International Journal of Occupational and Environmental Safety

Impacts of shift work: A study in textile companies in Portugal

I. S. Silva[a], J. Keating[b], D. Costa[c]
[a]School of Psychology, University of Minho, Braga, PT (isilva@psi.uminho.pt) ORCID: 0000-0002-2931-7218. [b]School of Psychology, University of Minho, Braga, PT (keating@psi.uminho.pt) ORCID: 0000-0002-8105-9148. [c]School of Psychology, University of Minho, Braga, PT (a65548@alumni.uminho.pt).

Article History

Received 29 January 2017
Accepted 5 July 2017
Published 1 September 2017

Keywords

shift work
work schedules
occupational health
work-life interface

DOI:
10.24840/2184-0954_001.001_0007

ISSN:
2184-0954

Type:
Research Article

Open Access
Peer Reviewed

Abstract

Shift work, especially if it involves night work and/or weekend work, may represent disadvantages for workers and their families at the level of family, social life, and health. The present study evaluates the impacts of three work shifts (morning, afternoon and night) on sleep, family and social life as well as satisfaction with work schedules. In total, 373 Portuguese textile workers participated in this study; all were men. The results indicated that night shift workers had greater sleep disturbances and less satisfaction with their work schedules. On the other hand, morning shift workers were most satisfied with family and social life in association with their work schedules. Based on the results, implications of the practice have been reflected.

1. INTRODUCTION

With the evolution of societies and the constant occurrence of economic (e.g. globalization of the economy), technological (e.g. dissemination of information via media), and/or social changes (e.g. changes in lifestyles and career aspirations), work has undergone worldwide changes, including the development of non-standard work schedules. According to Costa (2003), such schedules are characterized by diverging on some aspects of conventional work schedules, typically occurring from Monday to Friday, from 8 a.m. to 5 p.m. and the weekend off. Under the designation of non-standard or atypical work schedule, it is possible to find a great diversity of hourly arrangements, such as flexible hours, part-time or shift work. The use of shift work is a frequent practice. The Sixth European Working Conditions Survey indicated that in 2015, 21% of the workers in the European Union were working under shift work (Eurofound, 2016).

1.1. Shift work schedule

According to Costa (1997:89), “shiftwork refers to a way of organization of daily working hours in which different teams work in succession to cover more or all of the 24 h”. Shift systems may differ in a variety of ways, such as the start and end times of shifts, the existence or absence of rotation between shifts, or the occurrence of night work and work at the weekend or not (see, for example, Costa (1997) or Thierry and Jansen (1998). One of the most differentiating features is the existence of rotation between shifts, and shifts can be fixed or rotating. In the first case,

workers work every day at the same time, while in the second case, they alternate between different shifts. Considering the realization or not of the night and weekend work, the shift systems can be designated as continuous, semi-continuous or discontinuous. In continuous systems, a company works 24 hours a day, 7 days a week and 365 days a year, i.e., it works successively every day, including night and weekend. On the other hand, in the semi-continuous systems, it works 24 hours a day divided in three successive schedules of shifts. The work is, however, interrupted at the weekend. Finally, discontinuous shift systems are characterized by the work of only two-day shifts on business days. Therefore, no work takes place at night and at weekends.

1.2. Impacts of shift work

Shift work, in resemblance to other work schedules, has been associated with advantages and disadvantages for workers. In terms of advantages, in addition to the economic ones (provided by the shift allowance), benefits have been reported at the family/domestic level (e.g. care of children), or personal (e.g. more free time during the daytime period) Also, the advantages have been reported in the family dynamics (e.g. greater participation by the father in the education of the children) (Barnett and Gareis, 2007; Silva, 2012; West et al., 2012). In terms of negative impacts, these have also been associated with family and social life (e.g. interference to coexist with family and friends, increased difficulties in planning family and social activities) (Handy, 2010; Dhande and Sharma, 2011; Li et al., 2014). Also, the negative impacts have been reported in the health, physical (e.g. problems associated with the digestive or cardiovascular system) and psychological (e.g. sleep, mood changes) level (Costa, 1997; Boggild and Knutsson, 1999; Åkerstedt, 2003; Knutsson, 2003; Smith et al., 2003; Matheson et al., 2014; Gu et al., 2015). Some studies of these three levels of impacts will be presented, particularly those that reflect the impacts evaluated in the present study.

