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Effect of Depression, Anxiety, and Rumination on Sleep Quality in Healthcare Workers

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Abstract

Introduction: Depression, anxiety, and sleep problems are commonly seen among healthcare workers. Rumination is associated with many mental disorders. This study aimed to evaluate the relationship between rumination, anxiety, depression, and sleep quality in healthcare workers and find which factors affect sleep quality in this population

Materials and Methods: A total of 373 healthcare workers were included in this study. Participants were evaluated with The Hospital Anxiety Depression Scale (HADS), the Pittsburgh Sleep Quality Index (PSQI), and The Ruminative Thought Style Questionnaire (RTSQ). Statistical analyses were performed using SPSS software ver 26.0.

Results: The mean age of the participants was 35.83 ± 9.75 and 267 (71.6 %) were female. Within the whole group; 198 (53.1%) of them had poor sleep and 175 (46.9%) had good sleep quality. About HADS scores, 173 (46.4%) had minimal, 100 (26.8%) had borderline anxiety and 100 (26.8%) had abnormal anxiety scores; 224 (60.1) had minimal, 87 (23.3%) had borderline depression and 62 (16.6%) had abnormal depression scores. Participants having poor sleep according to PSQI had significantly higher HADS-A, HADS-D, and RTSQ scores compared to good sleepers. Individuals who scored above average on the RTSQ scale had significantly higher PSQI, HADS-A, and HADS-D scores compared to individuals having scores below average on the RTSQ. Regression analysis showed that HADS-A and HADS-D contributed more than all other variables for predicting sleep quality in the present study.

Conclusion: Poorer sleep is associated with higher anxiety and depression scores. Higher rumination is associated with higher anxiety, depression, and worse sleep. The best predictors of sleep quality in healthcare workers are depression and anxiety scores according to HADS. Therapeutic approaches focusing on depression and anxiety symptoms in healthcare workers may be important to increase the well-being of healthcare workers.

Key words: Sleep quality; anxiety; depression.

Introduction

Sleep quality is a crucial component of overall health and well-being. Adequate sleep has been linked to optimal cognitive functioning, immune system regulation, and emotional well-being (1). Sleep quality refers to the subjective assessment of how well an individual sleeps (2, 3). However, poor sleep quality is prevalent among various populations, including health workers, who often face unique challenges that can negatively impact their sleep patterns (4). Ruminative thinking refers to repetitive thoughts focused on negative experiences or emotions without reaching any solution or resolution. Ruminative thinking has been associated with an increased risk for psychiatric disorders and sleep problems in both clinical and non-clinical populations (5). In the context of health workers' sleep quality, ruminative thinking may contribute to persistent negative thoughts during nighttime wakefulness or difficulty falling back asleep after waking up. It was shown that rumination increased the risk of depression, burnout, and other mental problems in healthcare workers (6). Depression is highly prevalent among health workers due to various factors such as high work demands, long working hours, and exposure to patient suffering (7). Poor sleep quality has been found to exacerbate symptoms of depression among this population. A systematic review and meta-analysis study showed that decreased sleep quality is positively correlated with an increased risk of mental disorders in healthcare workers (8). Anxiety disorders are also common among health workers, with prevalence rates higher than those observed in the general population (7). Similar to depression, poor sleep quality has been linked to increased anxiety levels. The study by Yella and Dmello (9) found a significant association between poor sleep quality and higher levels of burnout and anxiety symptoms among these workers. Further research studies have explored the relationship between sleep quality, ruminative thinking, depression, and anxiety in health workers. For example, Ye et al. (10) investigated the effect of physical exercise on

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college students' sleep quality and found that exercise indirectly improved sleep quality through its positive impact on mindfulness and reduced ruminative thinking (10). It was also shown that meditation combined with exercise also decreased ruminative thinking in another study (11). These findings suggest that interventions targeting ruminative thinking patterns may be effective in improving sleep quality among health workers. Several potential mechanisms may explain how poor sleep quality is related to ruminative thinking, depression, and anxiety in health workers. Firstly, disrupted or insufficient sleep can impair cognitive functioning and emotional regulation processes necessary for adaptive coping strategies (12). This impairment may contribute to rumination as well as difficulties managing depressive or anxious thoughts. Secondly, disturbed or inadequate sleep can disrupt physiological systems involved in mood regulation such as HPA axis dysregulation (13). Lastly, chronic poor sleep can lead to fatigue and low energy levels which can further exacerbate symptoms of depression or anxiety. The implications of these findings are crucial for promoting better mental well-being among health workers who often experience high stress levels due to their demanding work environments. Interventions that focus on improving sleep hygiene, promoting relaxation techniques, and providing education about the importance of sleep for overall health could be beneficial. In this study, the aim was to evaluate the relationship between rumination, anxiety, depression, and sleep quality in healthcare workers and find which factors affect sleep quality in this population. In the light of the available data, we hypothesized that depression, anxiety, and rumination would predict sleep quality separately. The relationship between these variables highlights the need for interventions targeting both sleep quality and mental well-being in this population. So, we think that the findings of our study can provide important information for increasing healthcare workers' overall mental health.

