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The effects of amplitude and stability of circadian rhythm and occupational stress on burnout syndrome and job dissatisfaction among irregular shift working nurses

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Abstract

Aim: To investigate the relation between the circadian rhythm amplitude and stability, and occupational stress with burnout syndrome and job dissatisfaction among shift working nurses.

Background: Irregular shift working nurses are prone to burnout syndrome (BS) and job dissatisfaction (JD). circadian rhythm difference and occupational stress might be effective in causing burnout syndrome and dissatisfaction.

Design: In total, 684 nurses who worked in four teaching hospitals were selected by stratified random sampling in a cross-sectional design based on STROBE guidelines.

Methods: The data were collected by the Circadian Type Inventory, Job Content Questionnaire, Minnesota Satisfaction Questionnaire and the Maslach Burnout Inventory. Multiple linear regression, one-way ANOVA and independent *t* test were used for statistical analysis by SPSS v24.

Results: About 15% of the nurses suffered from high levels of burnout syndrome. Psychological demand ($\beta = 0.022$, CI 95% = 0.003–0.047 and $\beta = 0.016$, CI 95% = 0.001–0.032) and workplace support ($\beta = -0.043$, CI 95% = −0.097–0.003 and $\beta = -0.025$, CI 95% = −0.046–0.006) were significant predictors of BS and JD. Male nurses reported lower BS and higher JD compared to female nurses. Irregular shift working schedule was also related to a significantly higher odd of BS ($p = 0.009$) and JD ($p = 0.011$). Nurses classified as languid experienced significantly more BS and JD than vigorous nurses.

Conclusion: This study shows that BS and JD were strongly associated with psychological demand and workplace support; and vigorous nurses were less prone to BS and JD, and were more suitable for irregular shift work.

Relevance to clinical practice: In order to reduce burnout syndrome and job dissatisfaction among irregular shift working nurses, we need to identify the effect of risk factors such as individual differences on the circadian rhythm and job demand which can affect nurses who work in irregular schedules.

KEYWORDS

burnout syndrome, circadian rhythm, Job content questionnaire, Job dissatisfaction

1 | INTRODUCTION

Irregular shift workers are exposed to a higher risk of adverse health effects such as depression, unhealthy diets, diabetes, coronary heart disease and breast cancer than day workers (Lee, Kim, Kim, Lee, & Kim, 2016; Vetter et al., 2016; Wegrzyn et al., 2017; Yoshizaki et al., 2016). One of the possible mechanisms that causes such adverse effects is altered circadian rhythm, induced sleep deprivation, digestive problems and cardio-metabolic disorders (Anothaisintawee, Reutrakul, Cauter, & Thakkinstian, 2016; Lajoie, Aronson, Day, & Tranmer, 2015).

Shift work in healthcare workers especially nurses raises concern about its negative effects, not only on mental and physical health, but also on family life and quality of care among shift workers (Faseleh Jahromi, Moattari, & Sharif, 2013; West, Boughton, & Byrnes, 2009). The nursing profession includes tasks which are in direct relation to the patients' well-being, and insufficient sleep may lead to low job performance and fatigue-related errors which can endanger patients' health and safety (Caruso, 2014). Misalignment of the circadian rhythm may provoke a negative impact on the physical and mental health of nurses who do shift work (Lin, Liao, Chen, & Fan, 2014; Zhang, Punnett, Gore, & Team, 2014). Furthermore, shift work has also been associated with impaired cognition; and nurses working in rotating shifts for over 10 years have been reported to have poorer cognitive performance than nurses, never doing shift work (Marquié, Tucker, Folkard, Gentil, & Ansiau, 2014). Studies have found that rotating shifts are significantly related to increased risk for psychological distress and acute fatigue (Baron & Reid, 2014; Han, Trinkoff, & Geiger-Brown, 2014). It has also been suggested that stress and work demands are associated with the development of dysfunctional gastrointestinal disorders, depression, poor sleep quality and burnout (Lin et al., 2014, Moss, Good, Gozal, Kleinpell, & Sessler, 2016).

