



UMEÅ UNIVERSITET

# Do burnout and sleep quality interact when being treated for burnout?

Results from a student led, psychoeducative stress intervention

Lidiia Kasianchuk

Master thesis, 15 hp  
Master Programme in Health Psychology, 60 hp  
Spring term 2023  
Supervisor: Maria Nordin

**Abstract:**

Stress, burnout, and sleep problems are linked with negative health outcomes and are increasingly common globally and among the Swedish population. To strengthen mental health response at the primary health care level, the students of the Programme for Master of Science in Psychology give psycho-educative, CBT-based stress- and sleep treatments at health care centres in Umeå as part of their training. To understand what affects the treatment outcome, this study aimed to investigate whether burnout and sleep quality interact after a stress intervention. One hundred sixteen residents of Umeå, who went through treatment in the form of a stress school, participated in the study. The stress school treatment was delivered in four weekly sessions that lasted 90 minutes each including a break. The Shirom Melamed Burnout Questionnaire (SMBQ), the Karolinska Sleep Questionnaire (KSQ) and the Swedish version of the Perceived Stress Scale (PSS-10) were used before and after the intervention to assess its effects. The findings of the study showed no interaction effect between burnout and sleep quality at the beginning of the treatment and burnout as a treatment outcome. At the same time, it revealed main effects for both burnout and sleep quality, showing that high level of burnout and poor quality of sleep at the beginning predict higher levels of burnout after the treatment in the stress school. These findings suggest that addressing stress and sleep problems at the beginning may be important in improving burnout treatment outcomes in stress treatments.

Key concepts: Burnout/Exhaustion syndrome (ED), Sleep quality, Stress.

**Sammanfattning:**

Stress, utbrändhet och sömnproblem är relaterade till negativa hälsoutfall och har blivit allt vanligare globalt och bland den svenska befolkningen. För att stötta vården ger psykologstudenter på Umeå Universitet, som del av sin utbildning, psykoedukativ, KBT-baserade stress- och sömnbehandlingar på hälsocentraler i Umeå. Syftet med denna studie är att förstå vad som påverkar resultatet av behandlingen genom att undersöka om utbrändhet och sömnkvalitet påverkar varandra vid behandling av stress-relaterad ohälsa. Ett hundrasexton invånare i Umeå, som fullföljde behandling i form av en stress-skola, deltog i studien. Stressskolebehandlingen levererades i fyra veckovisa sessioner som varade 90-minuter var, inklusive en paus. Shirom Melamed Burnout Questionnaire (SMBQ), Karolinska Sleep Questionnaire (KSQ) och den svenska versionen av Perceived Stress Scale (PSS-10) användes före och efter interventionen. Studiens resultat visade ingen interaktion mellan utbrändhet och sömnkvalitet i relation till utbrändhet som behandlingsutfall. Samtidigt visade resultatet att det fanns en huvudeffekt för både utbrändhet och sömnkvalitet, då högre nivåer av utbrändhet och sämre sömn vid inledningen av behandlingen vid predicerade högre nivåer av utbrändhet efter behandlingen i stresskolan. Dessa resultat tyder på att det kan vara viktigt att ta itu med stress och sömnproblem i början för att förbättra resultaten av utbrändhetsbehandling i stressbehandlingar.

**Nyckelord:** Utbrändhet/utmattningssyndrom, sömnkvalitet, stress.

## Introduction

According to the Institute of Health Metrics and Evaluation, 970 million individuals worldwide, or one in every eight persons, had a mental disorder in 2019 with anxiety and depressive disorders being the most prevalent (Institute of Health Metrics and Evaluation, accessed 14 April 2023). These two mental health conditions are significantly positively associated with stress and sleep disorders (Merrill R. M., 2022). Moreover, stress and sleep are both linked with other negative health outcomes such as cardiovascular and respiratory diseases, eating disorders, and type 2 diabetes (Cappuccio et al., 2011; Cappuccio et al. 2010; Kelly & Ismail, 2015; Schneiderman et al., 2005).

Stress is defined as a state of homeostasis being challenged (Lu et al., 2021) and the research on stress expanded significantly over the last decades. The transactional model of stress and coping by Lazarus and Folkman views stress as an individual's cognitive, physiological, and behavioural reactions to perceived inability or not having sufficient resources to cope with demands (Lazarus and Folkman, 1984). According to cross-sectional studies, highly perceived stress is consistently linked to poor sleep quality (Akerstedt et al., 2002; Akerstedt et al., 2006; Hall et al., 2000). Sleep quality can be defined as an individual's satisfaction with all aspects of sleep experience that contains four attributes: sleep efficiency, sleep latency, sleep duration, and awakening after sleep onset (Nelson et al., 2022). Additionally, prolonged stress often leads to burnout (Maslach et al., 2001), which is related to the health condition exhaustion disorder (ED). The clinical diagnosis ED was proposed by Swedish National Board of Health and Welfare in 2005 to improve diagnostics, treatment, and follow-up in case of stress-related exhaustion (Kalliomäki & Brodda Jansen, 2021). In his extensive review, Shirom, A., (1989) conceptualises the unique content of burnout as "the depletion of an individual's energetic resources – a combination of physical fatigue, emotional exhaustion and cognitive weariness" (p.33). Numerous studies have demonstrated a causal relationship between prolonged stress without recuperation and burnout (Koniarek & Dudek, 1996; Melamed et al., 2006).

