NATIONAL CENTER OF
PUBLIC HEALTH AND ANALYSES

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STRESS AND WORK ABILITY AMONG NURSING PROFESSIONALS IN HOSPITAL CARE

DISSERTATION SUMMARY

for acquiring a PhD degree

in the field of higher education: 7. "Health and Sports";
professional field: 7.1. "Medicine";
doctoral program: "Hygiene".

SCIENTIFIC SUPERVISOR:
Assoc. Prof. Katya Vangelova, PhD

SOFIA, 2024

The dissertation is presented on 141 standard pages and is illustrated with 30 figures and 31 tables. The bibliography includes 172 literary sources, 14 of which are in Cyrillic. In relation to the dissertation outline there are 6 publications.

CONTENTS:

LIST OF ABBREVIATIONS:

GHs	General hospitals
ICU	Intensive Care Unit
NP	Nursing professionals
WAI	Work Ability Index

I. INTRODUCTION

One of the main challenges of the 21st century globally and in the European Union is stress. Occupational stress is a set of negative physical and emotional reactions that occur when there is a mismatch between the demands of the job and the abilities, resources or needs of the worker. In the European Union, work-related stress is the second most common health problem after musculoskeletal disorders.

Hospital nursing professionals experience higher levels of stress than other workers due to the nature of their work tasks (1). Work in the healthcare is intensive and under high pressure, it is necessary to take life-saving decisions under time pressure, which increases the risk of medical errors. In addition, nursing professionals are also exposed to a number of psychosocial risks such as shift work, long working hours (2), threat of violence, emotional dissonance from patients, lack of support from colleagues and supervisors, which contribute to high physical and emotional exhaustion and a large number of psychosomatic complaints.

It is also important to objectify the assessment of stress, and such a reliable stress indicator is cortisol, which has a marked diurnal rhythm and is a main end product of the activity of the hypothalamic-pituitary-adrenal axis. Cortisol in saliva has advantages in occupational health studies, as it reflects the free fraction of the hormone in the blood and enables non-invasive monitoring of its concentrations in the dynamics of the working day.

Work ability is an indicator of occupational health, which is related to the emotional and physical state of workers and depends on their age (3). The Finnish Institute of Occupational Health has developed a Work Ability Index (4), it provides an opportunity to compare the results of different occupational groups and populations and develop measures to strengthen and improve work ability.

II. AIM AND TASKS

AIM

The aim of the study was to assess the stress and work ability and the occupational risk factors that determine them among hospital nursing professionals in Sofia.

TASKS

1. Subjective assessment of the working conditions among hospital nursing professionals in Sofia.
2. Monitoring of work-related psychosocial risks and resources among hospital nursing professionals in Sofia:
   - nurses with different occupational profiles;
   - midwives in different types of hospitals;
   - laboratory assistants in different types of hospitals.
3. Assessment of emotional and physical exhaustion, psychosomatic complaints and their determinants among hospital nursing professionals in Sofia.
   - nurses with different occupational profiles;
   - midwives in different types of hospitals;
   - laboratory assistants in different types of hospitals.
4. Assessment of stress through salivary cortisol levels in nurses with different occupational profiles during work.
5. Assessment of work ability and its determinants among hospital nursing professionals in Sofia.
   - nurses with different occupational profiles;
   - midwives in different types of hospitals;
   - laboratory assistants in different types of hospitals.

III. CONTINGENT AND METHODS

CONTINGENT

The current study comprised 1811 nursing professionals working in 19 hospitals in Sofia. The mean age of nursing professionals was 49.9 ± 10.5 years, ranging from 22 to 73 years, length of service was 27.5 ± 11.2 years. Nursing professionals were divided into three professional groups – *nurses, midwives* and *laboratory assistants*. The group of nurses was the largest (1427 participants or 78.8 %), followed by laboratory assistants (n = 208 or 11.5 %) and midwives (n = 176 or 9.7 %).

METHODS

- **Questionnaire**

The participating nursing professionals completed at their workplaces an anonymous questionnaire, which included information on demographic characteristics and a subjective assessment of working conditions. An assessment of the shift systems was carried out.

Stress was assessed with a questionnaire based on the short version of the German Instrument for stress-related job analyses in health professionals (5) including questions about the frequency of occurrence of occupational and social stressors and resources. The questionnaire we used tracked the presence instead of the frequency of the following stressors: emotional dissonance due to contact with patients and threat of violence; as well as the following resources: autonomy, professional development, social support from supervisors and colleagues, justice.

Questions also about the subjective feeling of working under high strain, the need of maintaining constant concentration during work were introduced, as well as work-related problems in the family. The subjective assessment of health status was rated on a 4-point scale as very good, good, fair and poor, the participants answered how often felt emotionally and physically exhausted during the last 4 weeks (6)

and completed a self-rated health questionnaire (14 health symptoms).

- **Cortisol research**

The study included a group of 48 hospital nurses of average age of 49.7 ± 11.5 years and length of service 26.8 ± 10.9 years from two university hospitals in Sofia, of which 16 worked in the intensive care unit (ICU) and 32 in clinical wards. The shift system in both groups was fast rotating with 12-hour shifts and forward rotation, day shifts start from 07:00 am to 07:00 pm and night shifts from 07:00 pm to 07:00 am. During the day shifts 10 of the ICU nurses were studied and 6 during the night shifts, and 16 nurses from the wards each during the day and night shifts. The studied groups did not have a significant difference in age, length of service and years working night shifts.

The concentration of saliva cortisol was followed on four hour intervals at the following time points: day shift – 07:00 am, 11:00 am, 03:00 pm and 07:00 pm, and night shift – 07:00 pm, 11:00 pm, 03:00 am and 07:00 am. Saliva samples were collected in polyethylene containers and stored at -20°C until sample determination. Cortisol was determined by ELISA kits (ELISA cortisol saliva EQ 6141-9601 S) of Euroimmun, Germany. At the sampling times, the participants assessed stress, sleepiness, and fatigue on a questionnaire. At the end of each work shift, the participants also filled out a questionnaire described by Dahlgren et al. (7), including seven questions about various stress symptoms from the past day.

- **Work Ability Index**

The Work Ability Index (WAI) is defined by seven scales, each of which is assessed using one or more questions:

- ✓ Self-ratings of current work ability compared with lifetime best;
- ✓ Self-ratings of work ability in relation to job demands;
- ✓ Number of current diseases diagnosed by a physician;

- ✓ Estimated work impairment due to diseases;
- ✓ Sick leave during the past year (12 months);
- ✓ Own prognosis of work ability two years from now;
- ✓ Mental resources.

