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ORIGINAL PAPER

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# Effort Reward Imbalance and Insomnia Among Greek Healthcare Personnel During the Outbreak of COVID-19

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## ABSTRACT

**Background:** This study's objective was to examine associations between insomnia as measured by Athens Insomnia Scale (AIS) and perceived psychological work stress among nurses and physicians working in secondary and tertiary hospitals in Greece during the outbreak of COVID-19 pandemic. **Objective:** Taking into account the small but significant differences in the development of ADHD in women, this literature review aims at identifying the special characteristics of ADHD symptoms in all stages of a woman's life from childhood to menopause. Being aware of these signs is important to provide the best quality of health care in ADHD women. **Methods:** A cross-sectional study was conducted on a random sample of 268 healthcare workers (200 nurses and 68 physicians). The 8-item version of the AIS was used to assess insomnia. Perceived psychological work stress was investigated using the 23-item Effort-reward Imbalance (ERI) questionnaire based on the ERI model. **Results:** HCWS who cared for more than 5 patients and worried about personal issues had a higher insomnia score. ER-ratio and over-commitment are significantly associated with insomnia. A significant correlation was found between worries about pandemic COVID-19 and over-commitment. **Conclusion:** Since high effort-reward imbalance (ER-ratio > 1) and overcommitment were positively associated to insomnia and the treatment of more than five patients with COVID-19 infection was impacting predictor of sleep difficulties, it is necessary to implement a reward system in which physicians and nurses will work in a less stressful environment aiming at reducing personnel's negative feelings, poor health and sleeping difficulties.

**Keywords:** COVID-19 pandemic, insomnia, effort-reward.

## 1. BACKGROUND

At the end of 2019 the Coronavirus disease 2019 (COVID-19) was identified in a province of China, it gained attention worldwide, created confusion and an emerging situation (1). On February 26, 2020 the first confirmed case of COVID-19 was hospitalized in Thessaloniki Greece (2). One month later WHO announced that COVID-19 may be considered a pandemic (3). The Greek government, in partnership with local communities and under the guidance of crisis managers and physicians implemented precautionary measures to prevent the spread of the virus at an early stage. Substantial restrictions were imposed. Organized public events were canceled, schools, outdoor public areas and certain business and venues were closed, restrictions on gathering were imposed, working from home was encouraged, travel and movement restrictions were applied, and quarantine measures were implemented (4).

Healthcare workers (HCWS) comprise a significant factor of the national mechanism activated in response to the spread of COVID-19 pandemic. Its role is to secure and promote health condition of community members. Therefore, their own wellbeing is of great importance (5). Health care is a psychologically demanding work environment. The personnel faces series of stressors such as interaction with patients and their family members, work shift and ever-increasing demands. The exposure to such conditions deteriorates its physical and psychological health. As a result their efficiency and the quality of the care provided are negatively affected (6).

The high fatality and infection rates of CO-

COVID-19 reported globally in combination with the quarantine measures, isolation and the lockdown programs caused economic burden, financial losses and had a psychological impact on general population including health care personnel. Fear due to uncertainty, cause socioeconomic distress, anxiety and negative psychological effects (7). Studies concerning healthcare personnel carried out during previous pandemics reveal that quarantine had immediate effects as well as long lasting negative psychological effects like post-traumatic stress disorder and stigmatization (8). HCWS' psychological burden was more severe compared to that of the general population. Their working conditions changed as they had to work more since colleges were in quarantine. They often felt uncertainty insomnia, mental and physical fatigue. The feeling of personal danger and that of transmitting the virus to their family members was very intense as they expressed conflict between their role in the family and that of a healthcare worker (9).