As stress and inadequate recovery are strongly related to burnout/ED (Söderström et al., 2012), the association between them has been studied extensively (Schaufeli & Enzmann, 1998; Guido et al., 2012; Böhmert et al., 2011). The relationship between sleep quality and burnout/ED have also been investigated. Studies demonstrated that poor sleep quality was significantly associated with stress and burnout (Söderström et al., 2012; Metlaine et al., 2017; Saleh & Shapiro, 2008; Liu et al., 2021). Sleep disorders are also critically linked to burnout (Wolf & Rosenstock, 2017), which, according to the systematic review of Salvagioni et al. (2017), itself is a significant predictor of the following physical consequences: hypercholesterolemia, type 2 diabetes, coronary heart disease, musculoskeletal pain, prolonged fatigue, headaches, gastrointestinal and respiratory problems, severe injuries, and mortality below the age of 45 years. The psychological effects of burnout may be insomnia, depressive symptoms, use of psychotropic and antidepressant medications, hospitalization for mental disorders and psychological ill-health symptoms (Salvagioni et al., 2017).

The Swedish Social Insurance Agency's statistics shows that more than 40% of all Swedish residents who were on sick leave in 2020 obtained it due to underlying mental health conditions with stress-related mental health problems being the most prevalent health issue, particularly among young adults aged 25 to 39 (Folkhälsomyndigheten, 2020). According to recent data, 15% of the Swedish population report being stressed, while 42% complain about sleep problems (Folkhälsomyndigheten, 2022). Norlund et al. (2010) studied the prevalence of burnout in Sweden and found that 13% of the population reported high burnout scores (above 4.0 on Shirom Melamed Burnout Questionnaire; SMBQ).

Since consultations in case of depression, anxiety and stress-related conditions mostly take place in primary care in Sweden, general practitioners (GPs) play a crucial role when it comes to diagnosing and treating common mental disorders. Hanel et al. (2009) showed that patients diagnosed by their GPs with depression or anxiety often also suffered from psychosocial and/or financial stress. In clinical practice, patients diagnosed with ED frequently exhibit signs of anxiety and/or depression (Wiegner et al., 2015). However, only half of Swedish healthcare facilities have the resources to provide the psychological care that people with mental ill-health need, and there is a lack of evidence-based

care for mental health care (Socialstyrelsen, 2013). To help remedy this, the students of the Programme for Master of Science in Psychology from Umeå University give short, psycho-educative, manualised group-based cognitive behaviour therapy (CBT) treatments under supervision at health care centres in Umeå, as part of their training. The treatment is two-fold; one that aims towards treating stress problems (the stress school) and another aiming at patients with sleep problems (the sleep school). The project is being conducted in close collaboration with the primary care in the County Council of Västerbotten and aligns with World Health Organization (WHO) recommendations for scalable psychological interventions to address a large gap between prevalence of mental health problems and evidence-based service availability in most communities of the world. According to WHO (World Health Organization, 2017), potentially scalable psychological interventions include modified, evidence-based psychological treatments, such as brief, basic, non-specialist-delivered versions of existing evidence-based psychological treatments (e.g., basic versions of CBT, interpersonal therapy, self-help materials and guided self-help).

Preliminary results from the stress school treatment have shown that it is effective in short-term symptom reduction for two main outcomes: stress and burnout. Moreover, sleep, anxiety, depression, and somatic symptoms were improved (Bäcklund & Holmén, 2020; Hjelm Rönnlund & Wahlberg, 2020). A study that investigated the impact of potential background characteristics on treatment outcomes discovered that the stress school was effective for a variety of individuals (Funk & Nilsson Markhed, 2021). The participants have shown improvement in both stress and burnout also three months after completed treatment (Höglund, P., manuscript in preparation).

Since burnout and sleep are interrelated, it is important to understand how they affect each other in treatment outcomes. This study will use data collected at admission and immediately after treatment completion of the stress school and investigates the following research questions:

- a. is there an interaction between burnout and sleep in burnout as treatment outcome?
- b. how do sleep quality and burnout at baseline affect burnout immediately after treatment?

Considering the relationship between burnout and sleep we hypothesise that:

- (1) burnout and sleep problems will interact in burnout as treatment outcome.
- (2) poorer sleep quality at baseline will predict unchanged or higher burnout immediately after treatment in the stress school.
- (3) higher burnout at baseline will mean poorer recovery immediately after the treatment.