Materials and Methods

The study was carried out as a descriptive and cross-sectional study. Data were collected with an online, anonymous survey via Google Forms from November 28 to December 7, 2023. The study used convenience sampling for recruitment. Inclusion criteria were: Studying as a healthcare worker aged 18 years and above, and volunteer to participate in the study. Exclusion criteria were not volunteering to participate in the study. All health workers who agreed to participate in the study were included in the study. The research was publicized to all hospital staff through different channels (email, WhatsApp, etc). The completed questionnaire was submitted by 373 respondents who agreed to participate in the study. No personal identifiers were gathered from participants to protect confidentiality and participants gave electronic informed consent.

The Sociodemographic Data Form, The Hospital Anxiety Depression Scale (HADS), the Pittsburgh Sleep Quality Index (PSQI), and The Ruminative Thought Style Questionnaire (RTSQ) were used for collecting the data.

The sociodemographic data form: Prepared by the researchers, it included questions about age, gender, level of education, level of income, living environment, smoking status, and alcohol consumption.

The hospital anxiety depression scale (HADS): The HADS is used to measure the severity of depression, and it consists of two separate 7-item subscales designed 14- to assess anxiety and depression symptoms in medical patients (14). Each self-report question is scored between zero (no impairment) and three (severe impairment), with a maximum score of 21 for anxiety or depression. Total scores for each subscale range from 0 to 21, categorized as normal (0–7), mild (8–10), moderate (11–14) or severe (15–21). The Turkish version of the scale was found to be reliable and valid (15)

Pittsburgh sleep quality index (PSQI): The original PSQI was developed by Buysse et al. (16). The scale has 19 questions in 7 components regarding the past month. The PSQI consists of seven components. Each component score is rated from 0 to 3, with higher scores than 5 indicating significantly poor sleep quality. Turkish validity and reliability of the scale were conducted by Agargün et al. (17).

The ruminative thought style questionnaire (RTSQ): The Ruminative Thought Style Questionnaire consists of 20 items that aim to measure rumination. It is a self-reported 7-point Likert scale (18). The scale evaluates ruminative thoughts. Turkish adaptation study was conducted by Karatepe et al. (19).

Ethical consent: The research was approved by the Marmara University Clinical Research Ethical Committee (Approval Date: 28.11.2023, Approval Number: 09.2022.616)

Statistical analysis: Data was saved using "Microsoft Office Excel Version 2204". Statistical analyses were performed using SPSS software (ver. 26.0; SPSS Inc., Chicago, IL, USA). All numerical

data were expressed as means±standard deviations. All categorical variables were expressed as numbers and percentages (n, %). The p values, percentages, standard deviations, and correlations were calculated with the software. The value of $p < 0.05$ was considered to indicate statistical significance. Linear hierarchical regression was run to assess the predictors of sleep quality.

Results

Sociodemographic features: Within these 373 participants, 267 (71.6 %) were female, and 106 (28.4 %) were male with the mean age of the participants being 35.83 ± 9.75. Of the whole group; 225 (60.3) were married, 336 (90.1%) were graduated from a university, 241 (64.6%) were not smoking and 275 (73.7%) were not consuming alcohol. The sociodemographic features of participants are presented in Table 1. The most common percentages of the variables are given to avoid data redundancy.

