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Article

Anonymous Online Treatment and Prevention of Shift Work Sleep Disorder in Companies

Lukas Peter [1,*], Richard Reindl [2], Sigrid Zauter [2], Thomas Hillemacher [1] and Kneginja Richter [1,2,3]

[1] University Clinic for Psychiatry and Psychotherapy, Paracelsus Medical University, Nuremberg, Germany
[2] Faculty for Social Sciences, University of Applied Sciences Georg Simon Ohm, Nuremberg, Germany
[3] Faculty for Medical Sciences, University Goce Delcev, Stip, Republic of North Macedonia
* Correspondence: lukas.peter@klinikum-nuernberg.de

Abstract: In western societies about one in six employees works in shifts. Shiftwork is associated with a number of poor somatic and psychological health outcomes, especially sleep issues. Higher rates of absenteeism and accidents in the workplace are possible consequences. Still, prevention programs and treatment options that are specifically tailored to shift workers' needs are rare. We devised a 4-week online sleep intervention (n = 21) and compared treatment outcomes to our outpatient treatment for shift workers (n = 12). Measures included the WHO-5, ISI, and ESS scales as well as sleep diaries. Shift workers reported worse symptoms of insomnia than other participants. Results show significant average increases in sleep efficiency (+ 7%) and total sleep time (+ 25 min.), as well as significant improvements regarding insomnia symptoms and wellbeing in the online sample. Rates of improvement did not differ between the online and outpatient samples. Sleep disorders affect a relevant part of the working population, especially shift workers. Online approaches to treatment of these issues seem feasible and effective. Randomized controlled trials are needed.

Keywords: chronobiology; shiftwork; insomnia; cognitive behavioral therapy, telepsychiatry; occupational health

1. Introduction

Across western societies about one sixth of the working population is on a shift schedule [1–3]. Shiftwork includes any professional activity where working hours change according to a defined cycle, for example daily or weekly [4]. Working shifts is associated with increased risks of cardiovascular diseases, gastrointestinal disorders, breast cancer, as well as sleep disorders [5–8].

Multiple psychosocial, physiological, and behavioral mechanisms may contribute to causal connections between shiftwork and different disorders. On a psychosocial level, shiftwork is associated with reduced flexibility, less control over working conditions, impaired work-life-balance and recovery from work [7]. This can be interpreted as reduced job control [9] and as an effort reward imbalance [10]. Both models have been used in the past to causally connect poor working conditions with cardiovascular risk factors such as hypertension or atherosclerosis [7,11]. Behaviorally, a number of potentially unhealthy habits are associated with shiftwork. This includes smoking, cholesterol consumption, weight gain, and binge drinking [7,12]. The most prominent behavioral factor in associations between shiftwork and disease however is sleep. Especially work at night is opposed to human circadian rhythms and is thus associated with disturbances in melatonin secretion, which are in turn associated with increased risk of breast cancer [5,13]. Other consequences of having to work against internal rhythms include sleep deprivation, insomnia, and daytime sleepiness [5,13–15]. One in four shift-workers and one in three night-workers suffer from clinically relevant symptoms of sleep disorders [16,17]. Difficulties initiating or maintaining sleep and daytime sleepiness that persist for more than three months and are clearly linked to the individual shift rotation may be diagnosed as "shift work sleep disorder" according to the International Classification of Sleep Disorders [18]. The associated impairments in daytime functioning result in increased risks

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of accidents in the workplace and on the commute, which add up to billions of dollars in damage and healthcare costs every year in the US alone [19,20].

Seeing as shiftwork is indispensable in a number of different industries, programs for prevention and intervention that are especially tailored to the needs of shift-workers are needed [21]. This includes ergonomic redesign of shift schedules and work environments. Fast forward shift rotation (2 morning-, 2 evening-, 2 night shifts) with adequate time off between shifts (> 11 hours) and multiple days off after night shifts are recommended [21]. There is some evidence that the application of bright artificial light between 7.000 and 12.000 Lux during night shifts and wearing sunglasses on the morning commute home might improve circadian adaptation and wakefulness at work [14,22,23]. Allowing short naps during night shifts could potentially also improve wakefulness and performance [21]. There is however some conflicting evidence for most of these preventive measures [21], so providing clear recommendations presents a challenge for researchers.