## **Methods and Materials**

### *Design*

This thesis is based on data from the ongoing study Health Education (Utbildning in Swedish) Stress and Sleep (HUSS). The HUSS-study is of quasi-experimental design aiming at evaluating the so-called stress- and sleep schools. The schools were launched in 2017 and the attached HUSS- study started in the autumn of 2020. The data used in this thesis was collected from the stress-school in the period between autumn 2020 and autumn 2022, the years of COVID-19 pandemic. Thus, the groups were smaller than initially planned and the data collection has taken longer than expected. The stress school treatment was delivered at health care centres in Umeå in four weekly sessions that lasted 90 minutes each including a break. The stress school started with an introduction to the treatment and the contextual framework. Each session began with the practice of mindfulness and homeworks were assigned at the end. The main focus was on psychoeducation about stress, stress response, susceptibility factors, recovery strategies, problem solving and compassion. Participants learnt mindfulness, relaxation and tension release techniques. Also, they received basic information on cognition while practicing prevention of worry and rumination. The fourth session contained a maintenance and relapse prevention plan. The participants received handouts that covered the learnt material and relaxation techniques.

### *Procedure*

At the start of the first stress school session, everybody who entered the treatment was asked to fill out a questionnaire with demographic questions and self-assessment forms made up of validated

psychometric instruments. At the end of the last treatment session, the participants were asked to fill out the same self-assessment forms as at baseline. These data were used to make up the analytical basis of the present study.

#### Questionnaires

The background information questions at baseline included, among other things, inquiries about age, sex, living conditions, employment, level of education, diagnosis, and years of ill health. Information about previous treatment and motivation to participate in the stress school was also collected. A question of self-rated problem severity was used to measure initial symptom severity. The participants rated the symptoms severity on a scale from 1 (not at all) to 5 (a lot).

The Shirom Melamed Burnout Questionnaire (SMBQ; Melamed, Kushnir & Shirom 1992) was used to measure burnout. The SMBQ contains 22 items, and the examples of the items are: *"I feel tired"*, *"I have difficulty thinking about complex things"*, *"I feel tensed"*, *"I feel full of vitality"*. The answers are rated on a seven-point scale where 1 is *"almost never"* and 7 is *"almost always"*. In this thesis, the mean of all 22 items is used and higher scores indicate higher levels of burnout. The SMBQ has good reliability (Melamed et al., 1992) and correlates highly with other reliable tests that measure burnout (Grossi et al., 2003).

The Karolinska Sleep Questionnaire (KSQ; Kecklund & Åkerstedt, 1992) was used to measure sleep problems. The KSQ is a Swedish assessment tool of eighteen questions that measure four different indexes: sleep quality, non-restorative sleep, sleep apnoea and sleepiness. The answers are scaled from *"never"* (0) to *"always"* (5). High scores indicate sleep problems, and the results are interpreted by calculating a mean value for each index. All KSQ indexes have been shown to have good reliability and validity (Nordin, Åkerstedt & Nordin, 2013). In this study, the sleep quality index (four questions) and non-restorative sleep index (three questions) were combined and called sleep quality. The examples of the questions are: *"Have you been bothered by the following complaints during the past three months: repeated awakenings with difficulties falling asleep again; premature awakenings; disturbed/restless sleep?"* The normative data on a sleep quality dimension for Swedish population shows an average mean of 1.58; sd = 1.01 (Nordin, Åkerstedt & Nordin, 2013).

The Swedish version of the Perceived Stress Scale (PSS-10) was used to measure stress (Nordin & Nordin, 2013). PSS-10 was developed by Cohen and Williamson (1988) and translated into Swedish by Eskin and Parr (1996). The 10 items scale has response options ranging from *"never"* (0) to *"very often"* (4). The questions in this scale ask about a person's feelings and thoughts during the last month, for example: *"In the last month, how often have you been upset because of something that happened unexpectedly?"* The scale is summed up, and high scores correspond to a high degree of perceived stress and the maximum score is 40. Swedish norm values show an average mean of 14.56 for women and 13.20 for men. There are no established cut-off values. The Swedish version of PSS-10 has good internal reliability and construct validity (Nordin & Nordin, 2013).

#### Participants

Everybody who complained about stress-related problems when seeking the health care services at the collaborating health care centres in Umeå, were eligible to participate in a stress school. To participate in the treatment, the patients had to speak Swedish well enough to be able to follow the treatment. A total of 184 people, aged from 18 to 68 years started the stress school and 116 out of these filled out both the baseline and immediately after-treatment questionnaires. The mean age of the participants, who completed the stress school was 37.8; sd=12.76. The mean SMBQ score was 4.82; sd=1.03, the KSQ score was 2.50; sd = .97 and the PSS-10 score was 23.29; sd = 5.60 at baseline. The stress school sample is described in Table 1 with respect to background information and health conditions of relevance to our research questions.