Nowadays, the burnout syndrome has become prevalent, especially among healthcare workers over the world. Nurses who work in rotating shifts report burnout more than nurses who work in fixed shifts (Cañadas-De la Fuente et al., 2015). A longitudinal study among Chinese nurses and police officers showed that those who experienced more burnout were exposed to higher job demands and lower resources (Hu, Schaufeli, & Taris, 2017). Also, a recent study showed that burnout can cause poor quality of nursing care (Mudallal, Saleh, Al-Modallal, & Abdel-Rahman, 2017). On the other hand, burnout syndrome among nurses has been recognised as a risk factor for job dissatisfaction and intention to leave the job (Jiang et al., 2017). A systematic review indicated that job satisfaction was one of the most influential factors on nurses' intention to stay in the hospital environment and most nurses were dissatisfied with their jobs (Chan, Tam, Lung, Wong, & Chau, 2013). A cross-sectional survey in twelve European countries indicted that nurses' dissatisfaction had a direct effect on their intention to quit (Dall'Ora, Griffiths, Ball, Simon, & Aiken, 2015). Additionally, it is estimated that by the year 2025, there will be a shortage of nurses around the world (Australia, 2012; Velasquez, Mazhar, Chaikhouni, Zhou, & Wachs, 2017). But even already, nurse shortage has become a challenge for healthcare systems all around the world. Therefore, finding the factors that have an effect on nurses' intent to leave is a critical issue (Tahghighi, Rees, Brown, Breen, & Hegney, 2017).

What does this paper contribute to the wider global clinical community?

- This paper indicates that vigorous nurses are less affected by the burnout syndrome and job dissatisfaction, and are more suitable for irregular shift work.
- Psychological demand and workplace support were significant predictors of burnout syndrome and job dissatisfaction.
- Healthcare managers should designate the shift work schedule by considering the amplitude and stability of the circadian rhythm among employees and adjusting the demands according to personal capacities.

The aim of this study was to investigate and determine the relation between the circadian rhythm amplitude and stability, and occupational stress with job dissatisfaction and burnout syndrome among irregular and permanent shift working nurses.

2 | METHODS

2.1 | Participants and sample size

This cross-sectional study was conducted on nurses who worked in four teaching hospitals of Shahroud and Urmia University of Medical Sciences, from 25 May –27 July 2017. Full-time nurses with at least one-year experience in clinical work were included in this study. Nurses who had a second job or suffered from any specific psychological disorder were excluded from the study. Nurses who did not consent to participate were also excluded.

The sample size was calculated based on job dissatisfaction (53%) and burnout syndrome (22%) prevalence rates among Iranian nurses, which had been reported in previous studies (Mehrdad, Izadi, & Pouryaghoub, 2013; Nayeri, Negarandeh, Vaismoradi, Ahmadi, & Faghihzadeh, 2009) and a power = 0.8 and $\alpha = 0.05$. The minimum sample size calculated was 682 nurses from different hospital wards. The nurses were selected by stratified random sampling. Stratification was done based on hospital wards. The hospital wards were categorised into general, surgical, intensive care and emergency wards. From the total of 750 questionnaires distributed among nurses in different wards, 684 questionnaires were returned (91.2% response rate). The Strengthening the Reporting of Observational studies in Epidemiology (STROBE) checklist for cross-sectional studies was applied in the preparation of the paper (See Supporting information File S1).

2.2 | Measures

The questionnaire was used included questions about demographic variables (e.g., age, gender, education level, years of clinical experience, shift situation, number of working hours per day/week), circadian rhythm amplitude and stability, occupational stress, job satisfaction and burnout syndrome.

2.3 | Circadian rhythm amplitude and stability

The Circadian Type Inventory (CTI) questionnaire was used to determine the amplitude and stability of the circadian rhythm among nurses. The questionnaire was first developed by Folkard et al (Folkard, Monk, & Lobban, 1979) and revised by Di Milia, Smith, & Folkard (2005). The reliability and validity of the Persian version of CTI have been confirmed among nurses; and the Cronbach's α was 0.76 (Jafari Roodbandi et al., 2013). The circadian rhythm is a sinus type wave with a period of 24-hr. The amplitude is the maximum shift from a rest point and generally describes the wave strength. The stability of the circadian rhythm indicates the amount of its variability by changing other parameters such as the work–rest cycle (Folkard et al., 1979). This self-reported questionnaire consists of 11 items on a 4-point Likert scale, divided into two sections, stability (known as flexible and rigid) and amplitude (known as languid and vigorous). Nurses classified in the flexible group are able to sleep at irregular times easily, and those classified as rigid prefer to have regular sleep and eat times. Languid nurses are known as those less capable to tolerate drowsiness caused by reduced sleep. On the other side, vigorous nurses are able to dominate their sleepiness during shift work. The 75th percentile and above, in stability and amplitude scales were determined as flexible and languid types (Di Milia, Smith, & Folkard, 2004).

2.4 | Occupational stress

Occupational stress was measured by the Persian Job Content Questionnaire (PJCQ). The 29-item PJCQ measures three scales of job stress which are job control, job demands and social support. Job control includes nine items and consists of two dimensions which are task variety (six items) and autonomy (three items). Job demand was measured by twelve items, four items for psychological demand and eight items for physical demand. Social support was measured by the sum of supervisor support (four-item) and peer support (four-item). Each question had a 4-point Likert scale ranging from 1 = strongly disagree to 4 = strongly agree. The JCQ was developed based on the Karasek's model, the validity and reliability of each scale of the PJCQ have been approved, and the Cronbach's alpha was reported between 0.61–0.85 by Tabatabaee et al. (2013).

