-0.12	0.00	-0.79	1.00	0.34	-0.62
Actual sleep time	-0.09	0.07	0.54	-0.11	0.17	0.81	-0.10	0.34	1.00	-0.26
Fragmentation index	-0.01	0.18	0.05	-0.16	0.10	-0.06	0.57	-0.62	-0.26	1.00

TABLE 5. The scatterplot and the values of the Spearman's rank correlation coefficients between the parameters measured in the administration worker group. Statistically significant differences (p<0.05) are shown in red.

Administration										
Variable	Workplace stress	Household stress	Assumed sleep time	Sleep quality	Sleep latency	Time in bed	Actual wake time	Sleep efficiency	Actual sleep time	Fragmentation index
Workplace stress	1.00	0.15	0.14	-0.47	0.37	0.04	-0.01	-0.09	-0.08	0.07
Household stress	0.15	1.00	-0.03	0.01	-0.16	-0.10	-0.05	-0.05	-0.04	0.09
Assumed sleep time	0.14	-0.03	1.00	-0.15	0.65	0.73	-0.05	-0.04	0.76	-0.07
Sleep quality	-0.47	0.01	-0.15	1.00	-0.19	-0.04	-0.07	0.24	0.08	-0.18
Sleep latency	0.37	-0.16	0.65	-0.19	1.00	0.36	0.04	-0.31	0.35	0.14
Time in bed	0.04	-0.10	0.73	-0.04	0.36	1.00	0.02	0.08	0.88	-0.43
Actual wake time	-0.01	-0.05	-0.05	-0.07	0.04	0.02	1.00	-0.57	-0.08	0.49
Sleep efficiency	-0.09	-0.05	-0.04	0.24	-0.31	0.08	-0.57	1.00	0.20	-0.61
Actual sleep time	-0.08	-0.04	0.76	0.08	0.35	0.88	-0.08	0.20	1.00	-0.49
Fragmentation index	0.07	0.09	-0.07	-0.18	0.14	-0.43	0.49	-0.61	-0.49	1.00