The WAI was calculated by summing the points of each item, the final index score ranges from 7 to 49 points:

From 7 to 27 points – ***poor*** work ability. Restore work ability;

From 28 to 36 points – ***moderate*** work ability. Improve work ability;

From 37 to 43 points – ***good*** work ability. Support work ability;

From 44 to 49 points – ***excellent*** work ability. Maintain work ability.

- **Statistical analysis**

The data is entered and processed by IBM SPSS Statistics 23.0. ANOVA, $\chi 2$, stepwise multiple regression analysis and correlation analysis were applied. An analysis of repeated measurements with a significance level of $p<0.05$ was used to assess shift systems.

IV. RESULTS

- **Age structure and individual characteristics of the hospital nursing professionals.**

Hospital nursing professionals over the age of 51 had the largest share (48.8%), while young professionals under the age of 30 were only 5.9% (Figure 1). There was a statistically significant difference in the age structure between the different medical professionals (F = 15.851; p = 0.000). Midwives stood out, with the highest share of all nursing professionals under the age of 30 and over 51. The nurses over 51 years old had the largest share in the wards (54.3 %), as well as midwives working in the GHs (65.8 %).

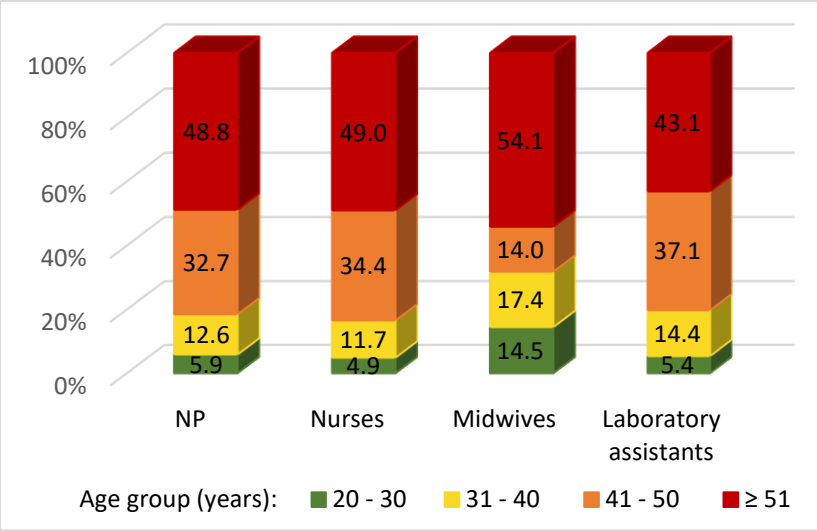

Figure 1: *Age characteristics of hospital nursing professionals (%).*

The length of service of the examined hospital nursing professionals was on average 27.5 ± 11.2 years, ranging from 1 to 50 years, almost all of them had a college degree or higher education, more than half were married. There were no significant differences in terms of length of service, education or family status between the different medical professions.

- **Subjective assessment of working conditions and the organization of shift work for the main professional groups of nursing professionals.**

Most hospital nursing professionals rated the working conditions in which they work as good (46.7 %) or fair (34.5 %) (Figure 2). There was a statistically significant difference in the subjective assessment of the working conditions between the different professions of medical specialists ($\chi 2 = 24.668$; $p = 0.000$). According to the regression analysis, with an increase in the number of night shifts per month, the subjective assessment of working conditions among nursing professionals worsened ($F = 12.692$; $p = 0.000$).

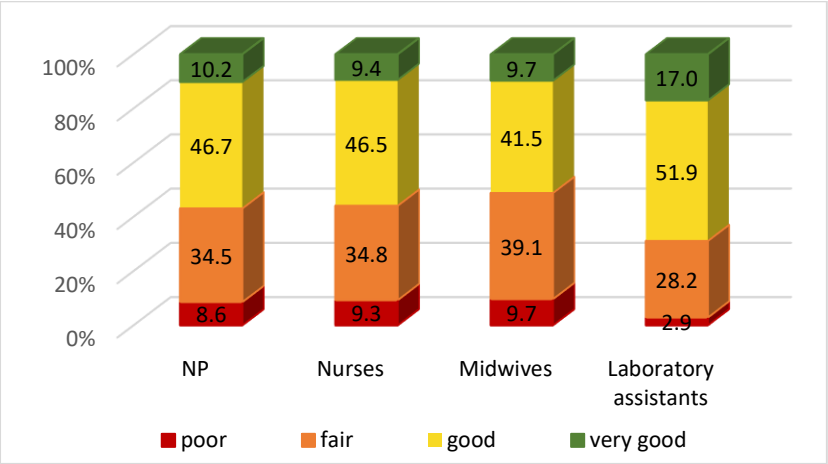

Figure 2: *Subjective assessment of working conditions of nursing professionals. (%).*

Shift work, night work, including 5 or more night shifts per month, and 12-hour shifts were common among the studied hospital nursing professionals (Table 1). These indicators were most common among midwives. 30.3 % of the studied specialists were working overtime more than 2 times per week, 27.8 % worked at multiple work places. Overtime together with multiple work places contributed to long working hours of more than 51 hours per week for 27 % of the nursing professionals, reaching 36.4 % for the midwives. Laboratory assistants were distinguished from other specialists by the lower

frequency of shift work, night work and 12-hour shifts, the largest share of them had a working week of 21 – 40 hours.

Table 1: The share of the studied hospital nursing professionals (%) working under the following time arrangement characteristics.

	NP n=1811	**Nurses n=1427 (78.8%)**	**Midwives n = 176 (9.7 %)**	**Laboratory assistants n = 208 (11.5 %)**	**χ^2; p**
Shift work	**70.0**	72.5	76.2	47.4	99.141; 0.000
Night work	**62.7**	65.6	78.0	28.7	141.824; 0.000
> 5 night shifts / month	**44.6**	46.7	65.5	11.2	141.824; 0.000
12 hour shifts	**52.9**	55.6	74.4	15.7	287.430; 0.000
Overtime > 2 days / week	**30.3**	33.4	16.6	20.9	37.294; 0.000
Multiple work places	**27.8**	27.8	34.9	21.7	8.136; 0.017
Working time:					
21–40 hours/week	**39.0**	38.4	23.5	57.9	45.108; 0.000
41–50 hours/week	**34.0**	34.2	40.1	26.4	
51–60 hours/week	**16.7**	16.8	22.8	10.1	
> 61 hours/week	**10.3**	10.6	13.6	5.6	

There was a statistically significant difference in the subjective assessment of working conditions between different groups of nurses ($\chi2=30.829$; $p=0.000$). 14.8% of nurses in the emergency / intensive sector defined the conditions under which they work as poor and 40.3% of them as fair, and this is also the group of nurses who most often worked shifts, including 12-hour shifts, put the most night work and had multiple work places. A greater deal of the surgery nurses (46.5%) worked overtime, followed by ward nurses (34.0%).

