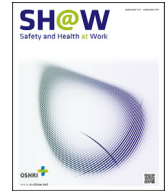




Contents lists available at ScienceDirect

Safety and Health at Work

journal homepage: www.e-shaw.net

Short Communication

Preventing Shift Work Disorder in Shift Health-care Workers

Gabriele d'Ettorre^{1,*}, Vincenza Pellicani²¹ Local Health Authority, Brindisi, Health Unit of Occupational Prevention and Protection, Piazza Di Summa, Postal Code 72100, Brindisi, Italy² Local Health Authority, Department of Mental Health, Lecce, Italy

ARTICLE INFO

Article history:

Received 11 October 2019

Received in revised form

23 March 2020

Accepted 30 March 2020

Available online 8 April 2020

Keywords:

Epworth Sleepiness Scale

Night work

RSQ-questionnaire

Shift work

Workplace health promotion

ABSTRACT

The occurrence of the shift work disorder (SWD) in health-care workers (HCWs) employed in 24/7 hospital wards is a major concern through the world. In accordance with literature, SWD is the most frequent work-related disturb in HCWs working on shift schedules including night shift. In agreement with the Luxembourg Declaration on workplace health promotion (WHP) in the European Union, a WHP program has been developed in a large Hospital, involving both individual-oriented and organizational-oriented measures, with the aim to prevent the occurrence of SWD in nurses working on shifts including night shift. The objective assessment of rotating shift work risk and the excessive sleepiness were detected before and after the implementation of the WHP program, by using the Rotating Shiftwork-questionnaire and the Epworth Sleepiness Scale. The findings of this study showed the effectiveness of the implemented WHP program in minimizing the impact of shift work on workers' health and in preventing the misalignment between sleep-wake rhythm and shift working.

© 2020 Occupational Safety and Health Research Institute, Published by Elsevier Korea LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

The prevention of shift work disorder (SWD) in health-care workers (HCWs) is a special challenge for both health-care organizations and HCWs, through the world [1–3]. Following the definition made by Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM V), SWD is a type of circadian rhythm sleep disorder and is characterized by complaints of insomnia and/or excessive sleepiness that occurs in relation to work hours being scheduled during the usual sleep period [4]. As most shift-HCWs are unable to adjust their circadian rhythms to the atypical hours of sleep and wake, they appear susceptible to excessive sleepiness and/or insomnia consistent with a diagnosis of SWD [5]. In accordance with literature, SWD is the most frequent work-related disturb in HCWs working on shift schedules including night shift; a recent review of the literature showed that between 28% and 52% of shift-HCWs was affected by SWD [6]. Advancing age, female gender, eveningness oriented chronotype, insomnia, and anxiety, are positively associated to SWD in shift-HCWs [7,8]; among the organizational risk factors, a positive relationship exists between SWD and quick returns, number of nights worked per year, long night-time working hours, frequent missing of nap opportunities during night-shift, unhealthy workplace [9–11]. The aim of this

study was to assess the effectiveness of a workplace health promotion (WHP) program focused on SWD prevention in shift-nurses.

2. Material and methods

In agreement with the Luxembourg Declaration on WHP in the European Union [12], a WHP program has been developed in a large Hospital in Salento, Italy, in the period between January 2018 and May 2019, involving both individual-oriented and organizational-oriented measures, with the aim to prevent the occurrence of SWD in nurses working on shifts including night shift. This study involved twenty-six hours hospital wards in which were employed 518 shift-nurses (Table 1). The objective assessment of rotating shift work risk and the excessive sleepiness were detected before and after the implementation of the abovementioned WHP program, by using the RSQ-questionnaire [13] and the Epworth Sleepiness Scale (ESS) [14], respectively. The scores of RSQ identifies three levels of risk: low (0–14), medium (14.1–26), high (>26); scores of 10 or higher on the ESS indicate abnormal levels of sleepiness. Continuous variables were compared using parametric the student t-test or nonparametric Mann–Whitney U-test after assessing for normality with the Shapiro–Wilk test.

* Corresponding author. Local Health Authority of Brindisi, (ASL Brindisi), Unit of Occupational Prevention and Protection, piazza Di Summa, 72100, Brindisi, Italy.
E-mail address: gabriele.det@libero.it (G. d'Ettorre).