Table 1. *Demographics and background information for the participants of the stress- and sleep schools.*

		Stress school n=116	
		N	%
<hr/>			

---

Sex		
Men	28	24.1
Women	86	73.5
Other option/Insecure	2	1.7
Living conditions		
With partner without children	26	22.4
With partner with children	61	52.6
Single with children	8	6.9
Single	16	13.8
Education		
High school	31	26.7
University/college	79	68.1
Employment		
Employed	78	67.2
Study	11	9.4
Looking for a job	3	2.6
Sick leave/retirement	15	12.7
Sick leave due to stress or sleep problems	40	34.5
Previous treatment from stress or sleep problems		
Yes	73	62.9
Years with ill-health		
Less than 1 year	34	29.3
1 year	26	22.4
More than 1 year	54	46.6
How serious is the problem		
Moderate	16	13.8
Quite serious	60	51.7
Serious	35	30.2
Big or quite big motivation to participate	89	76.7
Alcohol consumption		
Never	25	21.6
Once per month or more rarely	51	44.0
2-4 times per month	34	29.3
2-3 times per week	5	4.3
Four times per week or more	-	-
Physical exercise		
Never	21	18.1
Once per month or more rarely	27	23.3
2-4 times per month	45	38.8
2-3 times per week	20	17.2
Four times per week or more	-	-
Medicine intake for mental health issues	73	62.9
Antidepressants	23	19.8
Anti-anxiety	12	10.3
Sleeping pills	20	17.2
Pain killers	6	5.2
Diagnosis by physician		
Yes	71	61.2
Which diagnosis		
Hypertension	18	15.5
Pain in muscles, joints,	10	8.6

Asthma, allergy	26	22.4
Exhaustion disorder (Burnout)	47	40.5
Depression	38	32.8
Anxiety	35	30.2
Panic attacks	7	6.0
Chronic fatigue	14	12.1
Irritable bowel syndrome	7	6.0
Tinnitus	7	6.0
Migraine	13	11.2
Hypersensitivity (all types)	10	8.7
Chronic pain	6	5.2

Table 1 demonstrates that the majority of the participants in the stress school were women, employed or students, living with partners with or without children and had college or university degrees. About a third of the participants were on sick leave for stress and sleep-related problems. The background information also shows that one third of the participants already received treatment for stress and sleep problems and two thirds of the participants were prescribed medications for mental health related issues. None of the participants reported alcohol consumption or physical exercising four and more times per week. More than 80 percent of people considered their stress and sleep problems as quite serious and more than 60 percent had one or more medical diagnosis, the most common ones are presented in Table 1. Additionally, most of the participants reported that their stress or sleep related problems had lasted more than a year.

Thus, the basis of the analysis in the current study is formed on the survey responses from a total of 116 participants who filled in the psychometric instruments at baseline and after treatment. The group that dropped out from the treatment was not included in the analysis. The drop-out group consists of 68 people who only filled out the baseline questionnaire. A drop-out analysis was performed to assess potential group differences at baseline. No significant group differences were found with regard to baseline measurements of age, sex, educational level, occupational status, living conditions, initial symptom severity, motivation and number of years with reported mental health issues. Neither were there any significant differences between baseline scores of SMBQ, PSS and KSQ.

### Statistical Analyses

The statistical calculations were performed using IBM SPSS Statistics version 28.0.0.0. Imputed data was received by using Markov chain Monte Carlo (MCMC) imputation method – an algorithm for arbitrary data patterns where the underlying complete data is assumed to follow a multivariate normal distribution (Graham, 2009; Takahashi, 2017). The imputation was iterated five times and five datasets were consequently analysed in each analysis to extract representative values as replacement for the missing data.

We reported frequencies (n) and proportions (%) for categorical data and means (m) and standard deviation (sd) for continuous data. A drop-out analysis to assess potential group differences between those who finished the stress school and those who did not was conducted with independent t-tests (for continuous variables) and Chi-square tests (for categorical variables). Pearson's correlation analysis was used to select confounding variables. Z-scores for SMBQ and KSQ were obtained to be used in the linear regression that enabled us to compare the scores from different normal distributions. Hierarchical linear regression analysis was employed to examine the relationship between independent and dependent variables. The analysis was conducted in two models. The first model included the selected confounding variables for the stress school sample and the second included an interaction analysis. An interaction term between the standardized burnout and sleep quality variables, along with burnout and sleep quality separately were used to predict level of burnout immediately after the treatment. The significance level for all statistical calculations was set to <.05.

### Ethical considerations

Before the first measurement, all the participants agreed to participate in the research by signing an informed consent. The informed consent contained information about the voluntary nature of participation and the possibility to withdraw from the study at any time. The participants were also informed that, in accordance with general data protection regulation (GDPR), they had the right to receive extracts from the personal data they submitted for research. The collected data was anonymized and stored in accordance with the data protection standards at the Department of Psychology at Umeå University. The research project has received approval from the Swedish Ethical Review Authority (reference number 2020-00168).