- **Psychosocial risks and resources in nursing professionals.**

Almost all nursing professionals felt under strain, they worked with a high tempo and constant concentration (Figure 3). More than 80 % of them felt emotional dissonance of working with patients and considered the payment unsatisfactory. Nearly half of nursing

professionals felt unsafe at their workplaces and did not have enough time for their patients because a lot of administrative duties more than 2 times per week. About 30% of nursing professionals had problems in the family due to work load, they had to make decisions without enough information at least 2 times per week and worked always under time pressure. 22% of nurses suffered reproach from patients or their relatives more than twice a week, while for midwives and laboratory assistants this happened not so often. Over 90% of hospital nursing professionals had social support from supervisors and colleagues and 87.6 % could influence the organization of their work. Most nursing professionals felt that professional development was encouraged and that work was evenly distributed among them.

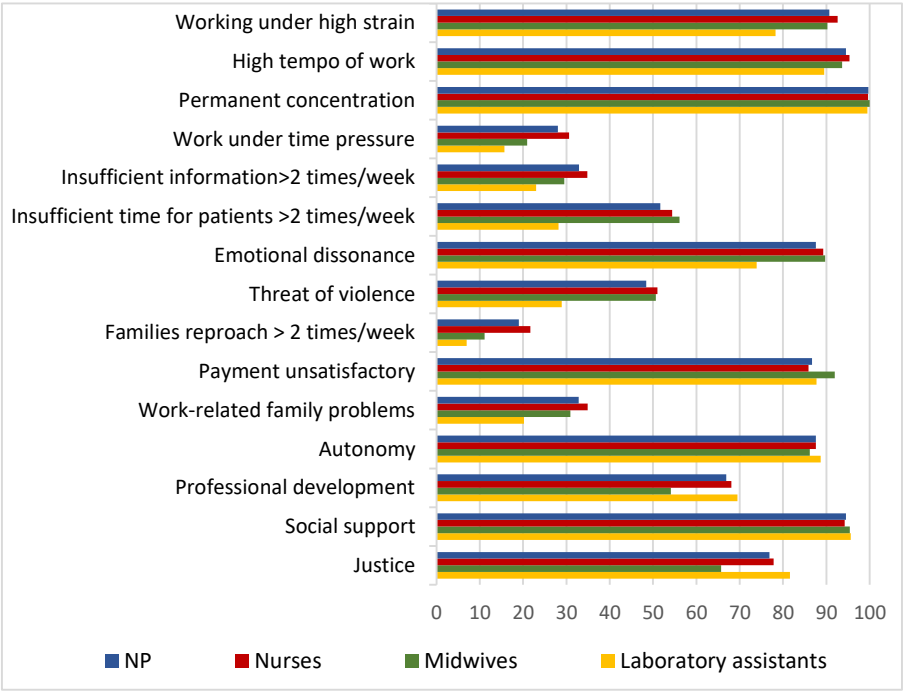

Figure 3: *Psychosocial stressors and resources in hospital nursing professionals (%).*

There was statistically significant difference in the ratings of psychosocial factors between the three employed groups. Nurses most often worked under high strain, with a high tempo of work, which led to problems in the family, under time pressure, making decisions

without having enough information, suffering the threat of violence and reproach from patients or their relatives. The nurses from emergency / intensive care unit had the highest values for these indicators. Midwives often did not have enough time for their patients due to administrative duties. On the other hand, laboratory assistants had the lowest values for all risk factors and the highest for resources – professional development, justice, autonomy and social support, although the latter two did not reach statistical significance. Laboratory assistants were rarely reproached by patients or their relatives, 28.9% of them felt a threat of violence; this was related to the nature of their work and their more limited contact with patients, compared to other nursing professionals.

- **Subjective assessment of health, emotional and mental exhaustion and psychosomatic complaints in nursing professionals.**

More than half of hospital nursing professionals rated their health as good and just over 30 % as satisfactory. The ratings for emotional and physical exhaustion were high, with the highest levels for the nurses. The reported number of health symptoms was the highest among midwives, followed by nurses and laboratory assistants, with the difference between groups of nursing professionals being within the trend.

The most frequent psychosomatic complaints (in over 70 % of the respondents) were anxiety and frequent fatigue, followed forgetting, back pain, sleep problems in over 60% of the participants. More than half of the nursing professionals reported limbs numbness, muscle and bone pain, dizziness and lack of mood. Complaints of quickly out of breath and apathy were the least frequent (Figure 4).

Emotional exhaustion, the main symptom of burnout syndrome, was determined by work-related problems in the family, work under high strain and time pressure, insufficient time for patients, fairness in the distribution of work tasks and emotional load, and for midwives of importance was also the length of service with night shifts. Physical exhaustion was related to the same factors plus the age of nursing professionals. The psychosomatic complaints were

influenced by problems in the family, time pressure, emotional dissonance with patients and their families and lack of justice.