Table 1: Sociodemographic and clinical variables of the participants

Variables	n/mean	%/S.D
Age	35.83	9.75
Gender		
Female	267	71.6
Male	106	28.4
Marital status		
Married	225	60.3
Education (last finished)		
University	213	57.1
Smoking		
None	241	64.6
Alcohol consuming		
None	275	73.7
Measurements		
PSQI	6.26	3.53
Poor sleepers	198	53.1
Good sleepers	175	46.9
HADS-A	8.09	4.40
Minimal	173	46.4
Borderline	100	26.8
Abnormal	100	26.8
HADS-D	6.59	4.22
Minimal	224	60.1
Borderline	87	23.3
Abnormal	62	16.6
RTSQ	69.88	29.69

PSQI: Pittsburgh Sleep Quality Index**; HADS-A and HADS-D:** The Hospital Anxiety Depression Scale anxiety and depression subscales; **RTSQ:** The Ruminative Thought Style Questionnaire

Clinical features: The mean PSQI score of all participants is 6.26 ± 3.53 and according to PSQI scores, 198 (53.1%) of the participants in our study had poor sleep and 175 (46.9%) had good sleep quality. Within all groups; the mean HADS-A score was: 8.09 ± 4.40 and the mean HADS-D score was: 6.59 ±4.22. When HADS-A scores were evaluated, 173 (46.4%) had minimal, 100 (26.8%) had borderline anxiety and 100 (26.8%) had abnormal anxiety scores. About HADS-D scores; 224 (60.1) had minimal, 87 (23.3%) had borderline depression and 62 (16.6%) had abnormal depression scores (Table 1). The mean RTSQ scores of the healthcare professionals who participated in our study were 69.88 ± 29.69 (Table 1). To compare this scale with other scales, the data were divided into two as below and above this average value. While 53.4% of the participants (n=199) have a score below the average value, 46.6 % (n=174) have a score above the average value. Participants having poor sleep according to PSQI had significantly higher HADS-A scores compared to participants having good sleep (t: -8.44; $p<0.001$). Similarly, poor sleepers according to PSQI had significantly higher HADS-D scores compared to good sleepers (t: -7.40; $p<0.001$). Moreover, poor sleepers had significantly higher RTSQ scores compared to poor sleepers (t: -6.42; $p<0.001$) (Table 2).

Table 2: Participants' clinical scale scores according to PSQI scale

	Good sleepers (n=198)		Poor sleepers (n=175)			
	Mean	S.D	Mean	S.D	t	p
HADS-A	6.21	3.95	9.75	4.12	-8.44	<0.001
HADS-D	4.99	3.64	8.02	4.21	-7.40	<0.001
RTSQ	59.90	26.97	78.70	29.25	-6.42	<0.001

HADS-A and HADS-D: The Hospital Anxiety Depression Scale anxiety and depression subscales; **RTSQ:** The Ruminative Thought Style Questionnaire **Good sleeper:** PSQI score ≤5; Poor sleeper: PSQI score > 5

Individuals who scored above average on the RTSQ scale had significantly higher PSQI scores compared to individuals having scores below average on the RTSQ (t: -1.94; $p<0.001$). Besides, participants scoring above average RTSQ scale had significantly higher HADS-A and HADS-D scores compared to participants scoring below average on the RTSQ scale (t: -3.68; $p<0.001$) and

Table 3: Participants' clinical scale scores according to rumination levels

	Lower rumination (n=199)		Higher rumination (n=174)			
	Mean	**S.D**	**Mean**	**S.D**	**t**	**p**
HADS-A	6.37	3.88	10.05	4.16	-3.68	<0.001
HADS-D	5.75	4.19	7.56	4.07	-1.80	<0.001
PSQI	5.36	3.273	7.30	3.54	-1.94	<0.001

HADS-A and HADS-D: The Hospital Anxiety Depression Scale anxiety and depression subscales; **PSQI:** Pittsburgh Sleep Quality Index Lower and higher rumination refers to rumination levels below and above compared to mean RTSQ scores

Table 4. Examining the predictors of sleep quality in health workers with hierarchical linear regression analysis.

IVs	**Step 1**		**Step 2a**		**Step 3a**		**Step 2b**		**Step 3b**	
	β	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Age	-.126*	-2.11	-.060	-1.13	-.032	-.581	-.022	-.369	-.032	-.581
Gender (Male)	.020	.392	.022	.468	.017	.369	.019	.381	.017	.369
Marital status (Married)	-.004	-.061	-.018	-.352	-.017	-.331	-.003	-.059	-.017	-.331
Education (Postgraduate)	-.111*	-2.07	-.055	-1.14	-.067	-1.40	-.132*	-2.60	-.067	-1.40
Smoking	.110*	2.06	.090	1.92	.084	1.81	.085	1.68	.084	1.81
Alcohol consumption	.028	.536	.018	.386	.016	.345	.018	.354	.016	.345
HADS-A			.313**	4.99	.248**	3.66	-	-	.248**	3.66
HADS-D			.215**	3.44	.213**	3.43	-	-	.213**	3.43
Rumination					.130*	2.40	.343**	6.80	.130*	2.40
Model metrics										
p	.004		<.001		<.001		<.001		<.001	
F	F(6.366)=3.21		F(8.364)=17.38		F(9.363)=16.28		F(7.365)= 9.70		F(9.363)= 16.28	
Adj.R^2	.034		.260		.270		.141		.270	
R^2 Change	.050		.226		.011		.107		.131	
p (F Change)	.004		<.001		.017		<.001		<.001	