Table 1
Sample demographics

Nurses		N.
Entire group		475
Female		281
Age range (years)	Females N (%)	Males N (%)
<35	27 (9.6)	19 (9.8)
36-40	31 (11.0)	21 (10.8)
41-45	36 (12.8)	28 (14.4)
46-50	65 (23.1)	46 (23.7)
51-55	61 (21.6)	43 (22.2)
56-60	39 (13.8)	24 (12.4)
61-65	23 (8.1)	11 (5.7)
>65	0 (0.0)	2 (1.0)
Years of shiftwork	Females N (%)	Males N (%)
<5	11 (3.9)	4 (2.0)
5-10	14 (5.0)	11 (5.7)
11-15	36 (12.8)	12 (6.3)
16-20	57 (20.3)	35 (18.3)
21-25	71 (25.3)	58 (29.9)
26-30	65 (23.1)	51 (27.4)
>31	27 (9.6)	20 (10.4)
Smoking habit	Females N (%)	Males N (%)
Age range (years)		
<35	54 (19.2)	41 (21.1)
35-50	19 (35.2)	15 (36.6)
>50	18 (33.3)	14 (34.1)
>50	17 (31.5)	12 (29.3)
Alcohol consumption	Females N (%)	Males N (%)
Age range (years)		
<35	61 (21.7)	51 (26.3)
35-50	18 (29.5)	19 (37.3)
>50	21 (34.4)	15 (29.4)
>50	22 (36.1)	17 (33.3)

2.1. Organizational and individual-level interventions

Although to date no strong conclusions exist about the strategies for shift workers to deal with the effects of shift work, we followed the best evidence from trials and international recommendations [15]. A balanced approach was adopted, combining the strategy of risk reduction with the strategy of the development of protective factors and health potentials, involving the organizational level of the company (head physicians and head nurses) and the HCWs exposed to shift work, including night shift. With regard to the organizational level interventions, the company management was trained to implement ergonomic work schedules, following the recommendations by the Health and Safety Executive [16] jointly with the findings of the recent literature on shift work risk in HCWs. In particular, we highlighted the need of regularity and predictability of shift work, high speed of shift rotation, one free weekend in the month at least, forward rotating schedules, rest periods between consecutive shifts (>11 hours), one rest day after night shift (Table 2). The individual-oriented measures consisted in mandatory trainings for shift-nurses, with the aim to assist shift workers in adopting effective safety strategies to manage and minimize the impact of occupational risks, including shift work risk, on workers' health and wellness. In particular, we trained shift workers on adoption of the following measures (Table 3):

The day before the night shift: unrestricted sleep on the morning before the first shift (waking without an alarm) and supplementing sleep time by napping during the afternoon

(perhaps taking advantage of the "circadian dip" between 2 and 6 pm, to help initiate daytime sleep).

During the night shift: keeping shift naps to less than 30 minutes, to avoid slow wave sleep followed by grogginess on waking, known as "sleep inertia"; assumption of caffeine before napping but making that the last caffeine of the night; eating just enough to remain comfortable during the shift; avoid caffeine and nicotine in the last few hours of the shift.

After the night shift: attempting 90 or 180-minute nap immediately following the shift; going outside after waking; going to bed close to the normal time. In the next days: avoiding daytime napping.

3. Results

Four hundred seventy-five ESS questionnaire were received, and the response rate was 91.7%. The excessive sleepiness measured by ESS resulted significantly higher before than after the adoption of the WHP program (11.1 ± 2.3 vs. 7.4 ± 1.9 ; $p < 0.05$) (Table 4). The objective assessment of the shift work risk showed a significant reduction of the level of risk in all the detected wards, after the implementation of the WHP, compared to the period before such intervention (cumulative score after intervention = 14.8 ± 2.1 vs cumulative score before intervention = 23.5 ± 2.3 ; $p < 0.05$) (Table 4). The significant reduction of both shift work risk and excessive sleepiness was confirmed after controlling for demographic variables (gender, age, years of shift work, smoking habit, and alcohol consumption).