### Results

At first, a selection of confounding variables was made based on what the research literature says about potential risk factors for burnout. The variables that were tested for correlation were age, sex, living conditions, education, employment status, sick leave, years with ill-health, medicine for mental health problems, alcohol consumption, exercising and diagnosis. The correlation analyses showed that in the stress school sample, the SMBQ was significantly correlated with sleep quality ( $r = .661$ ;  $p < .001$ ) and PSS ( $r = .612$ ;  $p < .001$ ). Significant inverse relationship coefficients were also found between burnout and sick leave due to the stress or sleep ( $r = -.337$ ;  $p < .001$ ). No correlation was found with sex, age, living conditions, education, employment status, years with ill-health, medicine intake, alcohol consumption and exercising. Based on the results from the correlation analyses, literature review and our research questions, the confounding variables presented in Model 1 (see Table 2) in the hierarchical linear regression analysis were chosen.

The results presented in Table 2 demonstrate that 22 % of the variance was explained by the variables used in Model I with PSS score at baseline being the main predictor of burnout immediately after treatment. The results also revealed that sick leave due to stress did not significantly predict burnout as treatment outcome.

*Table 2. Results from hierarchical linear regression analysis.*

Stress school			
	<i>R</i> <sup>2</sup>	<i>Beta</i>	<i>p</i>
<b>Model I</b>	.22		
PSS-10		.43	<.001
Sick leave due to stress		-.10	.26
<b>Model II</b>	.54		
Burnout*Sleep quality		.09	.17
Burnout		.63	<.001
Sleep quality		.20	<.05

Model II included the interaction term between burnout and sleep quality and explained 54 % of the variance. There was no significant interaction effect between burnout and sleep in relation to burnout as a treatment outcome. However, there was a main effect for both burnout and sleep quality in relation to burnout post-treatment: the higher the burnout and poorer the sleep at baseline, the higher burnout post-treatment. The residuals were normally distributed.

### Discussion

This study aimed at investigating the relationship between burnout and sleep quality when predicting burnout immediately after stress treatment intervention. The findings showed that there was no interaction between burnout and sleep quality meaning that our first hypothesis was not supported. The results of the study revealed main effects for both burnout and sleep quality, showing that high

levels of burnout and poor quality of sleep at admission predict higher levels of burnout after the treatment in the stress school which supported our second and third hypothesis.

These findings are in line with some of the earlier research suggesting that impaired sleep is an independent predictor of burnout (Wolf & Rosenstock, 2017; Söderström et al., 2012). Ekstedt et al. (2009) demonstrated that impaired sleep might be part of the fatigue component in burnout. Jansson-Fröjmark & Lindblom, 2010 showed that quality of sleep and burnout were not bidirectionally related, stating that while insomnia was linked to the maintenance of the central part of burnout, burnout was not related to future insomnia. At the same time, bidirectional effects were demonstrated between impaired sleep quality and burnout which is partly in contrast with previous studies (Pagnin et al., 2014; Liu et al., 2021). These contradictory results highlight that sleep should be an essential component of burnout investigation. Sleep is fundamental for the anabolic processes to repair the harm of the “wear and tear”. It is also required for the proper brain functioning, health, wellbeing, and daily functioning. Therefore, if the recovery through sleep is compromised, it is logical to assume that there might be an “energy debt” (Ekstedt, 2005).

The results could possibly be explained by the fact that in our study we relied on a comparatively small and selected sample. The participants of the study were already suffering from stress-related problems and 40.5% of them had been diagnosed with ED by a physician. Therefore, it is possible that the absence of interaction between sleep quality and burnout can be explained by the study sample not being representative to the Swedish population as a whole and cannot be compared to studies on other samples. The literature shows that both men and women are significantly more likely to miss work due to a medically certified illness when they are suffering from severe burnout (Ahola et al., 2008; Borritz et al., 2006). Thus, our results showing the inverse relationship between burnout and sick leave due to the stress or sleep need further investigation as they do not support the previously existing body of knowledge. The SMBQ and KSQ scores cannot be considered fully independent variables as the correlation is already high between those two measurements indicating potential multicollinearity. Additionally, with Model II of our hierarchical linear regression we have managed to explain only 54 % even though we brought burnout as a predictor in a sample with severe stress related problems (mean of SMBQ 4.82) and the time frame between two measurements was only three weeks. This means that there are other variables to be considered. The study did not include a control group and thus no conclusions can be made about whether this treatment differs from other stress management interventions.

This study design has its strength. We have conducted a drop-out analysis to investigate the difference between those who finished the treatment and those who quit. Secondly, we have invited everybody with stress problems regardless of diagnosis - this way we have achieved ecological validity. However, this is also a weakness of the study since we cannot target a certain population and investigate what works specifically for them. Additionally, the drop out analysis showed that there were no reliable differences found between the drop-outs and those who completed the treatment. Thus, we don't seem to have a very large selection bias that adds to the ecological validity. We also used valid psychometric instruments.

With this knowledge interventions for sleep improvement should be incorporated in stress and burnout prevention and treatment activities to improve burnout as a treatment outcome. For example, additional sessions on sleep could be recommended to those stress school participants whose KSQ scores show poor sleep quality, or they might be encouraged to visit two schools simultaneously. Additionally, the two schools' content could potentially be combined, particularly considering the previous contradictory research findings on sleep quality, stress and burnout relationships (Wolf & Rosenstock, 2017; Söderström et al., 2012; Ekstedt et al., 2009; Jansson-Fröjmark & Lindblom, 2010; Pagnin et al., 2014; Liu et al., 2021). Furthermore, our findings may indicate that such short-term, psycho-educative stress treatments may not be enough for the population with high level of burnout and significant sleep problems.