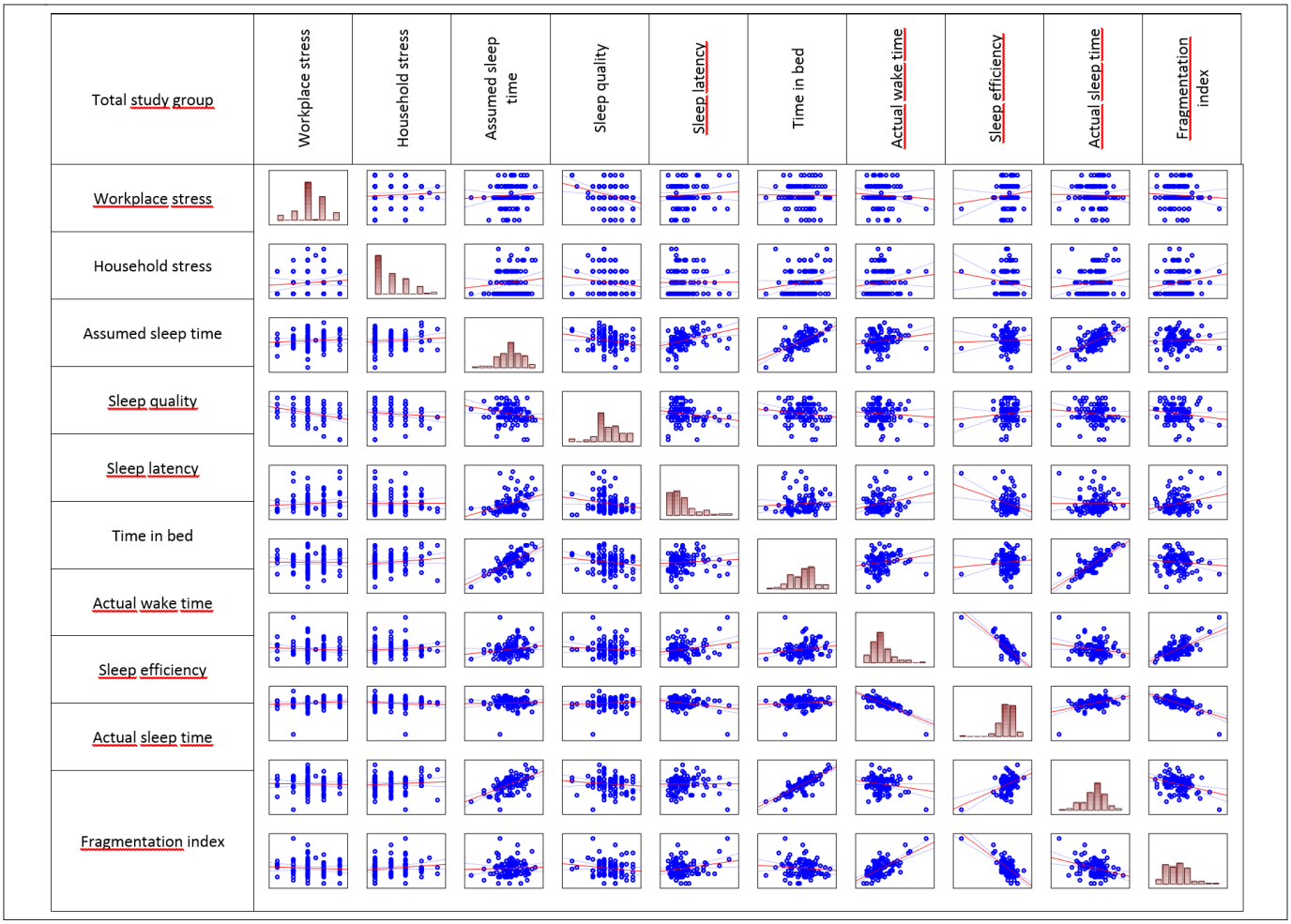

FIGURE 3. Scatterplots and regression charts (+/- 95% confidence interval) between the parameters measured in total study group.

TABLE 6. The scatterplot and the values of the Spearman's rank correlation coefficients between the parameters measured in the inspectors group. Statistically significant differences (p<0.05) are shown in red.

Inspectors										
Variable	Workplace stress	Household stress	Assumed sleep time	Sleep quality	Sleep latency	Time in bed	Actual wake time	Sleep efficiency	Actual sleep time	Fragmentation index
Workplace stress	1.00	0.07	-0.01	-0.13	-0.16	-0.09	-0.01	0.02	-0.12	-0.02
Household stress	0.07	1.00	0.15	-0.08	0.12	0.21	0.32	-0.23	0.11	0.23
Assumed sleep time	-0.01	0.15	1.00	-0.27	0.41	0.67	0.22	-0.02	0.55	0.09
Sleep quality	-0.13	-0.08	-0.27	1.00	-0.27	-0.08	-0.05	-0.07	-0.16	-0.14
Sleep latency	-0.16	0.12	0.41	-0.27	1.00	0.21	0.17	-0.12	0.18	0.12
Time in bed	-0.09	0.21	0.67	-0.08	0.21	1.00	0.33	-0.09	0.79	0.09
Actual wake time	-0.01	0.32	0.22	-0.05	0.17	0.33	1.00	-0.88	-0.11	0.59
Sleep efficiency	0.02	-0.23	-0.02	-0.07	-0.12	-0.09	-0.88	1.00	0.38	-0.60
Actual sleep time	-0.12	0.11	0.55	-0.16	0.18	0.79	-0.11	0.38	1.00	-0.19
Fragmentation index	0.07	0.09	-0.07	-0.18	0.14	-0.43	0.49	-0.61	-0.49	1.00

TABLE 7. The scatterplot and the values of the Spearman's rank correlation coefficients between the parameters measured in the managers group. Statistically significant differences (p<0.05) are shown in red.

Managers										
Variable	Workplace stress	Household stress	Assumed sleep time	Sleep quality	Sleep latency	Time in bed	Actual wake time	Sleep efficiency	Actual sleep time	Fragmentation index
Workplace stress	1.00	0.15	0.14	-0.47	0.37	0.04	-0.01	-0.09	-0.08	0.07
Household stress	0.15	1.00	-0.03	0.01	-0.16	-0.10	-0.05	-0.05	-0.04	0.09
Assumed sleep time	0.14	-0.03	1.00	-0.15	0.65	0.73	-0.05	-0.04	0.76	-0.07
Sleep quality	-0.47	0.01	-0.15	1.00	-0.19	-0.04	-0.07	0.24	0.08	-0.18
Sleep latency	0.37	-0.16	0.65	-0.19	1.00	0.36	0.04	-0.31	0.35	0.14
Time in bed	0.04	-0.10	0.73	-0.04	0.36	1.00	0.02	0.08	0.88	-0.43
Actual wake time	-0.01	-0.05	-0.05	-0.07	0.04	0.02	1.00	-0.57	-0.08	0.49
Sleep efficiency	-0.09	-0.05	-0.04	0.24	-0.31	0.08	-0.57	1.00	0.20	-0.61
Actual sleep time	-0.08	-0.04	0.76	0.08	0.35	0.88	-0.08	0.20	1.00	-0.49
Fragmentation index	0.07	0.09	-0.07	-0.18	0.14	-0.43	0.49	-0.61	-0.49	1.00

