Sleep Disturbance in Nursing Personnel Working Shifts

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OBJECTIVE. The aim of the present study was to explore the factors that are associated with sleep disturbance in nursing personnel working irregular shifts.
METHODS. A cross-sectional survey was carried out. The Standard Shiftwork Index was used for data collection, which was completed by 365 nurses and nurse assistants working shifts including nights.
RESULTS. Female nurses and nurses with elevated levels of chronic fatigue were found with greater sleep disturbance between all shifts. Sleep disturbance between most shifts was greater in participants with more than 18 years of working experience and those having family members to look after. No differences were observed in family status, professional training, or circadian characteristics.
CONCLUSION. Our results suggest that demographics, working characteristics, and family structure are associated with sleep disturbance between shifts in nursing personnel. The modification of shift schedules according to individual needs and preferences is necessary for the reduction of sleeping problems.

Introduction

Shiftworking is a common characteristic of modern societies. A recent European Union (EU) survey on working conditions estimated that only 24% of the working populations of the 15 EU countries were engaged in normal or standard day work (Shen et al., 2006). Healthcare personnel and nurses in particular provide and are responsible for healthcare services on a 24 hr basis. As a result, they tend to experience problems caused by the desynchronization of endogenous physiological system, the circadian rhythms, physical and psychological problems because of fatigue, and problems associated with a disruption on family and social life (Muecke, 2005). In particular, shift nurses, including night nurses, are subject to cumulative sleep debt, decreased quantity and quality of sleep, and continuous sleep deprivation, thereby compounding fatigue (Muecke, 2005). Consistent sleep deprivation is highly associated with chronic fatigue, which can manifest as a persistent reduction in alertness. Poor sleep quality was found to be strongly associated to chronic fatigue in critical care nurses (Samaha, Lal, Samaha, & Wyndham, 2007).

Methods

Study Design

The main aim of our study was to clarify whether nursing personnel working irregular shifts deal with problems associated with sleep difficulties. In addition to that, it was also aimed to study the extent to which feelings of fatigue and personality factors are affected by sleep problems.

A cross-sectional study was carried out to study the sleep problems in nursing personnel working irregular shifts. The study was conducted at three public general hospitals in Athens, Greece. Most nursing staff work irregular rotating shifts (morning, evening, and night shifts), but there was also a group working exclusively morning shifts. For shift workers, morning shifts last from 7 a.m. to 3 p.m., evening shifts last from 3 p.m. to 11 p.m., and night shifts last from 11 p.m. to 7 a.m. For the permanent morning shift group, morning shifts last from 7 a.m. to 3 p.m.

Participants

The study population included all registered nurses (university and technological institute graduates) and nursing assistants who were working morning or night shift for at least 3 months prior to the date of survey completion and had been working for more than 2 years. A total of 750 anonymous written surveys were administered to nurses and nursing assistants working an irregular shift system—including night shifts—and permanently morning shifts, and 365 (49%) questionnaires were returned completed.

Instrument

The instrument used for data collection is the Standard Shiftwork Index (SSI; Barton et al., 1995). The SSI questionnaire is based on existing knowledge of the problems associated with working shifts and measures variables that are thought to modify an individual's response to shiftwork, such as individual circumstances (age, marital status, and children to look after), personality characteristics (morningness/eveningness, extraversion/neuroticism, rigidity, and vigor), coping strategies and personal outcomes for the individual, including physical and psychological health, sleep disturbance, and social and domestic disruption. The process of cultural adaptation and translation followed international recommendations (Sidani, Guruge, Miranda, Ford-Gilboe, & Varcoe, 2010). After authors' permission, translation and back translation was made by two independent translators: one did the translation and the other who did not know the original English text performed the back translation. The final translation was reviewed by the study authors. The questionnaire had acceptable to high internal consistency with Cronbach's α coefficients ranging from 0.70 (extraversion scale) to 0.90 (chronic fatigue scale).