Although our understanding of burnout has advanced considerably in recent years, many gaps in the knowledge and clinical practice remain. The results of our study add to the existing body of

knowledge on the role of sleep quality in treating burnout and suggest that addressing stress and sleep problems on different levels may be an important public mental health intervention. Knowing that sleep quality impacts recovery from burnout in this specific population sample may guide the framing of further interventions, aimed at treating burnout, in order to increase desired effects. Moreover, based on the findings, the health-related information on burnout can be more tailored and include the information on the importance of sleep quality in the treatments in different applied settings (clinical, educational, occupational). The findings about the role of sleep quality on the burnout outcome can potentially be generalised to other treatments of stress related disorders.

In addition to the obtained results, it would be interesting to investigate the relationships between burnout and sleep quality further in the sleep school. Knowing how stress and burnout at baseline affect sleep as a treatment outcome may help to mitigate the impact of stress and sleep problems on individuals' well-being and treatment efficacy. Longitudinal studies on burnout's effects and the impact of sleep quality and stress management interventions on burnout are needed, as well as studies on effective treatment combinations.

### References:

- Ahola, K., Kivimäki, M., Honkonen, T., Virtanen, M., Koskinen, S., Vahtera, J., & Lönnqvist, J. (2008). Occupational burnout and medically certified sickness absence: a population-based study of Finnish employees. *Journal of psychosomatic research*, 64(2), 185–193. <https://doi.org/10.1016/j.jpsychores.2007.06.022>
- Akerstedt T. (2006). Psychosocial stress and impaired sleep. *Scandinavian journal of work, environment & health*, 32(6), 493–501.
- Akerstedt, T., Knutsson, A., Westerholm, P., Theorell, T., Alfredsson, L., & Kecklund, G. (2002). Sleep disturbances, work stress and work hours: a cross-sectional study. *Journal of psychosomatic research*, 53(3), 741–748. [https://doi.org/10.1016/s0022-3999\(02\)00333-1](https://doi.org/10.1016/s0022-3999(02)00333-1)
- Akerstedt, T., Kecklund, G., & Axelsson, J. (2007). Impaired sleep after bedtime stress and worries. *Biological psychology*, 76(3), 170–173. <https://doi.org/10.1016/j.biopsycho.2007.07.010>
- Bäcklund, J., & Holmén, M. (2020). STRESS-OCH SÖMNBHANDLING: Utvärdering av kliniskt relevanta effekter av gruppbehandling inom primärvård.
- Böhmert, M., Kuhnert, S., & Nienhaus, A. (2011). Psychological stress and strain in dialysis staff: a systematic review. *Journal of renal care*.
- Borritz, M., Rugulies, R., Christensen, K. B., Villadsen, E., & Kristensen, T. S. (2006). Burnout as a predictor of self-reported sickness absence among human service workers: prospective findings from three year follow up of the PUMA study. *Occupational and environmental medicine*, 63(2), 98–106. <https://doi.org/10.1136/oem.2004.019364>
- Cappuccio, F. P., Cooper, D., D'Elia, L., Strazzullo, P., & Miller, M. A. (2011). Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis of prospective studies. *European heart journal*, 32(12), 1484–1492. <https://doi.org/10.1093/eurheartj/ehr007>
- Cappuccio, F. P., D'Elia, L., Strazzullo, P., & Miller, M. A. (2010). Quantity and quality of sleep and incidence of type 2 diabetes: a systematic review and meta-analysis. *Diabetes care*, 33(2), 414–420. <https://doi.org/10.2337/dc09-1124>
- Cohen, S. & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health: Claremont Symposium on applied social psychology* (pp. 31–67). Newbury Park, CA: Sage.
- Ekstedt, M. (2005). Burnout and sleep. Karolinska Institutet (Sweden).