1.2.1. Health (sleep)

The negative impacts of this hourly arrangement on health have been associated mainly to shift systems that integrate night work, fixed or rotating, requiring such a characteristic that workers reverse the sleep-wake cycle. Due to this inversion, difficulties in sleep are the main difficulties associated to shift work, while daytime sleep of shift workers, when compared with nocturnal sleep of day workers, has been associated with shorter duration and quality (e.g., more fragmented, less recuperative) (e.g. Åkerstedt and Gillberg, 1981; Costa, 1997; Pilcher et al., 2000; Åkerstedt, 2003; Itani et al., 2011; Prata and Silva, 2013; Fekedulegn et al., 2016; Ferri et al., 2016; Dorrian et al., 2017). For example, the meta-analysis by Pilcher et al. (2000), based on almost forty empirical studies, indicated that performing night work, especially in rotating systems, implied a lower amount of sleep for the workers affected by these hours, compared to day workers. In the context of the association between night work and sleep deprivation, Øyane et al. (2013) or Lee et al. (2016) pointed out the negative repercussions that such impacts may have on performance and daytime sleepiness, when they studied a group of nurses and a group of drivers, respectively.

1.2.2. Family and social life

Shift work can also negatively interfere at the level of family and social life (e.g. Craig and Brown, 2014; Kunst et al., 2014; Mauno et al., 2015; Gracia and Kalmijn, 2016), especially if it involves night work, weekend work (especially on Sunday) or late afternoon (evening) (Gadbois, 2004; Handy, 2010). For example, the study by Simunic and Gregov (2012) with nurses indicated that different systems of rotating shifts (involving nights), compared to the morning shift, were associated with negative effects on the relationship between work and family. On the other hand, the study by Prata and Silva (2013) with industrial workers also compared different work schedules: three fixed shifts (morning, afternoon and night), and a rotating shift. The time of afternoon shift (fixed or rotational) was associated with greater interference with family and social life as compared to the other groups. Also, Mauno et al. (2015) found that shift workers reported greater work-family conflict when compared with daily workers.

1.2.3. Organizational (Satisfaction with the work schedule)

The study by Demerouti et al. (2004) indicated that rotating shift workers (including weekends), compared with those who worked in fixed shifts, had more negative attitudes towards their jobs. Other studies have also indicated lower satisfaction with work schedules that involve rotation. For example, in the study by Prata and Silva (2013), the rotating shift workers showed less satisfaction with work schedule and would prefer to change work schedule, if such a change did not imply changes in the salary. In contrast, the morning shift has been associated with greater satisfaction with the work schedule (Korompeli et al., 2009; Ferreira and Silva, 2013).

Regardless of the negative impacts of shift work, it is important to note that such impacts can be moderated by individual variables (e.g. age) in the social and family (e.g. social support) as well as the organizational context (e.g. shift systems) (e.g. Smith et al., 2003; Silva, 2012).

This study aims at contributing to the deepening of the impacts of shift work in different areas: health (sleep), interference with the family and social life and satisfaction with the work schedule. This evaluation will be done in Portuguese context, where there is a gap of studies on this issue in Portugal. From the results obtained, this work also has aimed to discuss possibilities of intervention in the adaptation to shift work, especially, focused in the organizational context. So, this study focuses in the deepening of this problem in the Portuguese context and the presentation of interventive aspects in shift work, being these areas little studied in Portugal.

2. MATERIALS AND METHODS

2.1. Procedures

Three textile companies from the north of Portugal participated in the study, and the best form of applying the evaluation protocol was negotiated in each company. In all the cases, the application was on paper. A letter (describing the research objectives, ensuring the confidentiality and anonymity of the collected data and filling instructions) followed the evaluation instrument as well as an envelope addressed to the investigation team in order to proceed with the return, once completed.

In terms of data analysis procedures, in addition to descriptive statistics, *One-Way Anova* tests were performed to compare the three work schedules (morning, afternoon and night) according to the studied variables (sleep, satisfaction with family and social life and satisfaction with work schedule). In the comparisons, where statistically significant differences observed, tests *Scheffe post-hoc* were performed. In the characterization of the sample, statistical tests were also performed, namely *One-Way Anova* and Qui-square for the purpose of comparing the three working hours. The data analysis procedures were realized in *Statistical Package for the Social Sciences* (IBM® SPSS®). The answers given to the open question were analyzed through content analysis (Amado, 2000).