Of the 11 scales included in the SSI, the sleep questionnaire, the chronic fatigue scale, the circadian-type inventory, and composite morningness questionnaire were of interest in relation to the aim of the study and were used in this analysis. The full description of the questionnaire has been presented elsewhere (Barton, Spelten, Tottedell, Smith, & Folkard, 1995; Korompeli, Sourtzi, Tzavara, & Velonakis, 2009).

The sleep questionnaire consists of 11 items and aims to identify sleep habits, as well as the extent to which sleep is disturbed depending on which shift has been or is about to be worked. A higher score is associated with higher sleep disturbance. For the present study, the score was broken down to give a measure of disturbance associated with each of the shifts (morning, late, and night) and rest days. For a total sleep disturbance score, all responses from the individual shift-related scales were added together, a higher score indicating greater sleep disturbance.

The chronic fatigue scale is a 10-item scale related to how energetic or tired the workers feel, irrespective of whether they have had enough sleep or have been working very hard. Higher score is an indication of more fatigue.

The circadian-type inventory consists of 30 items and contains two subscales: vigorousness and flexibility. On both factors, high scores indicate a tendency toward the first of the two labels describing the dimension, that is, languid types or flexible types.

Finally, the composite morningness questionnaire is a 13-item scale measuring morningness. The higher score is an indication of improved morningness and is associated with morning as opposed to evening preferences. Score ranges are provided for clarifying morning and evening types.

Demographic characteristics were also recorded through the SSI questionnaire.

Statistical Methods

Quantitative variables are expressed as mean ± standard deviation, while qualitative ones are expressed with absolute and relative frequencies. For the comparison of means concerning sleep disturbance scales between the two groups, Student's *t*-tests were used. For the comparison of sleep variables among three or more groups, one-way analysis of variance was performed. If the result from the analysis of variance was significant, the post hoc analysis with Bonferroni correction for multiple comparisons was conducted. Pearson correlation coefficients (*r*) were used to explore the association of sleep variables with chronic fatigue, morningness, languidity, and flexibility. To find independent factors associated with sleep problems, linear regression analysis was conducted with dependent sleep disturbance scales from the SSI questionnaire. Sex, shift, family status, the number of family members need looking after, professional training, working experience, scores on chronic fatigue, morningness, languidity, and flexibility scales were entered as covariates in multiple analyses. Age was not included as a covariate because of its high correlation with years of experience. Regression coefficients (β) with their standard errors were computed from the results of regression analyses. All reported *p* values are two-tailed. Statistical significance was set at $p < .05$, and analyses were conducted using SPSS statistical software (version 17.0, SPSS Inc., Chicago, IL, USA).

Ethics

The study protocol was approved by the Scientific Board and the Ethics Committee of each hospital. To protect the privacy of the respondents, the completed questionnaires were collected in sealed envelopes, which were anonymous. Informed consent was obtained from all participants.

Results

Demographics

Analysis was performed on cases with full data, concerning 311 subjects. The study sample consisted of 45 males and 266 females. Demographic data are presented in Table 1. The majority were registered nurses with a technological institute degree (technological education) (76.5%), and 38.9% had more than 18 years of working experience, while 60.5% were working rotating shifts, and the rest (39.5%) were exclusively day shifts. Almost half of the participants (50.5%) had one or two family members in their care.