- Ekstedt, M., Söderström, M., & Åkerstedt, T. (2009). Sleep physiology in recovery from burnout. *Biological psychology*, *82*(3), 267–273. <https://doi.org/10.1016/j.biopsycho.2009.08.006>
- Eskin, M. & Parr, D. (1996). Introducing a Swedish version of an instrument measuring mental stress. Reports from the Department of Psychology, no. 813. Stockholm: Stockholm University, Department of Psychology.
- Folkhälsomyndigheten, 2020. (Public Health Agency of Sweden) [accessed April, 2023].
- Folkhälsomyndigheten, 2022. (Public Health Agency of Sweden) [accessed April, 2023].
- Funck, R., & Nilsson Markhed, L. (2021). STUDENTLEDD GRUPPBEHANDLING FÖR STRESS OCH SÖMN INOM PRIMÄRVÅRDEN: En studie om behandlingseffekter för olika klientgrupper.
- Graham J. W. (2009). Missing data analysis: making it work in the real world. *Annual review of psychology*, *60*, 549–576. <https://doi.org/10.1146/annurev.psych.58.110405.085530>
- Grossi, G., Perski, A., Evengård, B., Blomkvist, V., & Orth-Gomér, K. (2003). Physiological correlates of burnout among women. *Journal of psychosomatic research*, *55*(4), 309–316. [https://doi.org/10.1016/s0022-3999\(02\)00633-5](https://doi.org/10.1016/s0022-3999(02)00633-5)
- Guido, L., Goulart, C., Silva, R., Lopes, L., & Ferreira, E. (2012). Stress and burnout among multidisciplinary residents. *Revista latino-americana de enfermagem*.
- Hall, M., Buysse, D. J., Nowell, P. D., Nofzinger, E. A., Houck, P., Reynolds, C. F., 3rd, & Kupfer, D. J. (2000). Symptoms of stress and depression as correlates of sleep in primary insomnia. *Psychosomatic medicine*, *62*(2), 227–230. <https://doi.org/10.1097/00006842-200003000-00014>
- Hanel, G., Henningsen, P., Herzog, W., Sauer, N., Schaefer, R., Szecsenyi, J., & Löwe, B. (2009). Depression, anxiety, and somatoform disorders: vague or distinct categories in primary care? Results from a large cross-sectional study. *Journal of psychosomatic research*, *67*(3), 189–197.
- Hartz, A. J., Daly, J. M., Kohatsu, N. D., Stromquist, A. M., Jogerst, G. J., & Kukoyi, O. A. (2007). Risk factors for insomnia in a rural population. *Annals of Epidemiology*, *17*(12), 940–947. <https://doi.org/10.1016/j.annepidem.2007.07.097>
- Hjelm Rönnlund, A., & Wahlberg, A. (2020). Studentledd stress-och sömnbehandling: En utvärdering av dess korttidseffekter.
- Institute of Health Metrics and Evaluation. Global Health Data Exchange (GHDx), (<https://vizhub.healthdata.org/gbd-results/>, accessed 14 April 2023).
- Jansson-Fröjmark, M., & Lindblom, K. (2010). Is there a bidirectional link between insomnia and burnout? A prospective study in the Swedish workforce. *International journal of behavioral medicine*, *17*(4), 306–313. <https://doi.org/10.1007/s12529-010-9107-8>
- Kalliomaäki, J., & Brodda Jansen, G. (2021). Development Of a Chronic Stress Diagnosis. *Journal of rehabilitation medicine. Clinical communications*, *4*, 1000064. <https://doi.org/10.2340/20030711-1000064>
- Kecklund, G., & Åkerstedt, T. (1992). The psychometric properties of the Karolinska Sleep Questionnaire. *Journal of Sleep Research*, *1*, 113.
- Kelly, S. J., & Ismail, M. (2015). Stress and type 2 diabetes: a review of how stress contributes to the development of type 2 diabetes. *Annual review of public health*, *36*, 441–462. <https://doi.org/10.1146/annurev-publhealth-031914-122921>