4. Discussion

The findings of this study showed the effectiveness of the ergonomic scheduling together with individual-oriented measures in minimizing the impact of shift work on workers' health and in preventing the misalignment between sleep-wake rhythm and shift working. With regard to the scheduling, in accordance with literature, we implemented a fast forward rotating shift as more protective than other scheduling (i.e. slow or intermediate rotating shifts, back-rotating scheduling), rest periods between consecutive shifts (>11 hours), a rest day after a night shift. Moreover, we suggested an organizational model in which the shift schedules were designed with thirty days in advance, to ensure the regularity of shiftwork model and the flexibility of shiftwork schedules through the worker's participation to the whole process of designing and implementing the schedules. In accordance with literature, the regularity and preventability of shifts represent protective factors in minimizing the impact of shift work on workers' wellness, through the improvement of work-life balance. The implemented shift scheduling provided for a morning start after 7 a.m., with the aim to avoid the interference of shift work with sleep regularity due to early morning awakenings; in fact many studies showed that early morning start has a detrimental effect on restful sleep due to the shorter rem phase in the last sleep period, interrupted by early awakening. The training of workers and company management on issues related to shift working and on the strategic role of ergonomic scheduling in preventing the impact of shift work on workers' health and safety, lead to reach the goal of the involvement of the entire health-care organization in addressing the concern, in agreement with a participatory approach to shiftwork risk management; the aim of the training was also to promote suitable lifestyles among workers to counteract the interference of shiftwork on circadian rhythms; in particular, workers were informed about healthy behaviors to be adopted during the night shift, and the days before and after the night shift, concerning not only the management of sleep

Table 2
Changes of exposure factors before and after improvement interventions at organizational level

Exposure factor	Before interventions	After interventions
Speed of shift rotation (number of consecutive days worked before changing shift)	Intermediate (every 4 or 14 days)	Fast (every 1-2-or 3 days)
Predictability of the shift	Between 50% and 75% of the shifts	100% of the shifts
Free week ends per month (no. per worker)	<1 0.63 (SD 0.49)	Between 1.1 and 2 0.93 (SD 0.25)
Forward rotating shift work schedule	Between 50% and 75% of the shift work schedules 75.4%	>95% of the shift work schedules 98.1%
Rest periods between consecutive shifts (>11 hours)	Between 50% and 75% of the rest periods between consecutive shifts were >11 hours	100% of the rest periods between consecutive shifts were >11 hours

Table 3
Individual-level intervention based on training: focus and safety strategies

Focus	Safety strategies
The day before the night shift	- Unrestricted sleep on the morning before the first shift and supplementing sleep time by napping during the afternoon.
During the night shift	- Keeping shift naps to less than 30 minutes, to avoid slow wave sleep followed by grogginess on waking, known as "sleep inertia" - Assumption of caffeine before napping but making that the last caffeine of the night - Eating just enough to remain comfortable during the shift - Avoid caffeine and nicotine in the last few hours of the shift.
The day after the night shift	- Attempting 90 or 180-minute nap immediately following the shift - Going outside after waking - Going to bed close to the normal time - In the next days: avoiding daytime napping.

deprivation, but also the appropriate diet and physical activity, recommended to ensure realignment of circadian rhythms, including the sleep–wake rhythm, in shift workers. Shift workers and management staff have become aware of the criteria to minimize shiftwork risk through organizational and individual-level interventions, and, therefore, to prevent SWD, with the aim not only to improve worker safety, but also to improve the quality of health services. In fact, by literature, in healthcare sector the SWD due to shift work has been associated with decreased productivity, high prevalence of medication errors, other than increased absenteeism, impaired safety, diminished quality of life, and adverse effects on health of shift-HCWs. Gómez-García et al. [17] revealed that SWD is related to nurses' concern for low performances at work; in fact shift-nurses felt both a negative quality of their job and an unwholesome work environment because sleep deprivation had detrimental effect on nurses' skill to ensure the high level of care to their patients and they perceived their work more unhealthy, difficult, and dangerous; moreover shift-nurses had negative perceptions of managers' skills regarding team working, coaching and leadership, and felt lack of support from supervisory staff; based on these findings, the authors demonstrated that the prevention of sleep deprivation in shift-nurses was essential to guarantee nurses' abilities to provide the high standard of care they want to give to their patients and, consequently, to avoid a significant number of adverse effects.

In this study the WHP focused on SWD prevention revealed a strategic way to minimize the impact of shift work on workers'

health and wellness; health-care organizations should consider the adoption of WHP programs focused on both individual and environmental oriented measures to prevent the SWD and to enhance health-promoting potentials and well-being in the workforce. In this study the safety policy oriented to the active involvement of both management staff and workers in achieving safety objectives has replaced the concept of a rigidly hierarchical organization and, therefore, workers' safety has been considered the result of the participation and collaboration of all company subjects. In accordance with the new approach, the implementation of an integrated safety system represents the strength for promoting workers' protection from occupational risks, including shift work.