Table 1. Sample Characteristics ($n = 365$)

	n	%
Age		
≤35	108	34.7
36–40	115	37
>40	88	28.3
Sex		
Men	45	14.5
Women	266	85.5
Shift		
Morning	123	39.5
Rotating	188	60.5
Family status		
Single	72	23.2
Divorced/widow	10	3.2
Married/living with a partner	229	73.6
Family members need looking after		
0	84	27
1–2	157	50.5
≥3	70	22.5
Professional training		
University bachelor's degree	23	7.4
Technological institute degree	238	76.5
Nursing assistants	50	16.1
Working experience (years)		
<10	85	27.3
10–17.5	105	33.8
≥18	121	38.9

Sleep Disturbance Scales

Univariate analyses (Table 2) revealed that females had greater sleep disturbance concerning morning, late, and night shifts as well as the total sleep disturbance score. Subjects working rotating shifts had greater problems on sleep disturbance between morning shifts compared with those having day shifts. Additionally, married subjects or those living with a partner had significantly greater problems on all sleep scales except for morning shifts compared with single ones. Also, participants who had three or more family members to look after had greater problems on sleep disturbance concerning late or night shifts, rest days, and total score as compared with those who had no family obligations. Specifically, sleep disturbance between late shifts increased as the number of family members they had in their care.

Table 2. Association of Sleep Disturbance Scales With Demographics and Job Characteristics: Univariate Analysis

	Sleep disturbance between morning shifts		Sleep disturbance between late shifts		Sleep disturbance between night shifts		Sleep disturbance between rest days		Sleep disturbance total score	
	Mean ± SD	*p*	Mean ± SD	*p*	Mean ± SD	*p*	Mean ± SD	*p*	Mean ± SD	*p*
Sex										
Men	17.1 ± 4.1	.001[a]	16.8 ± 4.0	.007[a]	19.6 ± 4.5	.001[a]	14.2 ± 3.9	.478[a]	68.7 ± 14.3	.004[a]
Women	19.4 ± 3.9		18.5 ± 3.3		22.5 ± 4.8		14.6 ± 3.5		75.3 ± 11.1	
Shift										
Early	18.3 ± 4.3	.029[a]	17.9 ± 4.0	.553[a]	22.2 ± 4.2	.802[a]	14.8 ± 3.4	.580[a]	75.8 ± 12.4	.539[a]
Rotating	19.3 ± 3.8		18.3 ± 3.3		21.9 ± 4.9		14.5 ± 3.6		73.9 ± 12.0	
Family status										
Single	18.2 ± 3.6	.166[b]	16.8 ± 3.0	.002[b]	20.1 ± 6.3	.001[b]	13.2 ± 3.3	.002[b]	68.6 ± 10.8	<.001[b]
Divorced/widow	18.9 ± 4.4		18.8 ± 2.5		19.5 ± 1.9		14.4 ± 3.2		75.0 ± 7.0	
Married/living with a partner	19.3 ± 4.1		18.7 ± 3.5		22.8 ± 4.0		15.0 ± 3.5		76.4 ± 11.9	
Family members need looking after										
0	18.6 ± 4.1	.179[b]	16.8 ± 2.8	<.001[b]	20.7 ± 5.9	<.001[b]	13.6 ± 3.0	.001[b]	69.8 ± 10.1	<.001[b]
1–2	18.9 ± 4.0		18.4 ± 3.5		21.7 ± 4.0		14.5 ± 3.8		73.6 ± 11.9	
≥3	19.8 ± 4.1		20.2 ± 3.3		24.7 ± 3.7		16.0 ± 3.3		83.1 ± 10.9	
Professional training										
University graduates	18.6 ± 4.7	.107[b]	16.4 ± 2.5	.064[b]	21.9 ± 10.6	.548[b]	13.5 ± 3.2	.305[b]	67.2 ± 11.4	.070[b]
Technological institute graduates	18.8 ± 3.9		18.2 ± 3.5		21.8 ± 4.2		14.5 ± 3.6		74.1 ± 12.1	
Nursing assistants	20.2 ± 4.1		18.9 ± 3.1		22.8 ± 4.4		15.1 ± 3.6		76.5 ± 11.1	
Working experience (years)										
<10	18.7 ± 3.8	.675[b]	17.2 ± 2.8	.002[b]	20.9 ± 5.9	.005[b]	13.4 ± 3.3	.005[b]	70.1 ± 10.4	<.001[b]
10–17.5	19.1 ± 3.9		18.5 ± 3.5		21.7 ± 3.7		14.8 ± 3.4		74.6 ± 11.4	
≥18	19.2 ± 4.4		19.3 ± 3.8		23.9 ± 4.4		15.3 ± 3.7		79.6 ± 13.3	

[a]Student's *t*-test.
[b]Analysis of variance.