2.2. Sample

In the total of three Portuguese textiles companies, 373 workers participated in the study. In the three cases, the shift system was semi-continuous with three fixed shifts: morning (6 a.m. – 2 p.m.), afternoon (2 p.m. – 10 p.m.), and night (10 p.m. – 6 a.m.). Table 1 presents the characterization of the workers according to their respective shifts and the total of the sample. All workers are male, 75.2% are married, 73.5% have at least one child under the age of 18, and the workers have an average age of 38 years (SD = 11.7). All workers performed the same function: weaving operators. Considering a level of significance $p < .05$, no statistically significant differences were observed between the three shifts in the described variables (i.e. status, existence of children and age).

The majority of the workers (89.8%) uses means of transportation in the home company travel, in particular, their own car (80.1%). It can also be seen in Table 1 that on the average, this travelling takes 15.81 minutes (SD=11). The seniority in the company, on the average, is 16.04 years (SD=12.28), but in their work schedule, it is in 12.05 (SD=10.78). Regarding the variables described (i.e., means of transport and home-work travel time, seniority in the company and in the shift), were also not observed statistically significant differences between the three shifts.

Approximately 18%, 15% e 10%, respectively, of the workers of the shifts of the morning, afternoon and night referred to have a second gainful occupation, not being this statistically significant difference. Of the participants who reported having other paid work in addition to the primary activity, on average they worked 4.23 days per week (SD=1.74) being the daytime workers (morning and afternoon) are those who work on average more days a week than night shift workers (see Table 1). This difference between day shifts and night shifts is statistically significant (F=9.541, p<.001). Finally, it should be noted that more than half of these workers (53.8%) reported that such work lasts up to 15 hours a week, being that there are statistically significant differences between the three shifts (χ^2 =10.379; p<.01). Also, in this case, it's the night shift workers who differ from the workers of the morning and afternoon shifts, with a weekly duration of the second occupation smaller (92.3% of night workers work up to 15 hours whereas more than half of the others shift workers work more than 15 hours).

Table 1. Characterization of shift workers by their work schedule and total.

Shift	**Morning (n=117)**		**Afternoon (n=114)**		**Night (n=142)**		**Total* (n=373)**	
Variable	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Status								
Single	30	25.9	23	20.4	37	26.1	90	24.3
Married	86	74.1	89	78.8	104	73.2	279	75.2
Widow	-	-	-	-	1	0.7	1	0.3
Separated	-	-	1	0.9	-	-	1	0.3
Children								
Yes**	79	71.8	81	73.0	98	75.4	258	73.5
Age								
M (SD)***	36.56 (11.18)		38.7 (10.67)		38.8 (11.50)		38.05 (11.70)	
Home-Work Travel (min)								
M (SD)	15.59 (8.34)		16.42 (10.21)		15.51 (13.38)		15.81 (11.00)	
Seniority in the company (years)								
M (SD)	16.27 (12.40)		16.93 (10.96)		15.14 (13.15)		16.04 (12.28)	
Seniority in the current shift (years)								
M (SD)	12.00 (11.20)		12.48 (10.12)		11.75 (11.02)		12.05 (10.78)	
Other paid work								
Yes	21	18.3	17	15.2	13	9.4	51	13.9
Other paid work (number of days per week)								
M (SD)	5.05 (1.24)		4.36 (1.53)		2.66 (1.74)		4.23 (1.74)	
Other paid work (number of hours per week)								
1h – 15h	9	42.9	7	38.9	12	92.3	28	53.8
More than 15h	12	57.1	11	61.1	1	7.7	24	46.2

* The N obtained can be different from the size of the sample (N=373) due to the lack of values in some variables; ** Children aged up to 18 years; *** M (Mean) SD (Standard Deviation)

2.3. Measures

The data was collected through a research questionnaire, which integrated an initial section aimed at collecting socio-demographic data, family and professional situation, scales and an open question.