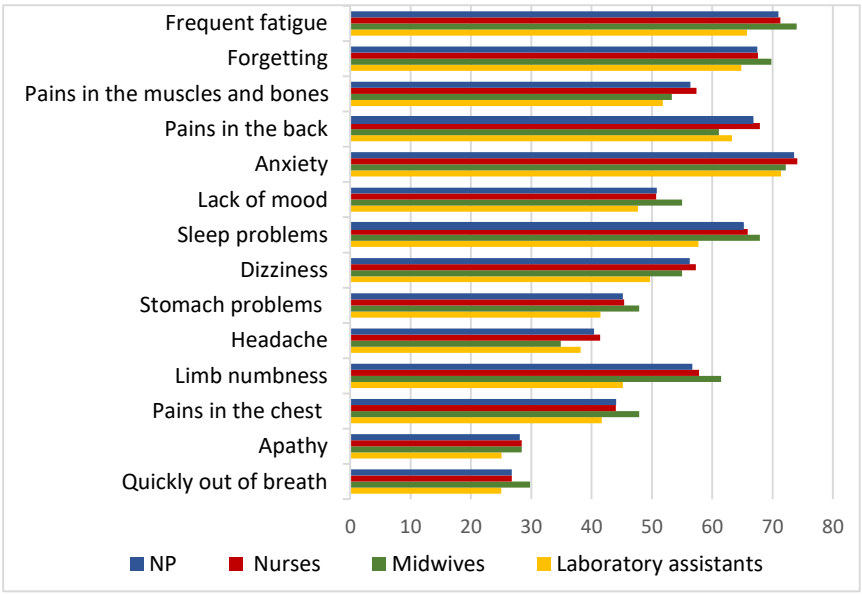

Figure 4: *Psychosomatic complaints in hospital nursing professionals (%).*

- **Assessment of stress through salivary cortisol levels in nurses with different occupational profiles.**

Our data showed that salivary cortisol in the studied nurses retained its typical diurnal pattern (F=23.878, p=0.000), with high morning levels declining during the day and reaching the lowest values in the evening (Figure 5). Cortisol levels in both groups of nurses were higher compared to reference values during both shifts. During the day shifts, cortisol levels in ICU nurses were significantly higher than those in the clinical ward nurses (F = 6.202, p = 0.027). The variation in cortisol levels in both groups was significant, especially in ICU nurses. During the night shift, salivary cortisol also maintained its diurnal rhythm (F = 5.480, p = 0.003), with no significant differences between the two groups of nurses, but again with a high variation in hormone levels in the morning, especially in ICU nurses.

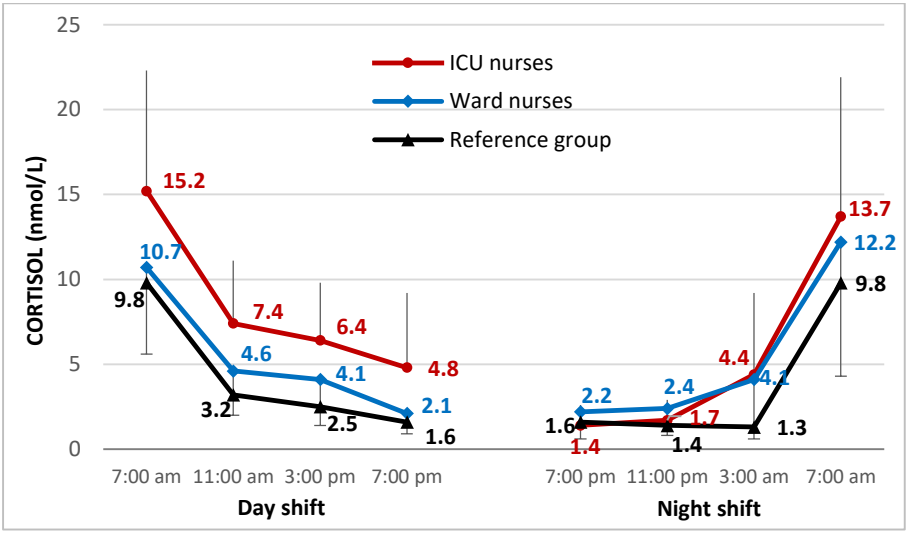

Figure 5: *Time-of-day levels of salivary cortisol during day and night shift in nurses in intensive care unit (ICU) and clinical wards.*

The self-rated stress was lower at the beginning of the shifts and gradually increased as the shifts progressed, with no significant differences between groups and shifts (Figure 6). Sleepiness increased as shifts progressed (F=15.089, p=0.001), with higher values during night shifts and peak values around 3:00 am, but without significant differences between the two groups (Figure 7). The self-rated fatigue was low at the beginning of the shifts and increased during work (F=52.123, p=0.000) with higher values during the night shifts, i.e. nurses felt more tired at night (Figure 8). No significant differences were found between the two groups, but the variation in values was greater in intensive care nurses.

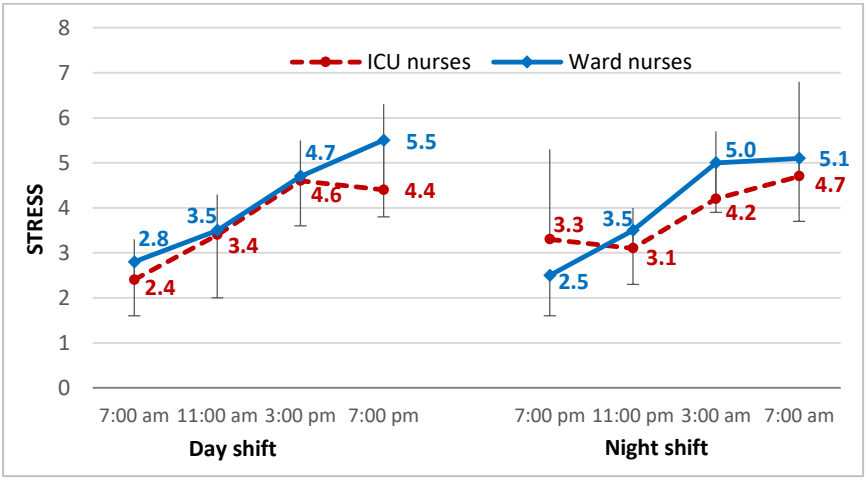

Figure 6: *Subjective assessment of stress during day and night shift in nurses in intensive care unit (ICU) and clinical wards (1 – very calm to 9 – very tense).*

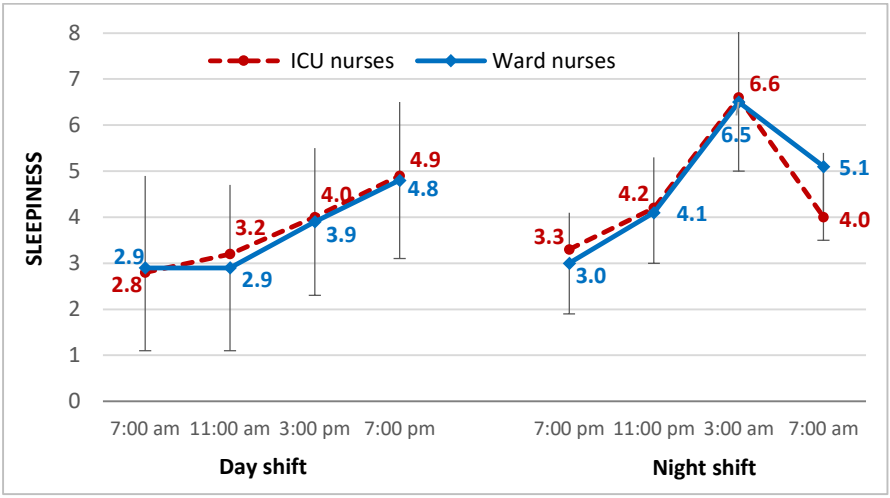

Figure 7: *Subjective assessment of sleepiness during day and night shift in nurses in intensive care unit (ICU) and clinical wards (1 – very alert to 9 – very sleepy).*