Table 3. Correlation Coefficients (*r*) of Sleep disturbance Scales With Chronic Fatigue, Morningness, Languidity, and Flexibility Scales

	Chronic fatigue	Morningness	Languidity	Flexibility
Sleep disturbance between morning shifts	0.44***	−0.26***	0.23***	−0.05
Sleep disturbance between late shifts	0.26***	0.04	0.01	−0.06
Sleep disturbance between night shifts	0.15*	0.03	0.02	−0.14
Sleep disturbance between rest days	0.28***	0.13	−0.08	−0.08
Sleep disturbance total score	0.32***	0.01	0.04	−0.10

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

Working experience was significantly associated with sleep problems in the univariate analyses. Nurses with more than 18 years of working experience had more sleep problems in total, among late shifts, night shifts, and rest days compared with nurses with less than 10 years of working experience. Also, more problems with sleep between rest days were found in those with 10–18 years of working experience compared with those with less than ten years of working experience.

Correlation analysis (Table 3) between sleep scales and scores on chronic fatigue, morningness, languidity and flexibility scales revealed significant positive associations of chronic fatigue with all sleep scales. Also, morningness was negatively associated with sleep disturbance between morning shifts. In contrast, the languidity score was positively associated with sleep disturbance between morning shifts.

When multiple analyses were conducted with scales of sleep disturbance as dependent variables (Table 4), it was found that greater problems on sleep disturbance between morning shifts were associated with females nurses, nurses working rotating shifts, and greater levels of chronic fatigue. On the other hand, greater score on the morningness scale was associated with lower scores on sleep problems between morning shifts. Being a female, having three or more family members to look after and chronic fatigue were independent predictors for sleep disturbance between late shifts. Also, greater sleep disturbance between night shifts was found in women, in those with three or more family members in their care, and in those with higher levels of chronic fatigue. Sleep disturbance between night shifts was greater in nurses with more than 18 years of working experience compared with those with less than 10 years of working experience. The number of family members they had to look after, years of working experience, and chronic fatigue were independent predictors for sleep disturbance between rest days. Specifically, greater scores on sleep disturbance between rest days were found in those who had three or more family members to look after compared with those who had no family members to look after; in those with more than 18 years of working experience compared with those who had less than 10 years of working experience; and in those with greater levels of chronic fatigue. Finally, women—those who had three or more family members to look after, those with more than 18 years of working experience, and those with greater levels of chronic fatigue—had a greater total score on sleep disturbance.

Discussion

It is evident from our study that sleep disturbance between all shifts is strongly associated with chronic fatigue. Shift work can increase fatigue by reducing sleep quality and quantity or by aggravating existing sleep problems, in turn increasing fatigue. The more often workers are engaged in shift work, the more severe could be their chronic fatigue (Shen et al., 2006). A number of shift work studies have reported the relationship between fatigue and sleep (Muecke, 2005; Ruggiero, 2003). Similar to our findings, Ruggiero (2003) also demonstrated that poor sleep quality contributed to chronic fatigue in critical care nurses. According to the findings of Smith et al. (1999) in a sample of 1,532 nurses, self-reported sleep disturbance was shown to progress to chronic fatigue.