Specifically, a scale consisting of four items was used to evaluate sleep problems (e.g., difficulties in initiating sleep), which was developed by Marquié et al. (1999) and translated and adapted by Silva (2008). The items were evaluated on a four-point Likert scale (1 = "never" to 4 = "often"), being the higher the score, the greater the difficulties experienced by the workers. In this study, the *Cronbach's alpha* obtained was 0.76. For the evaluation of the implications of the work schedule in life outside the company, the scale designated as satisfaction with family and social life, elaborated by Silva (2008), was used. This measure was made up of five items (e.g. *does your work schedule allow you enough time to be with your family and closest friends*?), having obtained a *Cronbach's alpha* value of 0.91. Finally, the scale of satisfaction with the work

schedule, also developed by Silva (2008), composed of four items (e.g. *compared to others, is the work schedule you have undoubtedly your favourite*?) was also used. The *Cronbach's alpha* obtained in the original study was 0.89. Both referred scales were answered on a five-point Likert scale (1 = "totally disagree" to 5 = "totally agree"), and the higher the scores obtained, the greater the satisfaction with the domain evaluated.

The research questionnaire ended with an open answer, where workers could make comments and / or suggestions related to their shift work experience.

3. RESULTS PRESENTATION

Table 2 presents the results obtained in the comparisons drawn between the three work schedules in sleep, satisfaction with family and social life, and satisfaction with work schedule. In all cases, statistically significant differences were observed between groups. Regarding sleep, night workers showed, on the average, greater sleep problems compared to morning and afternoon shift workers. These workers who work nights, differently from the workers who work mornings or evenings, also showed less satisfaction with their work schedule. Regarding the satisfaction between work schedule and family and social life, it was observed that the morning shift workers, in comparison to the afternoon and evening shifts, presented the greatest satisfaction in this work-life interface.

Table 2. Results of the comparison between shifts sleep, satisfaction with family and social life, and satisfaction with work schedule.

Shift	Morning		Afternoon		Night		F
Variable	M	SD	M	SD	M	SD	
Sleep	1.86	.60	1.89	.67	2.24	.71	12.534***
Family and social life	4.12	.69	3.79	.75	3.79	.90	6.524**
Work schedule	4.1	.73	4.06	.81	3.39	1.1	26.198***

* $p < .05$; ** $p < .01$; *** $p < .001$

Of the 373 workers, 80 responded to the open response question, which represents a response rate of 21.45%. In total, 99 comments were analyzed (some participants made more than one comment), which, after being analyzed, were divided into three categories: "positive aspects", "negative aspects" and "general comments". In relation to the "general comments", in total, 18 responses addressing issues not directly related to the work shift (e.g. remuneration in the textile sector, work recognition) were excluded from subsequent analyses. Table 3 shows the frequencies of "Positive Aspects" and "Negative Aspects" based on the three shifts. As can be seen, night shift workers compared with morning and afternoon shifts workers identified the most negative aspects associated with their shift. In contrast, the positive aspects of work schedule were more associated to the morning shift workers.

Table 3. Frequency of positives and negatives aspects, opinions according to shift and overall.

Shift	Morning (n=18)		Afternoon (n=26)		Night (n=37)		Total (n=81)	
Category	n	%	n	%	n	%	n	%
Positive aspects	14	77.78	14	53.85	9	24.32	37	45.68
Negativeaspects	4	22.22	12	46.15	28	75.68	44	54.32

At a later stage of the analysis, subcategories (e.g. family life) were created in the two categories considered (i.e., "positive aspects" and "negative aspects"). Table 4 presents the subcategories as well as some of the answers given in the sense of illustrating the most mentioned subcategories. It can be seen that the night shift workers emphasized the negative aspects associated with their work schedule; the economic aspects (low compensation for the effort required) as well as those related to health and family life. In contrast, morning shift workers emphasized the positive aspects associated with their work schedule, which highlights free time during the day. On the other hand, the workers of the afternoon shift referred the free time that the shift allowed to obtain as a positive aspect and the interference of work schedule with social coexistence as well as the family as a negative aspect.

Table 4. Subcategories of "positive aspects" and "negative aspects" on each shift.