Greek literature concerning the psychological work environment of HCWS and sleeping disorders is limited. In addition, no study has been conducted investigating the psychological work environment of HCWS and how this is associated with insomnia. A study conducted in public hospitals of central Greece indicated that younger nurses were vulnerable to insomnia (10). However, no study has been carried out in Greece that investigates healthcare personnel's perception regarding the psychological work environment in association with sleep difficulties during a manifold crisis where their contribution role is of great importance. Hence the need for empirical evidence is critical.

The Effort-reward Imbalance (ERI) model is used to measure occupational stress by focusing on three components, the effort spent, the reward received and the over-commitment. Effort includes the demands and obligations of work, reward refers to the occupational gains including salary, advancements and respect. Over-commitment as a personal characteristic promotes immoderate dedication, activated by the desire to achieve social approval (11). According to the ERI model the imbalance between effort and reward indicates negative feelings and poor health. Specifically, greater effort and lower reward (ER-ratio > 1) has stronger predictive effect on health and wellbeing disorders than the effect of each single variable. Moreover, higher level of over-commitment is associated with poor health (12).

One study conducted in China, examined the association between nurses' sleep disorders and occupational stress (13). While occupational stress has not been studied during any previous pandemics.

The Athens Insomnia Scale (AIS) is a self-assessment psychometric instrument used to quantify sleep difficulties based on the ICD-10 criteria. It consists of 8 items. The first 5 refer to sleep induction, awakenings during the night, final awakening, total sleep duration and sleep quality whilst the last three pertain to wellbeing, functional capacity and sleepiness during the day. The last three items correspond to daytime symptoms which are the result of nocturnal sleep difficulties (14).

Internationally, only three studies have addressed sleeping disturbances of HCWS during the outbreak of the pandemic COVID-19. A recent study in Bahrain reported that

high percentage of frontline and non-frontline healthcare workers have poor sleep quality (15), while 38% of pediatric healthcare workers of Children's Healthcare Centre of Renmin Hospital of Wuhan, China suffers from sleep disturbances (16). Finally, HCWS in China who were treating COVID-19 patients had levels of anxiety, stress, and self-efficacy that were dependent on sleep quality (17). Studies conducted during outbreaks of previous infectious diseases including Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome Coronavirus (MERS-CoV), Ebola virus, and Lassa reveal that healthcare workers are more likely to experience, psychological distress and insomnia (18-22).

Previous studies conducted in different occupational sector reported that stress and sleeping disorders particularly insomnia are related. Stress has a negative impact on sleep quality while insomnia increases the perception of stress (23).

## 2. OBJECTIVE

The aims of the present research are firstly to investigate the association between perceived psychological work stress and insomnia of HCWS of secondary and tertiary hospitals in Greece during the outbreak of COVID-19 pandemic and secondly whether current working conditions and the management of patient with confirmed COVID-19 are associated to insomnia. To date no research has focused on analyzing the association between occupational stress and insomnia during a pandemic.

## 3. METHODS

### 3.1. Study design and sample

A cross-sectional study was conducted among HCWS at four tertiary and one secondary public and military health care facilities in rural and urban areas in Greece from April, 2020 to May 2020. Participants were recruited using snowball sampling technique. The specific method was conducted since the sample was not easily accessible due to the lockdown program, the quarantine measures, the preventive measures applied in each hospital and the specific working conditions of HCWS. The participation in the study was voluntary, and the answers were anonymous. Online questionnaire was completed through the online survey platform, Google forms. Electronic informed consent was requested and obtained from each participant. By selecting "submission" participants agreed to participate in the study. To ensure accurate results each e-mail address could answer to the questionnaire only once. Inclusion criteria comprised being a full-time HCW, with more than six months of service in Greek National Health System (ESY), not having any previous psychiatric or neurological condition and being able to read and understand Greek. Health care workers suffering from, or taking medication for sleep related disease, who were not actively on duty at the time of the survey and whose online questionnaires were significantly incomplete, were excluded.