Shiftworking can result in a desynchronization of the endogenous light/dark cycle resulting in disruptions in the normal sleep–wake rhythm of shift workers (Costa, 2003). Shiftworkers suffer from insufficient restorative sleep that can lead to inability to tolerate morning shifts, which is consistent with the correlation found between sleep disturbance between morning shifts and those participants working a rotating shift system. In our study, a strong correlation was

Table 4. Multiple Linear Regression Models: Regression Coefficients ± Standard Error. Sleep Disturbance Scales

	Sleep disturbance between morning shifts	Sleep disturbance between late shifts	Sleep disturbance between night shifts	Sleep disturbance between rest days	Sleep disturbance total score
	β ± SE	β ± SE	β ± SE	β ± SE	β ± SE
Sex					
Male *(reference)*					
Female	1.78 ± 0.62**	1.29 ± 0.6*	2.24 ± 0.92*	−0.23 ± 0.62	4.86 ± 2.15*
Shift					
Morning *(reference)*					
Rotating	0.99 ± 0.44*	0.96 ± 0.64	0.03 ± 1.2	−0.14 ± 0.51	−0.15 ± 3.02
Family status					
Single *(reference)*					
Divorced/widow	−0.22 ± 1.37	−0.09 ± 1.76	−1.55 ± 2.56	−0.83 ± 1.52	1.49 ± 6.91
Married/Living with a partner	1.15 ± 0.66	0.25 ± 0.69	1.68 ± 1.02	0.37 ± 0.7	2.67 ± 2.47
Family members need looking after					
0 *(reference)*					
1–2	−0.67 ± 0.63	1.18 ± 0.66	1.12 ± 0.72	0.87 ± 0.76	0.27 ± 2.38
≥3	−0.37 ± 0.78	2.47 ± 0.86**	2.94 ± 0.91***	2.22 ± 1.07*	7.37 ± 3.26*
Education					
Nursing assistants *(reference)*					
Technological institute graduates	−0.67 ± 0.59	−0.31 ± 0.61	0.02 ± 0.92	−0.04 ± 0.61	−0.45 ± 2.25
University graduates	−0.45 ± 0.94	−0.93 ± 1.06	1.67 ± 1.59	−0.23 ± 1.05	−2.63 ± 3.91
Experience (years)					
<10 *(reference)*					
10–17.5	0.41 ± 0.57	0.79 ± 0.55	1.04 ± 0.72	1.09 ± 0.5*	2.6 ± 1.9
≥18	0.84 ± 0.65	0.73 ± 0.69	2.27 ± 0.82**	1.87 ± 0.52***	4.87 ± 2.46*
Chronic fatigue	0.21 ± 0.03***	0.1 ± 0.04*	0.1 ± 0.05*	0.16 ± 0.03***	0.39 ± 0.14**
Score morningness	−0.12 ± 0.04**	0.02 ± 0.04	−0.04 ± 0.06	0.08 ± 0.04	−0.06 ± 0.16
Score languidity	−0.01 ± 0.04	−0.01 ± 0.05	−0.01 ± 0.08	−0.05 ± 0.05	0 ± 0.19
Score flexibility	0.01 ± 0.04	0.02 ± 0.05	−0.07 ± 0.07	0 ± 0.04	−0.06 ± 0.17

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

found between sleep disturbance and most shifts, especially night shifts, as well as family responsibilities. Nurses working shifts find it stressful to deal with the combination of the burden of family–home environment, their responsibilities in caring for children and/or an elderly relative, and night shifts in shift work. When nurses must work a night shift after a full day of work at home, this does not allow sufficient time for rest and sleep. According to Watanabe et al. (2004), there are few studies on women who perform shift work that take into account the family–home environment, for example, their responsibilities in caring for a child and/or an elderly relative. Our findings indicate that family responsibilities affect the quantity and quality of sleep in married nurses, and that means that married nurses with children need more support with work schedules, adequate social care facilities, as well as coworker support.