Morning	
"Positive aspects"	**"Negative aspects"**
Free time (n=6) Personal life (n=3) General (n=3) Family life (n=1) Health (n=1)	Family life (n=1) Health (n=1) Rigidity of schedules (n=1) Economic aspects (n=1)
(e.g.: *"I like the shift because I have been in it for a few years, and it is also the shift that gives me the best to take care of my kids."*) (e.g.: *"I like the shift I have because I can take care of the backyard, be with friends and take rest."*)	(e.g.: *"I think there should be more understanding on the part of the bosses regarding shift changes."*) (e.g.: *"Having a child who has to go school, the most convenient schedule would be the normal, because then I wouldn`t have to depend on my family to do so."*)
Afternoon	
"Positive aspects"	**"Negative aspects"**
Free time (n=5) Family life (n=3) Health (n=3) Personal life (n=2) Economic aspects (n=1)	Family life (n=6) Personal life (n=2) Rigidity of schedules (n=1) Free time (n=1) Economic aspects (n=1) Health (n=1)
(e.g.: *"Shifts make it easy for parents to be with their children almost all the time, it`s good for the education of the children."*) (e.g.: *"It`s a shift that allows well-being, health and plenty of free time to do a little bit of everything."*)	(e.g.: *"While working in shifts, we are deprived of living with the family."*) (e.g.: *"The fact that you can`t attend some courses makes this shift lose some interest. Another has to do with the fact that I like very much to spend the afternoon with the family and, for example, take a walk."*)
Night	
"Positive aspects"	**"Negative aspects"**
Personal life (n=3) Economic aspects (n=3) Free time (n=2) Organizational aspects (n=1)	Economic aspects (n=11) Health (n=9) Family life (n=5) Rigidity of schedules (n=2) Organizational aspects (n=1)
(e.g.: *"I like to work in this shift because it gives me plenty of free time to do other things I like."*) (e.g.: *"The 3rd shift is important to me because I have been working for 21 years and I feel good (…) I always like to get up in the afternoon and early in the morning I don`t feel well."*)	(e.g.: *"For the effort we make while working at night (…), we are poorly paid."*) (e.g.: *"From the night shift that is mine, it creates a lot of problems to feed and rest."*)

4. DISCUSSION OF RESULTS AND CONCLUSIONS

Overall, the results obtained are consistent with the literature. In fact, the night workers, compared to "daytime" workers (morning and afternoon), reported more sleep difficulties, confirming the evidence in this field (e.g. Costa, 1997; Pilcher et al., 2000; Åkerstedt, 2003; Itani et al., 2011; Prata and Silva, 2013; Fekedulegn et al., 2016; Ferri et al., 2016). That indicates the existence of greater complaints when there is a need to reverse the sleep-wake cycle. For example, Lin et al. (2012) found evidence that nurses working in rotating shifts, including nights, had worse sleep quality compared with other groups that did not perform night work. In the same sense, in the study of Johnson et al. (2014), most of the participants reported having sleep problems, which was consequently reflected in greater mistakes made in the workplace. The spontaneously comments made by night workers, to the open question, also reinforce the negative impacts of this schedule on health, including sleep / rest. From of safety viewpoint, several studies (see, for example, Lee et al., 2016) have indicated an increased risk of road accidents when workers take off home after the night shift. Although we have not evaluated this risk, the result obtained also reinforces, in our perspective, the importance of the resources that the organization can make to promote adaptation to night shift. In this particular case, provision of transportation and/or the community to be sensitive to this need, adjusting the collective transportation schedules to atypical work schedules. In the case of night shift, all

the results obtained also reinforce the importance of periodic monitoring of health among these workers given the greater painfulness associated with this schedule.

The morning shift, on the other hand, is associated with greater satisfaction between work schedule and family and social life. This result is also consistent with the literature. For example, the study of Ferreira and Silva (2013), held on a Portuguese textile industry, noted that the morning shift workers were those who presented greater satisfaction with their work schedule. In the study of Ferreira and Silva (2013), as in the present study, the morning shift began at 06:00 a.m. and ended at 02:00 p.m. One of the main positive aspects associated with this work schedule, also indicated by the comments of the workers in the open question, concerns the free time it provides during the day, including evening. From the point of view of the organization of society`s time, end-of-day and weekend periods tend to be the most valued for family and social activities (Baker et al., 2003; Gadbois, 2004; Craig and Brown, 2014). So, the positive assessment made by the workers from morning shift to their work schedule will be held in large part by such conciliation. Difficulties in conciliation between work schedule and family and social life are, however, the main negative aspects associated with the work of the afternoon, since it implies working at the end of the day. The comparisons between the three schedules also indicated that night reported less satisfaction with their work schedule. This hourly arrangement, besides requiring the inversion of the sleep-wake cycle, also compromises the time available for social and family coexistence at the end of the day / early evening. Therefore, of the three schedules considered, the night shift is the furthest away from the configuration of conventional work schedule and, as Wedderburn (2000) refers, the longer a work schedule deviates from such a standard, more likely to lead to an unfavorable assessment.