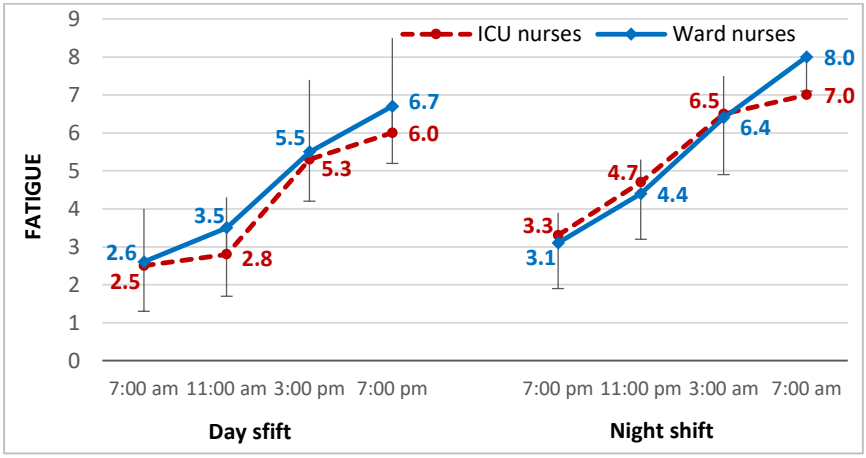

Figure 8: *Subjective assessment of fatigue during day and night shift in nurses in intensive care unit (ICU) and clinical wards (1 – fresh mood to 9 – very tired).*

Our data did not show significant difference between the reported stress symptoms at the end of work shifts, both when comparing day and night shifts, and when comparing the two groups. The nurses felt tense, irritated and very exhausted at the end of the shifts. They also considered that workload was high and that breaks during work were insufficient.

- **Assessment of working ability and its determinants in main groups of nursing professionals.**

The examined hospital nursing professionals had a high mean work ability index (WAI) of 39.3 ± 5.7, the highest was among laboratory assistants - 40.5 ± 5.4, followed by midwives and nurses, as the difference in mean WAI between different occupations reached statistical significance ($F = 4.994$; $p = 0.007$). The WAI differed among the four age groups ($F = 10.386$; $p = 0.000$) (Figure 9), being highest in age group 20 – 30 years (42.4 ± 4.7) and decreasing to 38.9 ± 5.6 at the age of more than 51 years. This tendency was also observed among nurses, who had an average WAI of 39.1 ± 5.9. Midwives had an average WAI of 40.0 ± 4.3, with its highest value at the age of 41-50

years, but the differences in the value of the index in different decades did not reach statistical significance. The group of laboratory assistants was distinguished by the highest average value of WAI - 40.5 ± 5.4 and the highest value of the index - 45.1 ± 2.6, which was in the decade of 20 – 30 years, a higher value of the index was also observed in the age 41 – 50 years than in the decade 31 – 40 (F = 2.685; p = 0.049).

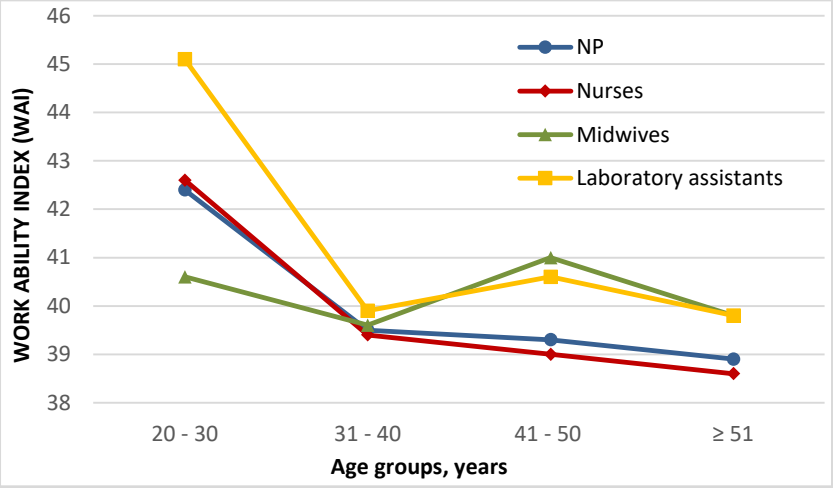

Figure 9: *Work Ability Index (WA)I in hospital nursing professionals by age groups.*

The data showed a high share of nursing professionals with good (46.6 %) and excellent (25.3 %) work ability, the results between the different professions reached statistical significance ($\chi 2 = 29.343$; $p = 0.000$).

The perception for good working conditions was positively related to WAI (Table 2). The nursing professionals working day or rotating shifts rated higher work ability in comparison to the ones working morning/afternoon shifts, the difference being within the trend, while shift length did not influence work ability. Nursing professionals who worked 5 or more night shifts per month (44.6 %) had a higher WAI compared to their colleagues who worked fewer night shifts per month. Working more than 61 hours/week was associated with considerable decrease in work ability. Good self-rated

health was positively related to WAI with high significance, while physical and emotional exhaustion negatively.