2.5 | Job dissatisfaction

Job dissatisfaction was evaluated by the Minnesota Satisfaction Questionnaire (MSQ), which was developed by Weiss & Cropanzano (1996). The questionnaire consists of 20 items on a 5-point Likert scale. The questionnaire scales were reversed and reported as job dissatisfaction. A higher score indicates higher job dissatisfaction. Based on the MSQ manual, job dissatisfaction is categorised as low (score >75), moderate (score 75–26) and high (score <26; Weiss, Dawis, & England, 1967). The reliability of the Persian version of the MSQ was reported 0.81 by Hadizadeh Talasaz, Nourani Saadoldin, & Taghi Shakeri (2014).

2.6 | Burnout syndrome

The Maslach Burnout Inventory–General Survey (MBI-GS) has been widely used for evaluating the burnout syndrome (BS). This inventory measures three aspects of BS including emotional exhaustion (EE), cynicism (CY) and professional efficacy (PE), and has 16 items. The participants report their feelings about their job in each question on a 7-point Likert scale, from 0 = never to 6 = every day.

Kalimo, Pahkin, Mutanen, and Topipinen-Tanner (2003) introduced a formula to calculate the total score of BS. BS score = 0.40 × EE + 0.3 × CY + 0.3 × PE). The final score is classified into three groups which are 0–1.49 (no burnout), 1.5–3.49 (medium burnout) and 3.5–6 (sever burnout; Kalimo et al., 2003). Each individual scale can also be classified as low, intermediate and high. For example, the EE was classified as <1.6, 1.6–3 and >3; the Cy was divided into <1, 1–2.4 and >2.4; and the PE was reversely classified as <4.2, 4.2–5.2 and >5.2. The reliability of the Persian MBI-GS was reported to be 0.87 by Shamloo et al. (2017).

2.7 | Ethics approval

This study was approved by the Ethical Committee of Shahroud University of Medical Sciences (IR.SHMU.REC.1395.67). The purpose of this study was explained to all nurses and the questionnaire was completed by the nurse herself/himself. At least one of the researchers was present to answer questions about how to complete the questionnaire. The nurses had the right to withdraw at any stage of the study and the questionnaires were anonymous. The completed questionnaire was checked by the researcher and if it had any unanswered question, it would be returned to the participant to complete.

2.8 | Statistical analysis

The demographic variables and occupational stress scales were reported as means and standard deviations. The BS dimensions, and circadian amplitude and stability were reported by frequency (per cent). The normality and variance equality of the data were tested by the K-S and Levene's test. Independent *t* tests and one-way ANOVA were used to examine the relation between BS dimensions, final BS score, job dissatisfaction and demographic variables such as age, gender, marital status, employment, position, shift, clinical experience and weekly working hours. If the p value of tests was <0.25, these variables would be included in the multiple linear regression for assessing the predictors of BS and job dissatisfaction. All statistical analyses were performed by SPSS v24 at a significance level of 0.05.

3 | RESULTS

3.1 | Demographic variables

The demographic information of participants and the mean ± *SD* of the burnout syndrome dimensions and job dissatisfaction in subgroups are represented in Table 1. The participants were mostly female (84.3%) and married (70.1%). The mean of emotional exhaustion differed significantly in demographic groups such as age, gender, marital status and clinical experience. Female nurses experienced more emotional exhaustion and cynicism than male nurses. Clinical experience had a significant correlation with professional efficiency. Burnout syndrome was higher in permanent, irregular shift nurses and those who worked more than 40 hr a week. A significant correlation was found between job dissatisfaction and age, shift and weekly working hours.

Table 2 shows the classification of BS and its dimensions. Emotional exhaustion had a bigger proportion in the high category and close to 40% of nurses experienced high burnout. At least half of the participants reported low levels of burnout in professional efficiency.

In Table 3, the descriptive results of the amplitude and stability of the circadian rhythm and occupational stress scales have been shown. Based on the circadian rhythm classification, more than three-quarters of nurses were classified as vigorous or rigid. The mean score of psychological demand, job control and workplace support was 35.62, 55.82 and 14.88, respectively.

The predictive variables of burnout syndrome dimensions and job dissatisfaction are shown in Table 4. Male nurses reported less emotional exhaustion, cynicism and burnout syndrome. On the other hand, female nurses were more satisfied. Psychological demand had a significant relation with the dimension of BS and with JD. Nurses who were less able to tolerate sleepiness (languid) were more likely to have higher EE and BS and lower PE. JD was significantly higher in languid than vigorous nurses. EE, BS and JD were less, if workplace support increased. Irregular shift nurses suffered from high EE and BS, and low job satisfaction.