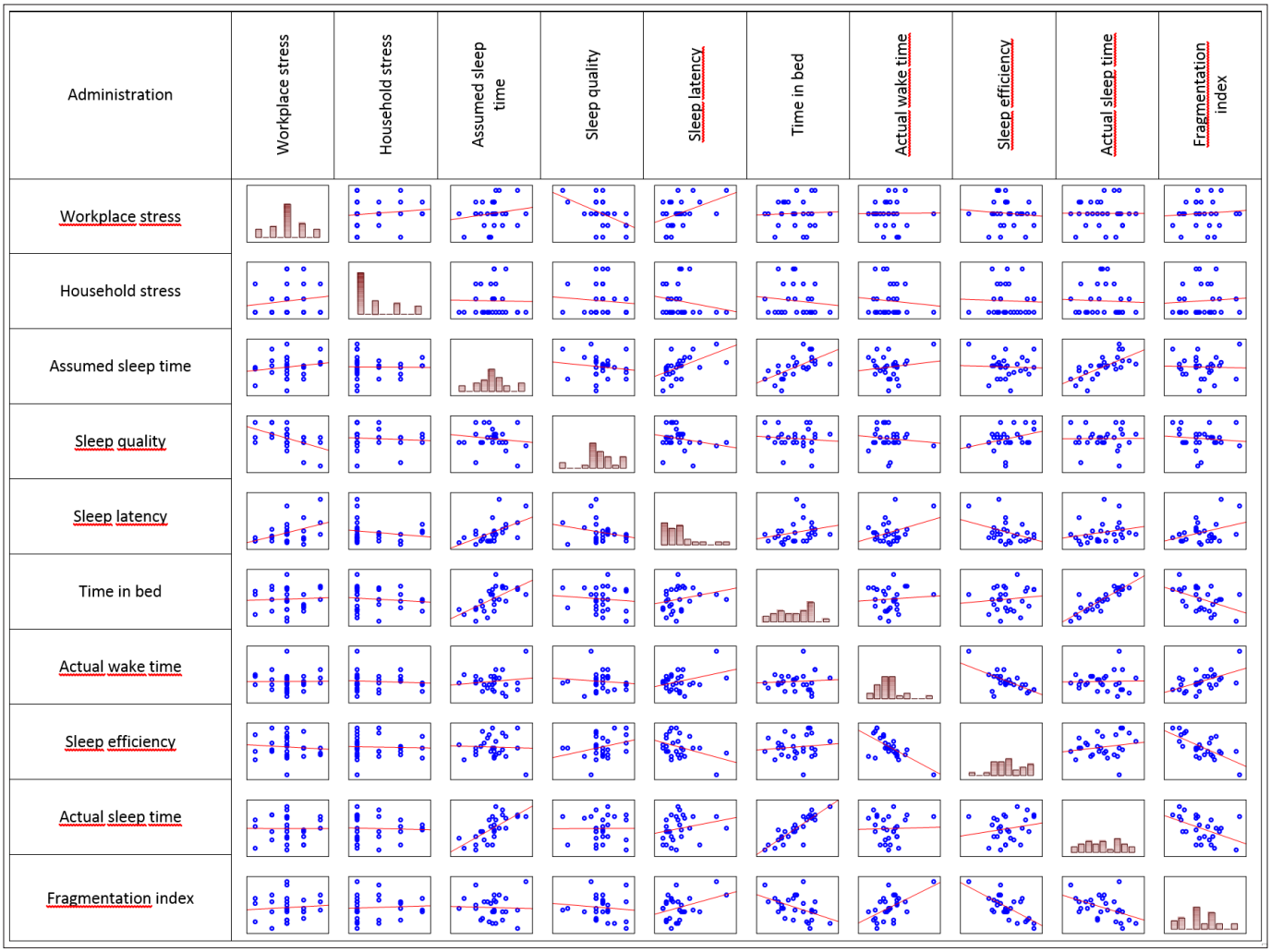

FIGURE 4. Scatterplots and regression charts (+/- 95% confidence interval) between the parameters measured in the administration group.