Table 2: *WAI in relation to self-rated working conditions, shift work, self-rated health, emotional and physical exhaustion in nursing professionals.*

Indexes		Share of NP, %	WAI ($\bar{x}$ ± SD)	F; p
Working conditions:	bad	8.5	37.8 ± 6.1	11.847; 0.000
	satisfactory	34.5	38.9 ± 5.6	
	good	46.7	39.4 ± 5.7	
	very good	10.3	41.6 ± 5.0	
Shift work:	day shift	30.0	39.3 ± 5.5	2.449; 0.062
	morning/afternoon shift	12.7	38.3 ± 6.4	
	rotating shift	57.3	39.5 ± 5.6	
Shift duration:	8-hour shift	26.0	38.9 ± 6.0	NS
	12-hour shift	53.0	39.5 ± 5.6	
	Other system	21.0	39.4 ± 5.6	
Night work:	0	37.3	38.8 ± 5.3	4.501; 0.004
	1-2 shifts/week	6.5	37.6 ± 6.6	
	3-4 shifts/week	11.6	38.6 ± 6.3	
	≥ 5 shifts/week	44.6	39.4 ± 5.6	
Working time:	21–40 hours/week	39.0	39.4 ± 5.6	7.538; 0.000
	41–50 hours/week	34.0	39.8 ± 5.3	
	51–60 hours/week	16.7	39.6 ± 5.8	
	> 61 hours/week	10.3	37.2 ± 6.7	
Self-rated health:	poor	1.0	31.3 ± 7.7	87.544; 0.000
	fair	32.3	36.7 ± 5.3	
	good	57.8	40.4 ± 5.2	
	very good	8.9	43.8 ± 4.7	
Emotional exhaustion:	never	12.3	42.6 ± 4.4	26.232; 0.000
	1-2 times/month	7.3	41.0 ± 5.4	
	several times/month	28.1	40.0 ± 5.2	
	often	52.3	38.1 ± 5.9	
Physical exhaustion:	never	9.6	42.4 ± 4.3	16.581; 0.000
	1-2 times/month	6.3	40.9 ± 5.8	
	several times/month	28.2	39.8 ± 5.1	
	often	55.9	38.4 ± 6.0	

Table 3 presents data on the scales of work ability, total and by group. Work ability compared to lifetime best was good for 86.9 % of nursing professionals, with a higher proportion in midwives and laboratory assistants. The work ability in relation to job demands was

estimated as high by 87.1 % of medical specialists, the highest among midwives. In general, the share of nursing professionals with diagnosed diseases was high, with 1-2 chronic diseases diagnosed in 26.4 % and 3 or more chronic diseases in 39.0 %, with no significant difference between groups of medical specialists. Over 50 % of nursing professionals considered that the diagnosed diseases did not affect their ability to work (or did not have a disease), and 38.6 % could work but had symptoms and sometimes had to slow the tempo. Despite the high proportion of diagnosed illnesses, 74.8 % of nursing professionals were not absent due to illness in the last year, 20.2 % were absent for up to 24 working days and 5.0 % – for more than 25 days. 82.8 % believed that they will certainly be able to carry the current job during the next two-year period, and this share was slightly but significantly higher among midwives ($\chi 2 = 10.686$; $p = 0.030$). About 65 % of nursing professionals had good mental resources, with the highest share again with being midwives.

Table 3: *Subjective estimate of nursing professionals of work ability scales, total and by professional groups, %.*

Indexes		NP	Nurses	Midwives	Laboratory assistants	F; p
WAI 1	Good current work ability compared with lifetime best	**86.9**	85.8	91.5	91.4	7.503; 0.001
WAI 2	Good work ability in relation to job demands	**87.1**	85.5	94.0	91.6	5.041; 0.007
WAI 3	No diagnosed diseases	**34.6**	34.4	34.3	36.5	NS
	1-2 diagnosed diseases	**26.4**	25.9	26.1	30.1	
	≥ 3 diagnosed diseases	**39.0**	39.7	39.6	33.4	
WAI 4	No influence on work ability / no disease	**57.9**	57.3	55.1	64.0	NS
	I can work, but it leads to symptoms and I have to slow the tempo	**38.6**	39.2	41.7	32.3	
	I have often to slow the tempo or work part time	**3.4**	3.3	3.2	3.7	
	Not able to work at all	**0.1**	0.2	0.0	0.0	

Indexes		NP	Nurses	Midwives	Laboratory assistants	F; p
WAI 5	No sickness absence	**74.8**	74.9	73.8	75.3	NS
	Absence up to 24 days	**20.2**	20.1	22.0	19.8	
	Absence of more than 25 days	**5.0**	5.0	4.2	4.9	
WAI 6	Prognosis of work ability in two years' period:					2.746; 0.064
	Relatively sure	**82.8**	81.4	89.2	87.0	
	Not sure	**13.9**	15.2	6.8	10.8	
	Probably not	**3.3**	3.3	4.1	2.2	
WAI 7	Good mental resources	**64.7**	62.9	72.3	70.5	4.909; 0.007

The regression analysis showed that WAI and its scales were determined by self-rated health (Table 4). WAI was also determined by work-related family problems, emotional exhaustion, social support, and length of service. The current workability compared with lifetime best was determined by work-related family problems, years working night shifts, and emotional exhaustion. On the other hand, the work ability in relation to job demands was also determined by education, physical exhaustion and the ability of nursing professionals to influence the organization of work. The subjective estimate of work impairment due to diseases was determined by emotional exhaustion, work-related family problems and length of service, while the number of diagnosed illnesses depended on the same indicators plus sleep problems and physical exhaustion. Social support, work-related family problems, self-rated health and working hours per week were key factors in the subjective prognosis of nursing professionals' ability to work in next two years. The mental resources were determined by health, emotional exhaustion, equal distribution of tasks, autonomy, criticism from patients and/or their relatives and career development.

Table 4: *Determinants of WAI and WAI dimensions among nursing professionals.*

Indexes	Determinants	β	T	p
WAI	Self-rated health	.348	13.776	.000
	Work-related family problems	-.175	-6.577	.000
	Emotional exhaustion	-.142	-5.402	.000
	Social support	.122	4.945	.000
	Length of service	-.094	-3.771	.000
r^2 = 26.20 %; F = 88.252; p = 0.000				
Current work ability compared with lifetime best (**WAI 1**)	Self-rated health	.227	8.695	.000
	Work-related family problems	-.125	-4.562	.000
	Years working night shifts	.111	4.334	.000
	Emotional exhaustion	-.118	-4.326	.000
r^2 = 11.60 %; F = 44.528; p = 0.000				
Work ability in relation to job demands (**WAI 2**)	Self-rated health	.260	10.955	.000
	Work-related family problems	-.136	-5.524	.000
	Education	.104	4.462	.000
	Physical exhaustion	-.107	-4.363	.000
	Autonomy	.099	4.229	.000
r^2 = 15.60 %; F = 57.768; p = 0.000				
Number of diagnosed diseases (**WAI 3**)	Self-rated health	.172	6.645	.000
	Length of service	-.187	-7.587	.000
	Sleep problems	-.106	-4.109	.000
	Emotional exhaustion	-.131	-4.246	.000
	Physical exhaustion	.076	2.472	.014
r^2 = 11.50 %; F = 39.610; p = 0.000				
Subjective estimate of work impairment due to diseases (**WAI 4**)	Self-rated health	.237	9.419	.000
	Emotional exhaustion	-.127	-4.860	.000
	Work-related family problems	-.128	-4.856	.000
	Length of service	-.124	-3.325	.000
r^2 = 13.70 %; F = 58.162; p = 0.000				
Sicknesses absence during the past year (**WAI 5**)	Self-rated health	.136	5.305	.000
r^2 = 1.80 %; F = 31.118; p = 0.000				
Own prognosis of work ability in two years' period (**WAI 6**)	Social support	.195	7.317	.000
	Work-related family problems	-.147	-5.416	.000
	Self-rated health	.126	4.757	.000
	Working hours/week	-.059	-2.216	.027
r^2 = 10.10 %; F = 37.195; p = 0.000				