Data on possible treatments for shiftwork related sleep disorders is scarce and as of today limited to the administration of Melatonin [23-26], other sleep-inducing medication [27], and relatively short interventions relying on elements from cognitive behavioral psychotherapy [28]. The outpatient department of the University Clinic for Psychiatry and Psychotherapy in Nuremberg, Germany offers a treatment program for shift-workers with sleep disorders where six sessions of cognitive behavioral psychotherapy for insomnia (CBT-I) are combined with bright light therapy and actometric diagnostics. Personnel expenditures and waiting times are high for single-outpatient treatments like this. Randomized controlled trials showed that a transfer of CBT-I from outpatient to online settings is principally possible and effective [29,30]. Thus, we designed, implemented and evaluated a short online intervention to deliver basic CBT-I elements via four e-mail contacts.

The aims of the intervention were to increase general wellbeing as measured by the World Health Organization wellbeing questionnaire (WHO-5) [31], reduce symptoms of insomnia as measured by the Insomnia Severity Index (ISI) [32], reduce daytime sleepiness as measured by the Epworth Sleepiness Scale (ESS) [33], and increase total sleep time and sleep efficiency as measured by sleep diaries [34]. Furthermore, we compare the results of the online-intervention to a sample of shift workers who received the aforementioned six-session outpatient treatment in our clinic.

2. Materials and Methods

Potential participants for the online intervention were informed and screened by their company physician in six locations of the partnering Bosch corporation across Germany, resulting in 50 recruited participants, of which 21 went on to complete the entire online treatment course. The information material contained a self-report screening questionnaire asking about nine characteristic symptoms of sleep disorders [35]. Participants that confirmed at least six of those symptoms received an individual, anonymized access code to the online treatment platform from their company physician. Alternative treatment options were explored with all other participants. In case of sustained interest, participating in the online treatment was still possible.

Upon registration on the online platform, using the access code, participants received a welcome message containing sociodemographic questions and the three questionnaires used to evaluate the intervention (WHO-5, ISI, ESS). In case of clinically critical scores, participants were encouraged to seek outpatient treatment and get diagnosed by a qualified physician. On a transitional basis, online treatment remained possible in these cases. Psychometric measurements were repeated upon completion of the treatment process. Sociodemographic questions included age, gender, composition of household, employment status, and shift schedule.

Based on experiences from outpatient treatment of shift-workers and recommendations of the German Association for Sleep Medicine [34] a sleep diary was developed. It contained five questions for every evening, such as daily amount of alcohol consumed and subjective tiredness on a scale from 1 to 6, and ten questions for every morning, such as bedtime, wake after sleep onset, and total sleep time. Diaries were filled out for one week at a time and transmitted at least four times over the course of the treatment. Participants were able to attach a message with supplementary information about the shifts they had worked, days off, etc.

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The usual six sessions of outpatient CBT-I [36] were condensed to four e-mail contacts for the purpose of a more economic approach. In the first module, participants were instructed to adhere to sleep restriction with regular bed times, coordinated with their individual shift schedules. The second module contained information on sleep hygiene and general psychoeducation about sleep. With the third contact, relaxation techniques, especially progressive muscle relaxation, were introduced. The fourth and last module contained concluding remarks and recommendations for the future use of sleep restriction and relaxation techniques. In addition, every contact was used to transmit individual feedback about last week's sleep diary and consequences for the individual sleep restriction program. During the entire program, participants were anonymous to the CBT-I professional with no possibility of connecting the individual access code to any personal information.

The second sample of n = 12 outpatients from our sleep clinic consists of shift workers from different local companies who were referred to us by their general physician because of shiftwork-related sleep disorders.

3. Results

The first contact of the online treatment program was initiated by 50 participants, aged between 20 and 63 years (M = 43.40; SD = 10.50). The online sample was predominately male (74%) and most participants stated living in a household with a spouse and/or children (78%) and working full-time (94%). Due to vacations or changes in scheduling, only 36% of online participants worked shifts during the entire treatment period (referred to as "shift workers" hereinafter). Complete data including pre- and post-measurements of the WHO-5, ISI, and ESS, as well as at least four sleep diaries were obtained for 21 online participants. Between the first and the last message, an average of 98.42 days passed (SD = 43.63).

At the start of the program 46% of the sample reported critical scores regarding daytime sleepiness (ESS > 10) and 74% reported critically impaired well-being (WHO-5 < 13). At least subclinically relevant scores regarding symptoms of insomnia (ISI > 7) were reported by 96% of the sample. No differences were found between shift- and non-shift-workers regarding daytime sleepiness and well-being. However, shift-workers reported higher ISI-scores, corresponding to higher impairment by symptoms of insomnia, than non-shift-workers ($p < .05$). Of the seven symptoms in the ISI, only the second item asking about problems staying asleep shows significantly higher scores ($p < .05$) for shift- than non-shift-workers in the online treatment sample. In the whole sample, ISI and WHO-5 scores improved over the course of the program (both $p < .05$). Symptoms of daytime sleepiness didn't change significantly.