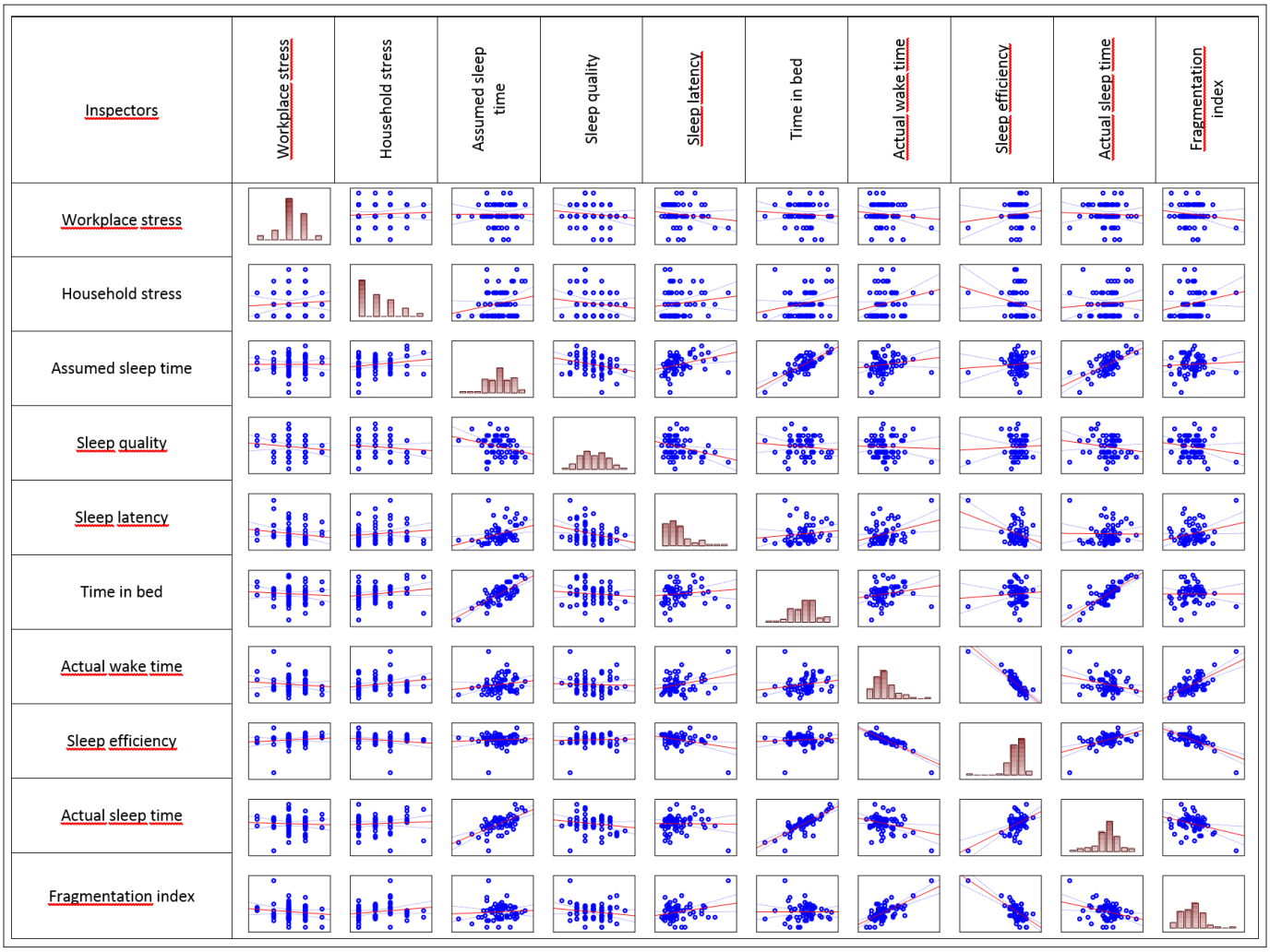

FIGURE 5. Scatterplots and regression charts (+/- 95% confidence interval) between the parameters measured in the inspectors' group.