Total number of 278 healthcare professionals participated while 10 questionnaires were not included due to an important percentage of missing values (>50%). 200 participants were nurses (128 females, 72 males) and 68

Variables	Physicians (n = 68)		Nurses (n=200)		p-value	Total n=268	
	n	%	n	%		n	%
Gender							
Female	25	36.8	128	64.0	0.000*	153	42,9
Male	43	63.2	72	36.0		115	57,1
	mean	SD	mean	SD		mean	SD
age	38.24	10.06	35.68	7.07	0.001**	32.69	8.38
Years of service	11.59	9.42	12.68	7.92	0.060	12.41	8.32
Age group							
>30 years old	21	30.9	66	33.0	0.432	87	32.5
31-40 years old	21	30.9	74	37.0		95	35.4
<40	26	38.2	60	30.0		86	32.1
Marital status							
single	33	48.5	98	49.0	0.529	131	48,9
married	35	51.5	102	51.0		137	51,1
Working Hospital							
Military	33	49.3	120	59.7	0.088	153	57.1
Public	34	50.7	81	40.3		1115	42.9
Department							
ICU	13	19.1	86	42.8	0.000*	99	36.8
Surgical ward	11	16.2	42	20.9		53	19.7
Pathological ward	44	64.7	72	36.3		116	43.5
Care for COVID-19 patients per week							
zero	35	51.5	134	66.7	0.080	169	62.8
>5	24	35.3	48	23.9		72	26.8
<5	9	13.2	18	9.5		27	10.4
Worry about							
none	21	30.9	74	36.8		95	35.3
Pandemic COVID-19	18	26.5	46	22.9	0.511	64	23.8
Personal issues (family, health, future, economic problems)	21	30.9	66	33.3		87	32.7
Working circumstances	8	11.8	14	7.0		22	8.2
Personal Protective equipment							
yes	32	47.1	120	60.2	0.040*	152	56.9
no	36	52.9	80	39.8		116	43.1
ER-ratio							
<1	20	29.4	49	24.5		199	74.3
>1	48	70.6	151	75.5		69	25.7
Overcommitment							
					0.074		
Low (lower tertile)	31	54.4	103	66.5		134	63.2
High (upper tertile)	26	45.6	52	33.5		78	36.8

Table 1. Personal characteristics and working conditions by occupational category \*Pearson's Chi2 test, \*\*Independent t-test

were physicians (25 females, 43 males). Ethics approval was obtained from the Research Councils Ethics Committees of: 251 Airforce Military Hospital, 417 General Military Hospital NIMTS, General Hospital of Mytilene Vostanio, Rhodes General Hospital and General Hospital of Filiates.

### 2.2. Study tools

The 8-item version of the AIS was used to assess insomnia. Each item is measured using a point Likert scale from 0 indicating "no problem at all" to 3 "very serious problem". Participants answer depending on if they faced the dif-

ficulty described in each item at least three times a week during the last month. Total score ranges from 0 signifying absence of any sleep problem to 24 corresponding to the most severe degree of insomnia (14).

The 23-item long version of the ERI questionnaire was used to measure healthcare personnel's perception of the psychological work environment. The Greek validated version was used, and no changes were made to the questionnaire. It consists of three psychometric scales. The effort scale includes 6 items referring to the following demanding

aspects of the work environment: work pressure, time pressure, workload, responsibility, increasing demands and physical load. Higher score refers to higher efforts. The reward scale includes 11 items referring to promotion, appreciation and safety and the over-commitment includes 6 items.

All three scales are measured using a 4-point Likert scale ranging from strongly disagree to strongly agree. Higher mean scores of effort and over-commitment as well as lower mean scores of reward were considered to indicate perceived psychological stress at work (11).

In order to assess special working conditions and managements of patient with confirmed COVID-19 respondents were asked: "Which issue concerns you at the present time?", "In your workplace do you treat patients with COVID-19 infection?", "How many COVID-19 patients do you hospitalize weekly?", "Have you been provided with all the necessary personal protective equipment?".