*p<.05 **p<.01;
Step1: Sociodemographic variables, **Step 2a:** HADS-A and HADS-D, **Step 3a:** RTSQ, **Step2b:** RTSQ, **Step 3b:** HADS-A and HADS-D **HADS-A and HADS-D:** The Hospital Anxiety Depression Scale anxiety and depression subscales; **RTSQ:** The Ruminative Thought Style Questionnaire

(t: -1.80; p<0.001) respectively (Table 3). Table 3 to be placed around here We aimed to explore the proportion of predictor sets within the variance that explains sleep quality. A hierarchical regression analysis consisting of three steps in total was performed, and two separate hierarchies were generated by changing the order of HADS-A&HADS-D and rumination variables in the 2nd step. R-squared explains how much of the variance from the mean does our model account for. R-squared is good at facilitating comparisons between models. The higher the R squared, the more variation is explained and hence one may consider the model to be better. Unlike R-squared, adjusted R-squared only adds new predictors to its model if it improves the model's predicting power. R-square change is the improvement in R-square when the other predictor is added. The *β* coefficient provides information about the relationship between the variable in question and the dependent variable when all other variables are held constant. The contribution of sociodemographic variables to variance explaining sleep quality was found to be negligible in the first step (R2adj=.034, F(6,366)=3.21, p=.004). The inclusion of HADS-A and HADS-D to the first block raised substantially the variance of sleep quality with an increment of 22.6% and significant effects in Step 2a (β=.313 and β=.215, p<.001 respectively). All variables in Step3a significantly predicted 27% of variance after including rumination in the full model (F(9,363)=16.28, p<.001), resulting in a slight incremental gain of 1.1% in a variance with a significant impact

(β=.130, p=.017). When steps 2a and 3a are evaluated together, it can be said that HADS-A and HADS-D are better than rumination for explaining the variance. Similarly, rumination accounted for a significant, albeit comparatively smaller, proportion (10.7%) of the variance and greater effect (β=.343, p<.001) in Step2b, as opposed to the contribution of both HADS-A and HADS-D in Step2a. Both HADS-A and HADS-D added a greater amount of proportion (13.1%) in the explained variance beyond that of all variables (in Step 3b) compared to rumination (in Step 3a). When step 2b and 3b are evaluated together, it can be seen that HADS-A and HADS-D are better than rumination for explaining the variance, similar to step 2a and 2b. In light of all the results, HADS-A and HADS-D have a significant contribution to the variance explaining the sleep quality, beyond and above all other variables (Table 4). Table 4 to be placed around here

Discussion

Our results demonstrated that participants having poor sleep according to PSQI had significantly higher HADS-A and HADS-D scores compared to participants having good sleep (p<0.001 and p<0.001). Participants having higher RTSQ scale scores had higher HADS-A, HADS-D, and PSQI scores (p<0.001, p<0.001, and p<0.001 respectively). Individuals who scored above average on the RTSQ scale had significantly higher PSQI scores compared to individuals having scores below average on the RTSQ(p<0.001). Besides, participants scoring above average RTSQ scale had significantly higher HADS-A and HADS-D scores compared to participants scoring below average on the RTSQ scale (p<0.001) and (p<0.001) respectively. Linear regression analysis showed that HADS-A and HADS-D scores were the best predictors of sleep quality in the present study of healthcare workers.