Between the second and the fourth weekly sleep diary, total sleep time per night increased linearly by an average of 24.50 minutes ($p < .05$), independent of shiftwork status. The first week of CBT-I treatment was omitted from this analysis, as it contained sleep restriction, which is usually accompanied by an initial drop in total bed time. However, sleep times didn't change significantly between the first and second sleep diary.

Critical sleep efficiency (< 85%), calculated weekly as the quotient of total sleep time divided by total bed time, was reported by 45% of the sample in the first week of treatment (M = 81.88%; SD = 11.60%). Analyses of variance showed linear improvements on this measure over the four sleep diaries ($p < .01$; Fig. 1) with an average improvement of 7.18% from the first to the last. Shift- and non-shift-workers did not differ significantly regarding initial values or the development of sleep efficiency. We compared these results with the development of sleep efficiency in a sample of n = 12 shiftworking outpatients from our clinic. In the outpatient sample, a higher incidence of critical sleep efficiency was reported in the first week (67%). However, average sleep efficiency did not differ between groups. Analyses of variance showed linear improvements of sleep efficiency in the outpatient sample ($p < .01$) by an average of 7.58% between the first and the fourth week of treatment. The online and the outpatient group showed no differences regarding the rate of improvement across four weeks of treatment (see Figure 1).

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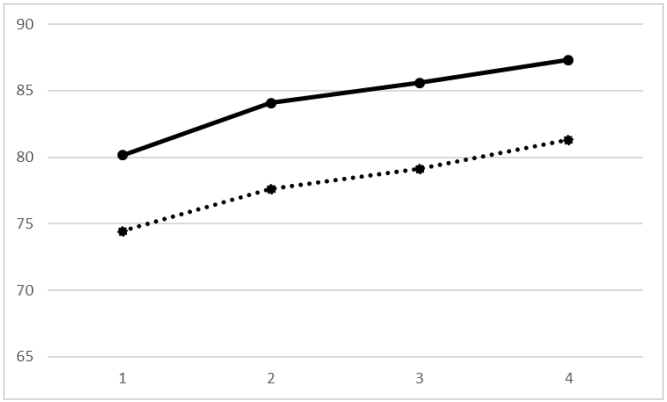

Figure 1. Average sleep efficiency (%) in the online (solid line) and outpatient sample (dotted line) across the first four sleep diaries.

4. Discussion

As shown by relatively high prevalence rates of symptoms of impaired well-being and insomnia in this sample, untreated, at least subclinical sleep disorders affect a relevant part of the working population. In accordance with the literature, shift-workers reported worse symptoms of insomnia than workers not on a shift schedule, especially regarding problems staying asleep.

Over the course of the online CBT-I treatment program, participants' quality and quantity of sleep as well as their well-being improved. Randomized controlled trials are needed in order to be able to make statements about cause and effect.

Most participants in this study were male, even though women show a higher prevalence of insomnia symptoms [8] and generally make more use of outpatient mental health services [37]. We assume that men might prefer anonymous online settings, such as the one described here, to outpatient therapy options. Data on college students shows no gender differences regarding preference for online versus face to face therapy [38] but we suggest that this might be subject to change in other age groups, where women have been found to express more favorable attitudes towards face to face treatment than men [39]. Online therapy could thus be used in gender specific approaches to prevention and treatment of sleep disorders in men.

In anonymous settings, participants don't have to fear being taken off their shift schedule by their employer, which would usually be accompanied by a significant cut in their paycheck. In severe cases of shiftwork sleep disorder, establishing regular working hours may be necessary in order to effectively treat the condition. However, most of our shiftworking patients don't want to leave their schedule due to the financial incentives. Presenting an anonymous treatment option may then reach those that previously didn't seek help in fear of their employer finding out about their condition.

To our knowledge, the described program is the first evaluation of an online treatment for sleep disorders in shift-workers. One of the limitations of this study is the relatively low number of actual shift-workers in the sample. This may be attributed to difficulties in the recruitment process, as well as high dropout rates. Future studies might benefit from close cooperation with partnering corporations, as well as more user friendly interfaces and short time lags between messages.

5. Conclusions

Treating shiftwork-related sleep problems in an anonymous online setting seems feasible and effective. Target groups may differ significantly regarding symptom severity in online and outpatient settings. Ensuring availability to the relevant target group and treatment adherence over the course of the program is critical.

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