5. Limitations

This study suffers from some limitations; first, this research is one group pretest–post-test study; pre-experimental design of the present research limits the possibility of drawing conclusions, therefore, caution should be taken in generalizing the findings. Moreover, the findings could have been influenced by organizational factors intrinsic to the Italian occupational context and, consequently, not be true for all hospital departments. Finally, the study did not consider the nurses' chronotype (morningness or eveningness oriented chronotype) in the analysis of SWD.

Conflicts of interest

All contributing authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.shaw.2020.03.007>.

Table 4
Scores (mean and SD) of ESS and RSQ before and after interventions

Questionnaires	Before interventions	After interventions
ESS	11.1(±2.3)	7.4 (±1.9)*
RSQ	23.5 (±2.3)	14.8 (±2.1)†

* Compared with ESS score before intervention, $p < 0.05$.

† Compared with RSQ score before intervention, $p < 0.05$. ESS, Epworth Sleepiness Scale.

References

- [1] Caruso CC. Negative impacts of shiftwork and long work hours. *Rehabil Nurs* 2014;39:16–25.
- [2] Fathi A, Hajizadeh M, Moradi K, et al. Medication errors among nurses in teaching hospitals in the west of Iran: what we need to know about prevalence, types, and barriers to reporting. *Epidemiol Health* 2017;39:e2017022.
- [3] Ferri P, Guadi M, Marcheselli L, et al. The impact of shift work on the psychological and physical health of nurses in a general hospital: a comparison between rotating night shifts and day shifts. *Risk Manag Health Policy* 2016;9: 203–11.
- [4] American Psychiatric Association. Sleep-wake disorders. Available online at: <http://www.dsm5.org/proposedrevision/Pages/Sleep-WakeDisorders.aspx> (last accessed 04-27-2020).
- [5] Huang Li-Bi, Tsai MC, Chen CY, et al. The effectiveness of light/dark exposure to treat insomnia in female nurses undertaking shift work during the evening/night shift. *J Clin Sleep Med* 2013;9:641–6.
- [6] d'Ettorre G, Pellicani V, Greco M, Mazzotta M, Vullo A. Assessing and managing the shift work disorder in healthcare workers. *Med Lav* 2018;109(2): 144–50.
- [7] Flo E, Pallesen S, Moen BE, et al. Short rest periods between work shifts predict sleep and health problems in nurses at 1-year follow-up. *Occup Environ Med* 2014;71:555–61.
- [8] Dijk DJ, Groeger JA, Stanley N, Deacon S. Age-related reduction in daytime sleep propensity and nocturnal slow wave sleep. *Sleep* 2010;33:211–23.
- [9] Chang YS, Wu YH, Chen HL, Hsu CY. Is one day off sufficient for re-adaptation to a daytime routine after two consecutive nights of work? *Ergonomics* 2017;31:1–7.
- [10] Waage S, Pallesen S, Moen BE, et al. Predictors of shift work disorder among nurses: a longitudinal study. *Sleep Med* 2014;15:1449–55.
- [11] Øyane N, Pallesen S, Moen BE, et al. Associations between night work and anxiety, depression, insomnia, sleepiness and fatigue in a sample of Norwegian nurses. *PLoS One* 2013;8:e70228.
- [12] European Network Workplace Health Promotion. Luxembourg declaration on workplace health promotion in the European Union. Bundesanstalt für Arbeitsschutz und Arbeitsmedizin; 1997.
- [13] d'Ettorre G, Vullo A, Pellicani V, Ceccarelli G. Preliminary assessment of rotating shiftwork risk in a twenty-four hours hospital department. *Annali di Igiene* 2018;30:297–306.
- [14] Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep* 1991;14:540–5 [PubMed: 1798888].
- [15] McKenna H, Wilkes M. Optimising sleep for night shifts. *BMJ* 2018;360:j5637.
- [16] Health, Executive Safety. Managing shiftwork: health and safety guidance. London: HSE. 2006. Available on: www.hse.gov.uk/pubns/books/hsg256.htm. [Accessed 29 September 2019].
- [17] Gómez-García T, Ruzafa-Martínez M, Fuentelsaz-Gallego C, et al. Nurses' sleep quality, work environment and quality of care in the Spanish National Health System: observational study among different shifts. *BMJ Open* 2016;6: e012073.