Indexes	Determinants	β	T	p
Mental resources	Self-rated health	.218	9.032	.000
	Emotional exhaustion	-.141	-5.608	.000
	Justice	.103	4.017	.000
(**WAI 7**)	Autonomy	.105	4.347	.000
	Families reproach	-.106	-4.266	.000
	Professional development	.089	3.555	.000
r^2 = 17.10 %; F = 50.746; p = 0.000				

V. DISCUSSION

Nursing professionals over the age of 51 had the largest share (48.8 %), while young professionals under the age of 30 were only 5.9 %. This raised concern considering the risk to their health when performing night work and working in conditions of long working hours and stress, as well as in view of the future provision of the profession with qualified and reliable personnel.

The majority of nursing professionals worked in shifts, including night shifts, and half of them had 12-hours shifts. Previous research has shown that working a schedule with more night shifts per month and overtime contributed to disturbed sleep and fatigue in the study group of nurses (8). An increase in the number of night shifts is associated with sleep disturbance, while an increase in working hours increased fatigue.

46.7 % of nursing professionals defined the working conditions as good and 34.5 % as satisfactory, the subjective assessment of working conditions worsened with an increase in the number of night shifts. The frequencies of workplace stressors for nurses and midwives were close, while for laboratory assistants they were significantly lower (work under high strain, insufficient time for patients, emotional dissonance, threat of violence). About 90 % of the surveyed nurses and midwives felt under high strain, worked with constant concentration and high tempo and felt emotional dissonance of working with patients. More than 50 % of nurses and midwives felt frustration, for example lack of enough

time for patients due to lot of administrative duties. Studied nurses and midwives felt unsafe in their work places due to threat of violence; female nursing professionals who had contact with patients and worked rotating shifts were at increased risk of psychological and physical violence (9). More than 30 % of nurses worked always under time pressure and felt uncertainty, for example, they had to make decisions without enough information at least 2 times a week.

Over 65 % of studied nursing professionals rated their health as good or very good, with values showing no significant difference between the three professions. Our data confirmed the results of a study by Shtereva-Nikolova et al. (10), who found that 49.5 % of the specialists included in their study self-rated health as good, and 29.4 % as very good. Our data showed high level of emotional and physical exhaustion, highest among emergency / intensive care nurses. Determinants of emotional exhaustion in the studied group of nursing professionals were work under time pressure and high strain, unfair distribution of work tasks and emotional dissonance from patients, while for physical exhaustion – in addition the age of specialists. We guess that the established negative correlation between physical exhaustion and age was due to the limitation of physical activity in the elderly, the transition of a part of them to day work and limitation of working hours. High-strain work, low autonomy, and violence, in addition to effort-reward imbalances, weak organizational justice, lack of support, conflict, and long work hours, were associated with anxiety, stress, burnout, and depression (11).

Our data showed high number of psychosomatic complaints with the studied nurses, higher in comparison with that of physicians (2), followed during the study. The number of psychosomatic complaints was the highest with the ward nurses, followed by the emergency and intensive care unit nurses. The number of psychosomatic complains with the nurses was highly significantly related to the working hours per week, nurses working more hours had more psychosomatic complaints.

The study showed that the salivary cortisol retained its 24-hour rhythm in the studied nurses, but its values were higher, especially in ICU nurses. Our data are consistent with the results of a study by Karhula et al. (12) for higher cortisol levels in intensive care nurses taking care for critically ill patients in high-stress settings.

The subjective perception of stress increased with the progress of the shifts, but did not show a significant difference between groups and shifts in contrast to salivary cortisol levels, which is an objective indicator of stress. Thus, the subjective perception of stress did not correspond to the endocrine response, but it should be noted that the objective and subjective assessment of stress were high in both groups of nurses - in the intensive care unit and in the wards. The differences in cortisol levels were significant during day shifts, at the end of work day ICU nurses reported that they had more work than wards nurses, while after night shifts the ratings did not differ, but after both shifts showed very high workload and insufficient time for rest.

Subjective perception of sleepiness and fatigue increased with the progress of the shifts and were higher during night shifts, consistent with results of Di Muzio et al. (13) who found that night shifts were associated with significantly greater sleepiness and fatigue in nurses. Our data showed peak values of sleepiness in both groups around 03:00 am, which corresponds to the diurnal rhythm of the indicator. The subjective feeling of fatigue had the highest values at the end of the shifts, and the nurses felt tense, irritable and very exhausted. They worked on schedules with long working hours, another prerequisite for higher levels of fatigue.

Work ability of the studied nursing professionals, as measured by WAI, was good and close to that described in other studies, decreasing with age (3). Nurses of the wards had the lowest work ability and highest age, which is consistent with other studies (14).

In our study, the main determinant of work ability was health, as also reported by Klasan et al. (15), who defined the health

conditions and job demands as determinants of work ability of healthcare professionals. More than 60 % of studied nursing professionals had at least one diagnosed disease, a result consistent with other studies where over 60 % of healthcare professionals had chronic diseases (16). The health conditions increased with the age as well as the work impairment due to diseases, while sickness absences and mental resources did not show differences in relation to the age. Our data confirmed other studies, showing that the decrease in WAI with the age was mainly on behalf of health conditions. Leijten et al. (16) found lower workability in employees with musculoskeletal, cardiovascular and mental diseases.