- Koniarek, J., Dudek, B. Social support as a buffer in the stress-burnout relationship. *Int J Stress Manage* 3, 99–106 (1996). <https://doi.org/10.1007/BF01857718>
- Lazarus, R. and S. Folkman (1984). *Stress, appraisal and coping*. New York, Springer.
- Liu, X., Zhang, L., Wu, G., Yang, R., & Liang, Y. (2021). The longitudinal relationship between sleep problems and school burnout in adolescents: A cross-lagged panel analysis. *Journal of Adolescence*, 88(1), 14–24. <https://doi.org/10.1016/j.adolescence.2021.02.001>
- Lu, S., Wei, F., & Li, G. (2021). The evolution of the concept of stress and the framework of the stress system. *Cell stress*, 5(6), 76–85. <https://doi.org/10.15698/cst2021.06.250>
- Lundgren-Nilsson, Å., Jonsdottir, I. H., Pallant, J., & Ahlborg, G., Jr (2012). Internal construct validity of the Shirom-Melamed Burnout Questionnaire (SMBQ). *BMC public health*, 12, 1. <https://doi.org/10.1186/1471-2458-12-1>
- Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual review of psychology*, 52(1), 397-422.
- Melamed, S., Kushnir, T., & Shirom, A. (1992). Burnout and risk factors for cardiovascular diseases. *Behavioral medicine (Washington, D.C.)*, 18(2), 53–60. <https://doi.org/10.1080/08964289.1992.9935172>
- Melamed, S., Shirom, A., Toker, S., Berliner, S., & Shapira, I. (2006). Burnout and risk of cardiovascular disease: evidence, possible causal paths, and promising research directions. *Psychological bulletin*, 132(3), 327–353. <https://doi.org/10.1037/0033-2909.132.3.327>
- Merrill R. M. (2022). Mental Health Conditions According to Stress and Sleep Disorders. *International journal of environmental research and public health*, 19(13), 7957. <https://doi.org/10.3390/ijerph19137957>
- Metlaine, A., Sauvet, F., Gomez-Merino, D., Elbaz, M., Delafosse, J. Y., Leger, D., & Chennaoui, M. (2017). Association between insomnia symptoms, job strain and burnout syndrome: a cross-sectional survey of 1300 financial workers. *BMJ open*, 7(1), e012816. <https://doi.org/10.1136/bmjopen-2016-012816>
- Nelson, K. L., Davis, J. E., & Corbett, C. F. (2022). Sleep quality: *An evolutionary concept analysis*. *Nursing forum*, 57(1), 144–151. <https://doi.org/10.1111/nuf.12659>
- Nordin, M., Åkerstedt, T., & Nordin, S. (2013). Psychometric evaluation and normative data for the Karolinska Sleep Questionnaire. *Sleep and Biological Rhythms*, 11(4), 216–226. <https://doi.org/10.1111/sbr.12024>
- Nordin, M., & Nordin, S. (2013). Psychometric evaluation and normative data of the Swedish version of the 10-item perceived stress scale. *Scandinavian journal of psychology*, 54(6), 502–507. <https://doi.org/10.1111/sjop.12071>
- Norlund, S., Reuterwall, C., Höög, J., Lindahl, B., Janlert, U., & Birgander, L. S. (2010). Burnout, working conditions and gender--results from the northern Sweden MONICA Study. *BMC public health*, 10, 326. <https://doi.org/10.1186/1471-2458-10-326>
- Pagnin, D., de Queiroz, V., Carvalho, Y. T., Dutra, A. S., Amaral, M. B., & Queiroz, T. T. (2014). The relation between burnout and sleep disorders in medical students. *Academic psychiatry : the journal of the American Association of Directors of Psychiatric Residency Training and the Association for Academic Psychiatry*, 38(4), 438–444. <https://doi.org/10.1007/s40596-014-0093-z>
- Richardson, S., Shaffer, J. A., Falzon, L., Krupka, D., Davidson, K. W., & Edmondson, D. (2012). Meta-analysis of perceived stress and its association with incident coronary heart disease. *The*

- American journal of cardiology*, 110(12), 1711–1716.  
<https://doi.org/10.1016/j.amjcard.2012.08.004>
- Saleh, P., & Shapiro, C. M. (2008). Disturbed sleep and burnout: implications for long-term health. *Journal of psychosomatic research*, 65(1), 1–3.  
<https://doi.org/10.1016/j.jpsychores.2008.05.028>
- Salvagioni, D. A. J., Melanda, F. N., Mesas, A. E., González, A. D., Gabani, F. L., & Andrade, S. M. (2017). Physical, psychological and occupational consequences of job burnout: A systematic review of prospective studies. *PloS one*, 12(10), e0185781.  
<https://doi.org/10.1371/journal.pone.0185781>
- Schaufeli, W.B., & Enzmann, D. (1998). *The burnout companion to study and practice: A critical analysis*. Philadelphia: Taylor & Francis.
- Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: psychological, behavioral, and biological determinants. *Annual review of clinical psychology*, 1, 607–628.  
<https://doi.org/10.1146/annurev.clinpsy.1.102803.144141>
- Shirom, A. (1989) Burnout in work organizations. In: Cooper, C.L. and Robertson, I., Eds., *International Review of Industrial and Organizational Psychology*, Wiley, New York, 25-48.
- Socialstyrelsen (2013). För låg tillgång till psykologisk behandling. <http://www.socialstyrelsen.se/nyheter/2013juni/forlagtillgangtillpsykologiskbehandling>
- Söderström, M., Jeding, K., Ekstedt, M., Perski, A., & Akerstedt, T. (2012). Insufficient sleep predicts clinical burnout. *Journal of occupational health psychology*, 17(2), 175–183.  
<https://doi.org/10.1037/a0027518>
- Takahashi, M., 2017. Statistical Inference in Missing Data by MCMC and Non-MCMC Multiple Imputation Algorithms: Assessing the Effects of Between-Imputation Iterations. *Data Science Journal*, 16(0), p.37. DOI: <https://doi.org/10.5334/dsj-2017-037>
- World Health Organization. (2017). Scalable psychological interventions for people in communities affected by adversity: a new area of mental health and psychosocial work at WHO. World Health Organization. <https://apps.who.int/iris/handle/10665/254581>. License: CC BY-NC-SA 3.0 IGO
- Wiegner, L., Hange, D., Björkelund, C., & Ahlborg, G., Jr (2015). Prevalence of perceived stress and associations to symptoms of exhaustion, depression and anxiety in a working age population seeking primary care--an observational study. *BMC family practice*, 16, 38.  
<https://doi.org/10.1186/s12875-015-0252-7>
- Wolf, M. R., & Rosenstock, J. B. (2017). Inadequate Sleep and Exercise Associated with Burnout and Depression Among Medical Students. *Academic psychiatry: the journal of the American Association of Directors of Psychiatric Residency Training and the Association for Academic Psychiatry*, 41(2), 174–179. <https://doi.org/10.1007/s40596-016-0526-y>