Within the participants, 71.6 % of the group consisted of women. The vast majority of the group (90.1%) graduated from university and most of the group (60.3 %) were married. The mean age of the participants was 35.83 ± 9.75. There are numerous studies evaluating depression, anxiety, and sleep disorders in healthcare professionals, and it is seen that the samples (gender, age, educational level) included in these studies are very different from each other (7, 20). Of all participants, 53.1% of them had poor sleep according to PSQI scores. It is known that health workers had worse sleep quality than the general population and the Covid-19 outbreak worsened this group's sleep quality (21). Systemic review and meta-analysis showed that the prevalence of sleep problems in health workers varies from 11.3 to 100%. In studies examining the sleep quality of healthcare workers in our country, it was reported that 76.5% to 85.3% of the workers had poor sleep quality (22). It has been determined that the different rates in the studies vary according to the sample selection, number, place of work, and whether the study was conducted before or after Covid-19 outbreak. According to HADS scores, participants with high levels of anxiety and depression were 26.8% and 16.6 % respectively. A meta-analysis found that the prevalence of anxiety and depression was 23.2% and 22.8% respectively (20). Studies from Turkey also yield different results for anxiety (18.9 % to 57.7) and depression (8.9 to 53.4 %) (23). Similarly, different results may be associated with sample selection, number, place of study, and whether it is made before or after Covid-19. Participants having poor sleep quality according to PSQI had higher HADS-A and HADS-D subscale scores in the present study (p<0.001 and p<0.001). Various studies have found a bidirectional relationship between sleep disturbances and anxiety disorders. Poorer quality of sleep was associated with higher anxiety levels in healthcare workers (24). Additionally, higher levels of anxiety were associated with lesser quality of sleep in healthcare workers (25). Participants with higher PSQI scores had generally worse HADS depression subscale scores. Most of the studies in this field have shown a strong relationship between depression and sleep problems (24). Our results seem to be consistent with the existing literature. The result of the present study also showed that poor sleepers had significantly higher RTSQ scale scores. Similarly, participants scoring above average on RTSQ scores had significantly higher PSQI scores compared to participants scoring below average on RTSQ scale. It is well-established that individuals who ruminate more experience poorer sleep quality than those who ruminate less (26). In studies controlling for depression and anxiety, rumination has an ongoing effect on reduced sleep quality (5). It was shown that rumination disrupts sleep quality by its effects on negative affect and bedtime procrastination (5). As expected, correlational studies can not establish a causal or temporal relationship between rumination and sleep problems. An equally plausible alternative explanation may be that the sleep disturbance may trigger rumination (27). Considering the models in the regression, it was shown that both sociodemographic variables and rumination had relatively small effects, but adding HADS-A and

HADS-D to the models made a larger contribution to the variance in explaining sleep quality. All three models were statistically significant but the best predictors of sleep quality were HADS-A and HADS-D scales. In the general population, sleep complaints are most common in individuals with depression and anxiety disorders. (42-63%) (28). Both depression and anxiety are known to be good predictors of sleep quality and it has been shown that individuals with higher levels of depression and anxiety had poorer sleep quality both in cross-sectional and prospective studies (7). Recent studies showed that rumination has a mediating effect on the relationship between sleep quality and depression/anxiety (27). Our regression results showed that rumination has a significant effect on sleep quality but this effect was smaller compared to the contribution of HADS-A and HADS-D scores. The effects of rumination on sleep independent of anxiety and depression have recently started to be investigated, but it is noteworthy that most of the studies in this field were conducted during the Covid period. Therefore, our study differs from other studies in that it was conducted in a period when Covid was relatively not at the forefront and included health workers from different professional groups.

Study limitations: The results should be interpreted considering several study limitations. First, the present study was conducted with only healthcare workers in a non-clinical sample. Secondly, data collection was made using a convenient online survey which limits the generalizability of the present findings. Thirdly, depression, anxiety, and sleep disturbances were measured with clinical scales rather than using a clinical interview. Fourth, as the present study has a cross-sectional nature, it will be impossible to make causal relationships between depression, anxiety, sleep disturbance, and rumination. Future studies using clinical interviews and following participants and controlling for confounding factors will be needed to confirm the present findings.

Conclusion

The present study showed that sleep problems are not uncommon in healthcare workers and in this group, poorer sleep is associated with higher anxiety and depression scores. Higher rumination is associated with higher anxiety, depression, and worse sleep in healthcare workers. The best predictors of sleep quality in healthcare workers are depression and anxiety scores according to HADS. Therefore, with these results, we can say that therapeutic approaches that focus on depression and anxiety symptoms in healthcare workers may be important. It is clear that when depression and anxiety symptoms improve in this group, sleep problems related to these symptoms will also decrease. Prospective intervention studies in which the factors related to the development of depression and anxiety in healthcare workers are addressed in detail will contribute to better elucidation of this issue.

Ethics approval statement: The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Marmara University (Approval Date:28.11.2023; Approval Number: 09.2022.616).

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