According to nearly two-thirds of nursing professionals, their health conditions did not affect their ability to work, while for the rest, their deteriorating health led to symptoms, reduced tempo or ability to work only part time. The relatively high morbidity was not consistent with the low number of sickness absences in the last year. This was probably due to the shortage of nursing professionals, as nearly a third of them worked overtime and had more than one workplace. There were difficulties in using sick leave due to a lack of medical professionals to cover the shifts.

VI. CONCLUSIONS

1. The majority of the nurses and midwives covered in the study worked in shifts, including night shifts, often overtime and multiple workplaces (weekly working hours in more than 60.0 % of both groups exceeded 40 working hours per week). Another problem was the aging workforces.

2. 46.7 % of the nursing professionals rated the working conditions as good, and 34.5 % as satisfactory. 14.8 % of nurses in the emergency / intensive care sector defined the conditions under which they work as poor.

3. The work tasks of nursing professionals required constant concentration, their work was intense, with high tempo, emotionally burdened by patients and unsatisfactory pay, which combined with night work and long working hours led to emotional and physical exhaustion. The positive aspects of the psychosocial environment were support from colleagues and the opportunity to influence the organization of work.

4. The ratings of emotional and physical exhaustion were high, with the highest values for emergency / intensive care nurses. The emotional exhaustion was determined by work-related family problems, work under high strain and time pressure and emotional dissonance, while for the physical exhaustion nurses' age was also important.

5. The cortisol, the biomarker of stress, confirmed the data of high levels of stress in the nurses, maintaining its circadian rhythm, but with higher values, especially in ICU nurses, which was consistent with their subjective assessment of high workload and insufficient rest time. The subjective perception of stress, sleepiness and fatigue increased as the 12-hour shifts progressed, especially night shifts, and at the end of the shifts the nurses felt tense, irritable and very exhausted.

6. A large share of nursing professionals had excellent and good work ability (71.9 %), higher among midwives (82.5 %) and laboratory assistants (79.8 %), and the prognosis for maintaining their work ability in the next two years was relatively certain. Work ability decreased slightly as the working age increases.

7. WAI was positively related to good working conditions and self-perceived good health and negatively to emotional and physical exhaustion and long working hours per week.

8. Nursing professionals maintained a good work ability compared with lifetime best and in relation to job demands, but in 42.1 % of them their health condition affected work ability.

9. The data showed high share of workers with chronic illnesses (65.4 %) and low share of absentees due to illness, which was probably due to presentism. 74.8 % of healthcare professionals were not absent due to illness in the previous year, 20.2 % were absent for up to 25 days, and persons with long absences due to illness were 5.0 %.

10. The determinants of work ability for nurses were subjective assessment of health, work-related family problems, emotional exhaustion, social support and length of service, for midwives - subjective assessment of health and physical exhaustion, for laboratory technicians - subjective assessment of health, emotional exhaustion and justice.

11. Shift work, long working hours, subjective assessment of stress, cortisol levels at work and psychosomatic complaints in nursing professionals were indications of increased health risk.

VII. CONTRIBUTIONS

SCIENTIFIC CONTRIBUTIONS

- ✓ An assessment of psychosocial risks in the workplace was carried out and the risk factors for increasing emotional and physical exhaustion and psychosomatic complaints in the main groups of nursing professionals were outlined.
- ✓ For the first time in Bulgaria, the concentration of cortisol in saliva was tracked in nurses from the intensive sector and wards during the day and night shift, and the data confirmed the subjective assessment of high levels of stress.
- ✓ For the first time in Bulgaria, an assessment of the work ability of nursing professionals was carried out with WAI.
- ✓ The factors determining work ability were established.

SCIENTIFIC-APPLIED CONTRIBUTIONS

- ✓ A survey was conducted on a representative group of 1811 nursing professionals working in 19 hospitals in Sofia, which ensured the reliability of the results.
- ✓ Psychosocial risks, emotional and physical exhaustion, as well as their interrelationships in the covered occupational groups and types of workplaces were the basis for scientifically based measures for the prevention of the risk associated with psychosocial risks, stress and the spread of burnout syndrome.
- ✓ The data from the analysis of work ability enabled differentiated measures to improve the organization of work and increase the working capacity for different professional groups of nursing professionals and those working in different workplaces.
- ✓ Recommendations were developed to limit the health risks of hospital nursing professionals.

VIII. LIST OF PUBLICATIONS on the topic of the dissertation

1. Stoyanova R. Biochemical indicators of stress. Health and safety at work 2017, 1 (1): 30-36; (ISSN 2367-7171).

2. Cekova I, Stoyanova R, Vangelova K. Excretion of melatonin and cortisol in saliva in hospital nurses during 12-hour shifts. Bulgarian journal of public health 2018; 10 (4): 46-54; (ISSN 1313-860X).

3. Vangelova K, Dimitrova I, Cekova I, Stoyanova R. Shift work and occupational stress in hospital nurses in Sofia. Acta Medica Bulgarica 2021, 58 (1): 81-87. doi: 10.2478/amb-2021-0013

4. Stoyanova R, Cekova I, Vangelova K. Stress and fatigue in intensive care unit nurses in Sofia. Ukrainian Journal of Occupational Health 2022, 18 (1), 22-28. doi:10.33573/ujoh2022.01.022

5. Stoyanova R, Vangelova K. Shift work and stress among midwives working in hospitals. Bulgarian journal of public health 2022, 14 (2): 52-60; (ISSN 1313-860X).

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IX. PARTICIPATION IN SCIENTIFIC EVENTS in relation with the dissertation

- Cekova I, Vangelova K, Stoyanova R. Excretion of melatonin and cortisol in saliva in hospital nurses. First Congress of Occupational Medicine and Expertise of Working Capacity with an international conference on the Epsilon project, November 7 - 8, 2018, Sofia, Bulgaria
- Cekova I, Stoyanova R, Dimitrova-Toneva I, Vangelova K. Sleep and fatigue in nurses in relation to shift work. 20th Congress of International Ergonomics Association, 26 – 30. 08. 2018, Florence, Italy
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- Cekova I, Dimitrova I, Stoyanova R, Vangelova K. The influence of night shift work and long working hours on sleep and fatigue in hospital healthcare workers in Bulgaria. 6th International Conference on Wellbeing at Work, 13 – 15 June 2022, online
- Stoyanova R, Cekova I, Dimitrova I, Vangelova K. Impact of psychosocial working conditions on wellbeing of hospital nurses and midwives in Bulgaria. 6th International Conference on Wellbeing at Work, 13 – 15 June 2022, online

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