### 2.3. Statistical analysis

In the present study, the dependent variable was insomnia. Health care personnel's perceptions of their psychological work environment, special working conditions and managements of patient with confirmed COVID-19 were defined as independent variables.

To increase the accuracy of the association between psychological work stress, current working conditions, managements of patient with confirmed COVID-19 infection and sleep difficulties, potential cofounders were added to the model. These included age, gender, education level, marital status, occupational group, years of service and service department.

Cronbach alpha ( $\alpha$ ) was used to assess the internal consistency of the ERI scale and the AIS. All personal characteristics and working conditions (gender, age, education level, marital status, working hospital, years of service, service department, care patient with COVID-19 infection weekly, worry about and personal protective equipment) were analyzed by Pearson's Chi-square and independent t-test to examine their association with profession (physicians and nurses).

One way Anova and independent t-test were conducted to examine the correlation between demographic characteristics, working conditions and AIS as well as demographic characteristics, working conditions and ERI. Pearson's correlation was conducted to provide results concerning the association between ERI and AIS. Results presented were based upon cases with complete data as incomplete cases were deleted. The statistical program Statistical Package for Social Sciences, IBM SPSS Statistics 25 was used for all analyses.

	Athens Insomnia scale		
	mean	SD	p-value
Gender			
Female	14.35	4.335	0.306
Male	14.93	4.319	
Marital status			
Single	14.35	4.046	0.426
Married	14.86	4.557	
Profession			
Physician	14.17	3.929	0.101
Nurse	14.73	4.453	
Working Hospital			
Military	14.19	4.150	0,225
Public	15.13	4.525	
Department			
ICU	14.04	4.063	0.017**
Surgical ward	16.07	4.324	
Pathological ward	14.07	4.135	
Care for patients with COVID-19			
yes	15.15	4.662	0.080
no	13.98	3.852	
Care for COVID-19 patients per week			
Zero	13.97	3.807	0.008**
<5	15.47	4.987	
> 5	16.03	4.841	
Worry about			
None	13.44	3.607	0.007**
Pandemic COVID-19	14.67	4.227	
Personal issues (family, health, future, economic problems)	15.54	4.487	
Working circumstances	15.50	5.72	
Personal Protective equipment			
Yes	14.26	4.181	0.841
No	15.02	4.488	
ER-ratio			0.006*
<1	12.43	3.173	
>1	15.36	4.419	
Overcommitment			0.045*
Low (lower tertile)	12.30	3.214	
High (upper tertile)	18.15	4.039	

Table 2. Correlation between demographic characteristics, working conditions, ERI and AIS \*Independent t-test, \*\*One-way Anova

## 4. RESULTS

Results of Chi-square analysis and independent t-test are presented in Table 1. It compares the personal characteristics, working conditions and worries between the two occupational groups. Of the 268 surveyed participants, physicians were relatively older with a mean age of 38.2. The proportion of females was higher among nurses, 64% and marital status was almost the same between nurses (51%) and physicians (51.5%). In addition, 57.1% of the par-

Variables	Effort	p-value	Reward	p-value	Over-commitment	p-value	ER-ratio	p-value
Gender								
Female	17.55 ±2.496	0.265	27.41±4.106	0.519	13.84±3.288	0.693	1.21±0.298	0.844
Male	17.60 ±2.827		27.60 ±3.899		13.92±3.211		1.20±0.303	
Marital status								
Single	17.24	<b>0.014*</b>	27.16	0.853	13.63	<b>0.007*</b>	1.20	0.429
Married	17.88		27.75		14.13		1.21	
Working Hospital								
Military	17.15	0.145	27.81	0.473	13.53	0.226	1.16	0.354
Public	18.13		27.01		14.36		1.26	
Department								
ICU	17.63	0.883	27.07	0.070	13.72	0.764	1.23	0.233
Surgical ward	17.66		26.84		14.13		1.23	
Pathological ward	17.48		28.12		13.89		1.17	
Care for COVID-19 patients per week								
Zero	17.42	0.474	27.54	0.791	13.64	0.316	1.19	0.640
<5	17.81		27.22		14.29		1.23	
>5	17.85		27.75		14.21		1.21	
Worry about								
Nothing	17.25	0.199	27.60	0.624	12.98	<b>0.004**</b>	1.19	0.612
Pandemic COVID-19	17.47		27.71		14.35		1.18	
Personal issues (family health, future, economic problems)	17.76		27.04		14.12		1.23	
Working circumstances	18.50		28.04		15.31		1.23	
Personal Protective Equipment								
Yes	17.43	0.123	28.25	0.948	13.65	0.492	1.15	<b>0.005*</b>
No	17.76		26.45		14.17		1.27	