According to the characterization of the sample, we believe that the data obtained about the existence or not of other paid work contribute to the deepening of the understanding of some of the advantages and disadvantages associated with the different shifts. Wherein the shift workers in the morning and in afternoon shifts who have other paid work, compared with the night shift workers, spend more time on this activity in terms of days per week and in terms of weekly duration. In addition, particularly the morning shift has a higher level of satisfaction with the work schedule. This may mean that part of the satisfaction with these shifts is associated with the possibility of conciliation with other paid work. On the other hand, possibly this second work is performed at a time when the remaining household members and/or friends are working and/or studying whereby interference with family and social life will be minimized.

The results obtained also suggests significant complexity in understanding and intervening on this area. For example, considering the results obtained in the open question, the presence of “family life” both in the negative and positive aspects in morning and afternoon shifts has been noted, this can suggest the importance given by workers to personal circumstances in assessing what they make of their work schedules. In this sense, the importance of flexible practices in the management of working time has been referred (see, for example, Silva and Prata, 2015), with the aim of promoting adaptation to working hours. From the intervention viewpoint, in addition to the management practices of working time and the availability of physical resources (especially, transport and food services), organizations should also consider the ergonomic recommendations in the design of shift systems (see, for example, Knauth, 1997 and Dall’Ora et al., 2016).

The transversal nature of the study and the absence of a rotating shift system and standard are the main limitations of the study. In any case, the study carried out shows the main advantages and disadvantages associated with each work schedule. The inclusion of other sources of information (e.g. spouses of shift workers and / or children), in addition to the shift workers themselves, may contribute to the deepening of the effects associated to shift work, especially in the family and social spheres.

REFERENCES

Amado, J., 2000. A técnica de análise de conteúdo. Revista Referência 5, 53e63.

Åkerstedt, T., 2003. Shift work and disturbed sleep/wakefulness. Occup. Med. (Lond) 53 (2), 89e94. DOI: 10.1093/occmed/kqg046.

Åkerstedt, T., Gillberg, M., 1981. Sleep disturbances and shift work. In: Reinberg, A., Vieux, N., Andlauer, P. (Eds.), Night and shift work: Biological and social aspects, Oxford, Pergamon Press, pp. 127e137).

Baker, A., Ferguson, S., Dawson, D., 2003. The perceived value of time: Controls versus shiftworkers. Time Soc. 12 (1), 27e39. DOI: 10.1177/0961463X03012001444.

Barnett, R.C., Gareis, K.C., 2007. Shift work, parenting behaviors, and children's socioemotional well-being: A within-family study. J. Fam. Issues 28 (6), 727e748. DOI: 10.1177/0192513X06298737.

Bøggild, H., Knutsson, A., 1999. Shift work, risk factors and cardiovascular disease. Scand. J. Work Environ. Health 25 (2), 85e99.

Costa, G., 1997. The problem: Shitwork. Chronobiol. Int. 14 (2), 89e98. DOI: 10.3109/07420529709001147.

Costa, G., 2003. Shift work and occupational medicine: An overview. Occup. Med. 53 (2), 83e88. DOI: 10.1093/occmed/kqg045.

Craig, L., Brown, J., 2014. Weekend and leisure time with family and friends: Who misses out? J. Marriage Fam. 76 (4), 710e727. DOI: 10.1111/jomf.12127.

Dall'Ora, C., Ball, J., Recio-Saucedo, A., Griffiths, P., 2016. Characteristics of shift work and their impact on employee performance and wellbeing: A literature review. Int. J. Nurs. Stud. 57, 12e27. DOI: 10.1016/j.ijnurstu.2016.01.007.

Demerouti, E., Geurts, S.A., Bakker, A.B., Euwema, M., 2004. The impact of shiftwork on work – home conflict, job attitudes and health. Ergonomics 47 (9), 987e1002. DOI: 10.1080/00140130410001670408.

Dhande, K.K., Sharma, S., 2011. Influence of shift work in process industry on workers' occupational health, productivity, and family and social life: An ergonomic approach. Hum. Factors Ergon. Manuf. 21 (3), 260e268. DOI: 10.1002/hfm.20231.

Dorrian, J., Grant, C., Banks, S., 2017. An industry case study of 'stand-up' and 'sleepover' night shifts in disability support: Residential support worker perspectives. Appl. Ergon. 58, 110e118. DOI: 10.1016/j.apergo.2016.05.016.