The ability to achieve sleep that is uninterrupted and of sufficient length, even under optimal conditions, is diminished with age (Muecke, 2005); this explains the finding of this study where shiftworkers with more years of professional experience reported having more sleep disturbance problems, which is consistent with the findings of a recent study (Tucker, Folkard, Ansiau, & Marquié, 2010). Furthermore, according to other researchers, there is a natural tendency for older people to become morning people rather than night owls, which makes night work difficult and may contribute to their resignation from night shifts (Reilly, Waterhouse, & Atkinson, 1997). Workers older than 45 years generally have less ability to adapt to a night shift, and scores on cognitive testing in shift workers worsen with age. Thus, age should be taken into consideration when scheduling shifts (Burgess, 2007). Furthermore, our findings suggest that female nurses suffer more sleep problems in all shifts than males, which is consistent with the findings of other studies (Edell-Gustafsson, Kritz, & Bogren, 2002; Poissonnet et al., 2001). A possible explanation could be that female shift workers have more responsibilities of looking after the home and children, and the majority of housework, which may aggravate sleep problems and tiredness (Pati, Chandrawanshi, & Reinberg, 2001).

Finally, shift nurses, who prefer morning activities, appear to have less sleep problems between morning shifts, and this finding is consistent with other studies (Tucker & Knowles, 2008). No differences were observed with family status, professional training, or circadian characteristics (languidity and flexibility).

Conclusion

Our results suggest that female gender, the irregular rotating shifts, having more than three family members to look after, and more than 18 years of professional experience are associated with sleep disturbance between shifts. Therefore, the nursing personnel should be able to modify their shift schedules according to their needs, as well as preferences, to reduce sleep deprivation that may result in health problems as well as patient safety consequences. In addition to that, but also a prerequisite, is an efficient work organization that provides sufficient staffing, which will allow adequate rest time and more flexibility in shift schedules. The results of this study could be an incentive to further study the sleep disturbance of nurses working rotating shifts, especially following changes in the work organization that takes into account individual preferences.

Relevance to Clinical Practice

Shift work, particularly work including night shifts, is the most widely studied condition, as it may interfere at several levels with nurses' well-being. Several studies have demonstrated that nursing personnel working shifts are subject to sleep deprivation that is associated with fatigue. The results of our study provide strong evidence for an association between sleep disturbance and shiftwork, female gender, chronic fatigue, age, and family duties. Ergonomic shift schedules sympathetic to the body clock and nurses' preferences should be adopted to mitigate the adverse effects on sleep. For example, the Metropolitan plan (Table 5), also referred to as the 2-2-2 rota, is a rotating shift schedule, using 8-hr shifts and characterized by fast, forward rotation from day shift to late shift to night shift, with a repeat cycle every 8 days.

Table 5. Rotating Shift Schedule: Metropolitan Plan

Team	Days 1–8							
1	M	M	L	L	N	N		
2	L	L	N	N			M	M
3	N	N			M	M	L	L
4			M	M	L	L	N	N

M, morning shift; L, late shift; N, night shift.

Table 6. Rotating Shift Schedule: Continental Plan

Team	Days 1–7							Days 8–14							Days 15–21							Days 22–28						
1	M	M	L	L	N	N	N			M	M	L	L	L	N	N			M	M	L	L	N	N				
2		M	M	L	L	L	N	N	N		M	M	M	L	L	N	N				M	M	L	L	L	N	N	N
3	N	N		M	M	M	L	L	N	N				M	M	L	L	N	N	N			M	L	L	L	L	L
4	L	L	N	N			M	M	L	L	N	N	N			M	M	L	L	L	N	N			M	M	M	M

M, morning shift; L, late shift; N, night shift.

The main advantages of the Metropolitan plan are two consecutive days off every 8 days and maximum 2 consecutive night shifts, and the disadvantage is that a free weekend (Saturday and Sunday) comes only once in every 8 weeks. On the other hand, the Continental plan (Table 6) is an alternative to the Metropolitan plan using 8-hr shifts. It provides up to three consecutive days off and ensures one free weekend every 4 weeks. Its main drawback is the long seven consecutive work days (Snap Schedule Learning Center, 2005–2012).

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