**Table 3.** Correlation between demographics and Effort-Reward Imbalance scale (ERI). \*Independent t-test, \*\*One-way Anova

Participants worked at military hospitals and 42.9% at public hospitals. 36.8% worked in Intensive Care Unit, 19.7% in surgical ward and 43.5% at pathological ward. Approximately one third of the sample cared for up to 5 patients with COVID-19 infection weekly whereas almost half of them had access at personal protective equipment (PPE). Finally, one quarter of physicians (26.9%) and a lower percentage of nurses (22.9%) are concerned about the pandemic.

The correlation between demographics and Athens Insomnia Scale is presented in Table 2. Hospital department, number of patients with COVID-19 infection they treat and their worries are the characteristics of the sample that are correlated significantly with AIS. More specifically the department was significantly associated with AIS (p=0.017). HCWS working in surgical wards had a higher score in AIS. The number of patients with COVID-19 infection they treated per week (p=0.008) and their worries (p=0.007) were significantly associated with AIS. Those who cared for more than

	Effort	Reward	Over-commitment	ER-ratio
Reward	r	-.296**		
	p	.000		
Over-commitment	r	.521**	-.190**	
	p	.000	.002	
ER-ratio	r	.776**	-.802**	.421**
	p	.000	.000	.000
Athens Insomnia Scale	r	.386**	-.285**	.631**
	p	.000	.000	.000

**Table 4.** Correlation analysis of ERI scales, and Athens Insomnia scale \*\* correlation is significant at the 0,01 level (2-tailed)

5 patients had a higher insomnia score and so did HCWS who were worried about personal issues. Finally, ER-ratio and over-commitment are significantly associated with insomnia. Those with ER-ratio >1 (m=15.36) and (p=0.006) and those with high over-commitment score (m=18.15) and (p=0.045) scored higher in AIS.

At Table 3 the correlation between ERI scale and demographics is presented. Marital status was found to correlate

significantly with effort ( $p=0.014$ ) and over-commitment ( $p=0.007$ ) while married scored higher than single in the subscales with higher values indicating more intense effort and overcommitment, respectively. In addition, a significant correlation was found between worries and over-commitment ( $p=0.004$ ) with those who worry about pandemic COVID-19 to score higher in overcommitment which reflects the motivational personality elements that foster excessive ambition and devotion to work due to an underlying need for social approval and esteem. The lack of PPE was found to correlate significantly with and ER-ratio ( $p=0.005$ ) with those who reported lack of PPE to score higher although both categories scored higher than 1 indicating an imbalance between high effort and low reward.

Table 4 presents Pearson's correlation coefficients for the ERI, and AIS scales. Effort and over-commitment were positively correlated with ER-ratio ( $p=0.000$ ) while reward was negatively correlated with ER-ratio ( $p=0.000$ ). AIS was positively correlated with effort, overcommitment and ER-ratio ( $p=0.000$ ) but negatively correlated with reward ( $p=0.000$ ).