European Foundation for the Improvement of Living and Working Conditions – Eurofound, 2016. Sixth European Working Conditions Survey – Overview report. Publications Office of the European Union, Luxembourg.

Fekedulegn, D., Burchfiel, C.M., Charles, L.E., Hartley, T.A., Andrew, M.E., Violanti, J.M., 2016. Shift work and sleep quality among urban police officers: The BCOPS Study. J. Occup. Environ. Med. 58 (3), e66ee71. DOI: 10.1097/JOM.0000000000000620.

Ferreira, A.I., Silva, I.S., 2013. Trabalho em turnos e dimensões sociais: Um estudo na indústria têxtil [Shiftwork and social dimensions: A study in the textile industry]. Estud. Psicol. 18 (3), 477e485. DOI: 10.1590/S1413-294X2013000300008.

Ferri, P., Guadi, M., Marcheselli, L., Balduzzi, S., Magnani, D., Di Lorenzo, R., 2016. 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. Healthc. Policy 9, 203e211. DOI: 10.2147/RMHP.S115326.

Gadbois, C., 2004. Les discordances psychosociales des horaires postés: Questions en suspens. Trav. Hum. 67 (1), 63e85.

Gracia, P., Kalmijn, M., 2016. Parents' family time and work schedules: The split-shift schedule in Spain. J. Marriage Fam. 78 (2), 401e415. DOI: 10.1111/jomf.12270.

Gu, F., Han, J., Laden, F., Pan, A., Caporaso, N.E., Stampfer, M.J., Kawachi, I., Rexrode, K.M., Willett, W.C., Hankinson, S.E., Speizer, F.E., Schernhammer, E.S., 2015. Total and cause-specific mortality of US nurses working rotating night shifts. Am. J. Prev. Med. 48 (3), 241e252. DOI: 10.1016/j.amepre.2014.10.018.

Handy, J., 2010. Maintaining family life under shiftwork schedules: A case study of a New Zealand petrochemical plant. NZ J. Psychol. 39 (1), 29e37.

Itani, O., Kaneita, Y., Murata, A., Yokoyama, E., Ohida, T., 2011. Association of onset of obesity with sleep duration and shift work among Japanese adults. Sleep Med. 12 (4), 341e345. DOI: 10.1016/j.sleep.2010.09.007.

Johnson, A.L., Jung, L., Brown, K.C., Weaver, M.T., Richards, K.C., 2014. Sleep deprivation and error in nurses who work the night shift. J. Nurs. Adm. 44 (1), 17e22. DOI: 10.1097/NNA.0000000000000016.

Knauth, P., 1997. Changing schedules: Shiftwork. Chronobiol. Int. 14 (2), 159e171.

Knutsson, A., 2003. Health disorders of shift workers. Occup. Med. (Lond) 53 (2), 103e108. DOI: 10.1093/occmed/kqg048.

Korompeli, A., Sourtzi, P., Tzavara, C., Velonakis, E., 2009. Rotating shift-related changes in hormone levels in intensive care unit nurses. J. Adv. Nurs. 65 (6), 1274e1282. DOI: 10.1111/j.1365-2648.2009.04987.x.

Kunst, J.R., Løset, G.K., Hosøy, D., Bjorvatn, B., Moen, B.E., Magerøy, N., Pallesen, S., 2014. The relationship between shift work schedules and spillover in a sample of nurses. Int. J. Occup. Saf. Ergon. 20 (1), 139e147. DOI: 10.1080/10803548.2014.11077030.

Lee, M.L., Howard, M.E., Horrey, W.J., Liang, Y., Anderson, C., Shreeve, M.S., O'Brien, C.S., Czeisler, C.A., 2016. High risk of near-crash driving events following night-shift work. Proc. Natl. Acad. Sci. U. S. A. 113 (1), 176e181. DOI: 10.1073/pnas.1510383112.

Li, J., Johnson, S.E., Han, W., Andrews, S., Kendall, G., Stradzins, L., Dockery, A., 2014. Parents' nonstandard work schedules and child well-being: A critical review of the literature. J. Prim. Prev. 35, 53e73. DOI: 10.1007/s10935-013-0318-z.