DISCUSSION

Other authors' research indicates that sleeping disorders are more frequently observed among women [29,30]. This may be due to women's hormonal changes during puberty, pregnancy, and menopause [31-33]. In hereby research, the group of participants was strongly feminized. The lower-level officials more frequently declared will to participate in this study than those holding a managerial position. Meanwhile, managers both in the actigraphic examination and sleep self-assessment more often demonstrated worse sleep parameters, affecting sleep efficiency negatively.

Global research results indicate work has a significant impact on sleep and fatigue among officials holding positions associated with a high level of responsibility and stress [34]. In this paper, officials holding managerial positions were older than lower-level workers, worked more hours per week, experienced greater workplace stress, and had lower sleep efficiency. Average work time for study participants complied with the European Union working week limits of 48 hours (the same for all professions, except for health care workers) and Polish average weekly working time norms of 41.1 hours [35]. Besides, digitalization of administrative processes and officials' activities, although aimed to facilitate and improve the work, due to increased time spent in front of the computer, may adversely affect one's sleep [36].

The analysis of the objective actigraphic data collected in the hereby study revealed that results deriving from the first study night were often worse than two consecutive nights. Hence, the authors confirmed what is called "a first night effect" [36]. Despite being ensured that sleep recorders detect only one's movement and should be used only for sleep, some participants expressed their privacy concerns (e.g., the recorders' registers also sounds and/or images). All those concerns related to recorder' use, however, subsided after the first night.

Self-care methods, consisting in self-measurement of particular health and life parameters by an individual, are not perfect, however in certain situations – where there is no other option (e.g. access to health care services and/or specialists is hindered) or data is collected for cross-selectional epidemiology research, their application seems to be the most optimal.

Additional value is an opportunity to perform the actigraphic examination at home – individuals' safe and well-known environment, which may greatly impact the study results in sleep measurement. Actigraphy measurement can be performed independently or jointly with polysomnography (PSG) – a golden standard or the extension of sleep disorder diagnostics (especially in case of insomnia) within a framework of home monitoring [37,38].

According to the National Sleep Foundation, recommended circadian sleep time for adults aged 26-64 ranges from 7 to 9 hours. Simultaneously, the length of sleep shorter than 6 hours and longer than 10 hours is contraindicated. Recent reports of

FIGURE 6. Scatterplots and regression charts (+/- 95% confidence interval) between the parameters measured in the managers' group.

the America Sleep Poll 2020 indicate that nearly half of Americans (44%) declares daily sleepiness 2-4 times a week, caused by insufficient nighttime sleep [39].

Hereby research indicates that sleep deprivation is a common problem within the officials' group and that the average actual sleep time is nearly 1-hour shorter than recommended. Sleep efficiency above 85% suggests lower sleep quality due to young age – a normal value of this parameter ranges above 90%. How many hours one sleeps and how often one wakes up during the night – those are the factors that in subjective perception impact the most quality of one's sleep. This hypothesis was also confirmed in hereby research.

An interesting association was also found regarding stress. Participants' observation revealed that workplace stress was correlated with reducing sleep time hours, while household stress resulted in more frequent sleep interruptions and wake-ups. Hence, officials who consider their stress levels at work and home as high are at double risk for the sleep disorder. Among additional factors that may significantly impact higher stress levels and sleeping problems in managerial staff are risks of being influenced, hence the risk of corruption, prosecuted by the national law [40].

Assessment of sleep quality as a parameter indirectly associated with the type of work and occupied position could constitute a valuable tool in evaluating whether and what programs, including work hygiene, sleep hygiene, should be implemented among public administration officials [41].

CONCLUSIONS

Basing on the results of the performed research, it can be concluded:

Officials are at risk for developing sleeping disorders. Most of them, regardless of an occupied position, experience low quality of sleep and 1-hour reduction of sleep. Those holding managerial positions report worse sleep quality than lower-level workers, which may be associated with higher workplace stress levels. Officials experiencing a higher stress level at work and home sleep less and wake up more frequently during the night.

Giving the abovementioned facts, it is recommended to implement the prevention programs dedicated to proper sleep hygiene and stress in this professional group.

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