## 5. DISCUSSION

This is the first study to examine sleep difficulties in association with occupational stress among healthcare workers in Greece, during the COVID-19 pandemic. Very few studies have been carried out in the international literature during the outbreak of COVID-19 concerning the sleep quality of HCWS. The study in Wuhan, China used the Pittsburgh sleep quality index (PSQI), and found that 38% of pediatric HCWS were suffering from sleep disturbances which were independently associated with being an only child, exposed to COVID-19 patients and suffering from depression (16). The study carried out in Bahrain on a larger sample ( $n = 280$ ) using the PSQI compared sleep quality of frontline HCWS with the sleep quality of non-frontline HCWS. Poor sleep quality and stress are common during the COVID-19 crisis. Specifically, 60% of both frontline and non-frontline personnel had poor sleep quality combined with moderate-severe stress (15).

In the present study mean insomnia score among physicians is 14.17 and among nurses is 14.73. It was found that the hospital department is significantly associated with sleep difficulties. Specifically, participants who work at surgical ward score higher in AIS than those working in ICU and pathological ward. However in the only Greek study evaluating insomnia of healthcare workers using AIS no statistical differences were observed between different hospital departments (10). Not surprisingly, the results demonstrate a positive association between the treatment of COVID-19 patients and insomnia, specifically those who care for more than five patients weekly face more sleep difficulties. This prevalence may be related to the contagious nature of COVID-19. This finding is supported by the results of recent studies in China and in Bahrain, of healthcare workers who cared for COVID-19 patients and reported high PSQI scores (15-17).

The present study demonstrates a significant association between ER-ratio, effort and insomnia. Physicians and nurses who reported imbalance between high effort and

low reward (ER-ratio  $> 1$ ), have a higher insomnia score. According to the ERI model the imbalance between efforts and rewards in work setting produce emotional distress (12). Another interesting finding related to what is mentioned above is that insomnia exhibits statistical relevance with over-commitment. This implies that as the need for esteem and approval increases, the chance of insomnia increases too. This finding is consistent with the assumption of the ERI model, that high level of overcommitment at work predicts generally poor health (12). In addition, according to a study conducted in general hospitals in China in 2016, nurses' sleep disorder status was related to occupational stress measured by ERI (13).

Therefore, psychological work environment is of great importance during the COVID-19 pandemic. Occupational rewards and benefits should be provided to HCWS including money, esteem, positive feedback, and career opportunities.

There are some limitations to this study. Firstly, it is a cross sectional study conducted at the early stage of the pandemic. Results might have led towards a different direction if the study was conducted at the stage with the most confirmed COVID-19 cases. Secondly, the number of patients with COVID-19 infection was relatively low however the conditions that HCWS had to face were completely unknown. Finally, researchers had limited access to the hospitals due to the lockdown program.

## 6. CONCLUSION

The present study showed that high effort reward imbalance (ER-ratio  $> 1$ ) and overcommitment were positively associated to insomnia. In addition, the treatment of more than five patients with COVID-19 infection was impacting predictor of sleep difficulties. Therefore, it is necessary to implement a reward system in which physicians and nurses will work in a less stressful environment aiming at reducing personnel's sleeping difficulties.

- **Ethics approval and consent to participate:** Ethics approval was obtained from the Research Councils Ethics Committees of: 251 Airforce Military Hospital, 417 General Military Hospital NIMTS, General Hospital of Mytilene Vostanio, Rhodes General Hospital and General Hospital of Filiates.
- **Acknowledgements:** We would like to thank the participants for their cooperation.
- **Authors' contribution:** VT and MM were responsible for designing the study and for the statistical analysis, IP and NT collected the data and wrote the paper. AN and SP made final corrections. All the authors read and approved the final manuscript.
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- **Key points:** Poor sleep quality and stress are common during the COVID-19 crisis. psychological work environment is of great importance during the COVID-19 pandemic Occupational rewards and benefits should be provided to HCWS including money, esteem, positive feedback, and career opportunities

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