Lin, P.C., Chen, C.H., Pan, S.M., Pan, C.H., Chen, C.J., Chen, Y.M., Hung, H.C., Wu, M.T., 2012. Atypical work schedules are associated with poor sleep quality and mental health in Taiwan female nurses. Int. Arch. Occup. Environ. Health 85 (8), 877e884. DOI: 10.1007/s00420-011-0730-8.

Marquié, J.C., Foret, J., Quéinnec, Y., 1999. Effects of age, working hours, and job content on sleep: A pilot study. Exp. Aging Res. 25, 421e427.

Matheson, A., O'Brien, L., Reid, J.A., 2014. The impact of shiftwork on health: A literature review. J. Clin. Nurs. 23, 3309e3320. DOI: 10.1111/jocn.12524.

Mauno, S., Ruokolainen, M., Kinnunen, U., 2015. Work–family conflict and enrichment from the perspective of psychosocial resources: Comparing Finnish healthcare workers by working schedules. Appl. Ergon. 48, 86e94. DOI: 10.1016/j.apergo.2014.11.009.

Øyane, N.M., Pallesen, S., Moen, B.E., Åkerstedt, T., Bjorvatn, B., 2013. Associations between night work and anxiety, depression, insomnia, sleepiness and fatigue in a sample of Norwegian nurses. PloS One 8 (8), e70228. DOI: 10.1371/journal.pone.0070228.

Pilcher, J.J., Lambert, B.J., Huffcutt, A.I., 2000. Differential effects of permanent and rotating shifts on self-report sleep length: A meta-analytic review. Sleep 23 (2), 155e163. DOI: 10.1093/sleep/23.2.1b.

Prata, J., Silva, I.S., 2013. Efeitos do trabalho em turnos na saúde e em dimensões do contexto social e organizacional: Um estudo na indústria eletrônica [Shiftwork effects on health and on social and organizational life: a study in the electronics]. Revista Psicologia: Organizações e Trabalho 13 (2), 141e154.

Silva, I.S., 2008. Adaptação ao trabalho por turnos [Adaptation to shift work]. Dissertação de Doutoramento em Psicologia do Trabalho e das Organizações [PhD in Work and Organizational Psychology], Braga, Portugal, Universidade do Minho.

Silva, I.S., 2012. As condições de trabalho no trabalho por turnos. Conceitos, efeitos e intervenções [The working conditions in shift work. Concepts, effects and interventions], Lisboa, Portugal, Climepsi Editores.

Silva, I.S., Prata, J., 2015. Work schedules and human resource management: The case of shift work. In: Machado, C., Davim, J.P. (Eds.), Human resource management challenges and changes, New York, USA, Nova Publishers, pp. 67e93.

Silva, I.S., Keating, J., 2016. Shift Work: Impact on sleep, family and social life, and satisfaction with work schedule. In: Arezes, P.M., Baptista, J.S., Barroso, M.P., Carneiro, P., Cordeiro, P., Costa, N., Melo, R.B., Miguel, A.S., Perestrelo, G. (Eds.), Occupational Safety and Hygiene IV, London, UK, Taylor & Francis Group, pp. 265e268.

Simunic, A., Gregov, L., 2012. Conflict between work and family roles and satisfaction among nurses in diferent shift systems in Croatia: A questionnaire survey. Arh Hig Rada Toksikol 63 (2), 189e197. DOI: 10.2478/10004-1254-63-2012-2159.

Smith, C.S., Folkard, S., Fuller, J.A., 2003. Shiftwork and working hours. In: Quick, J.C., Tetrick, L.E. (Eds.), Handbook of occupational health psychology (2nd ed.), Washington, DC, USA, American Psychological Association, pp. 163e183.

Thierry, H., Jansen, B., 1998. Work time and behaviour at work. In: Drenth, P.J.D., Thierry, H., de Wolff, C.J. (Eds.), Handbook of work and organizational psychology (Vol. 2: Work Psychology) (2nd ed.), East Sussex, UK, Psychology Press, pp. 89e119.

Wedderburn, A., 2000. (Ed.). Shiftwork and health. European Studies on Time, Dublin, UK, European Foundation for the Improvement of Living and Working Conditions.

West, S., Mapedzahama, V., Ahern, M., Rudge, T., 2012. Rethinking shiftwork: Mid-life nurses making it work. Nurs. Inq. 19 (2), 177e187. DOI: 10.1111/j.1440-1800.2011.00552.x.