4 | DISCUSSION

In this study, the effects of amplitude and stability of the circadian rhythm and occupational stress on burnout syndrome and job dissatisfaction among nurses were examined. Due to the shortage of nurses all over the world, high rates of burnout syndrome can be an alarm for healthcare systems, and improving the situation should be a priority (Mealer, 2016).

The results of this study showed that more than one-third of participants experienced high rates of emotional exhaustion, and high rates of cynicism and professional efficiency were reported in 30% and 24% of the nurses. Most nurses suffered from moderate levels of BS. In Australia, Mcmillan et al. (2016) reported that 21.3% (EE), 15.7% (Cy) and 55.2% (PE) of Australian nurses who took care of cancer patients reported high levels of BS, respectively (McMillan et al., 2016). A study in Canada showed that based on the Maslach Burnout Inventory–General Survey questionnaire, 41.1%, 47.6% and 18.1% of genetic counsellors reported high levels of emotional exhaustion, cynicism and professional efficacy, respectively (Johnstone et al., 2016). Al-Imam and Al-Sobayel (2014) studied burnout among Arabian physiotherapists and found that 42%, 33.6 and 37.8% of them experienced high levels of exhaustion, cynicism and professional efficacy, respectively (Al-Imam & Al-Sobayel, 2014).

Our results showed that emotional exhaustion had a significant relation with age, gender, marital status, circadian rhythm, psychological demand and workplace support and younger nurses had experienced higher levels of emotional exhaustion. Similar results have been observed among oncology employees in Turkey, and age was negatively related to emotional exhaustion (Demirci et al., 2010). Li, Guan, Chang, and Zhang (2014) also indicated that older nurses were less vulnerable to emotional exhaustion (Li et al., 2014). This relation maybe because younger nurses have less confidence and experience, and cannot cope with the emotional stress such as suffering or even death of patients which are common in nursing and are more affected.

In our study, gender played a significant role in emotional exhaustion reported by nurses, and female nurses reported higher levels of emotional exhaustion than male nurses. The same results have been found in several other studies as well (Amiri et al., 2016; Li et al., 2014). However, few studies found higher levels of emotional exhaustion among male nurses (Lin, Jiang, & Lam, 2013) and some studies did not find a significant relation between exhaustion and gender (Guo et al., 2017; Schadenhofer, Kundi, Abrahamian, Stummer, & Kautzky-Willer, 2017). It is possible that male nurses can better manage emotional situations and are less affected by emotional exhaustion. In addition, female nurses possibly tend to get more emotionally involved in nursing tasks compared to male nurses and are more easily affected by EE.

According to our results, married nurses reported less EE than unmarried nurses. But, Wu et al. (2013) did not find a significant relation between marital status and EE among Chinese nurses (Wu et al., 2014) or doctors (Wu et al., 2013). Similar to our results, a study done by Qu and Wang (2015) in China reported that single nurses experienced significantly more EE than married nurses. They thought the reason was that single nurses often have less work experience and high job pressure, so their perceived burnout was higher (Qu & Wang, 2015).

In our study, nurses with more than 10 years' clinical experience had more EE than others. Similar to us, Li et al. (2014) concluded that by increasing clinical experience, nurses reported more EE (Li et al., 2014). Demirci et al. (2010) also found a positive significant relation between work experience and EE among Turkish oncology employees (Demirci et al., 2010). Probably, nurses with more clinical experience are older and feel that their job has become a tiresome routine.

According to our results, irregular shift work can be related to EE. Wisetborisut, Angkurawaranon, Jiraporncharoen, Uaphanthasath, and Wiwatanadate (2014) found that shift work had a significant

TABLE 1 The scores of BS and job dissatisfaction among different population subgroups

Variables	Frequency (%)	Burnout syndrome				Dissatisfaction
		EE	Cy	PE	BS score	
Age						
30>	275 (40.3)	2.54 ± 1.33	1.69 ± 1.41	3.95 ± 1.33	2.73 ± 0.85	1.41 ± 0.56
30–40	285 (41.7)	2.94 ± 1.21	1.66 ± 1.42	3.99 ± 1.43	2.76 ± 0.72	1.25 ± 0.61
40<	123 (18)	3.33 ± 1.27	1.63 ± 1.72	4.22 ± 1.24	2.85 ± 0.86	1.34 ± 0.53
p value		0.001>	0.959	0.356	0.576	0.048
Gender						
Female	575 (84.3)	2.94 ± 1.29	2.05 ± 1.66	4.03 ± 1.35	2.9 ± 0.84	1.32 ± 0.58
Male	107 (15.7)	2.36 ± 1.25	1.61 ± 1.42	3.96 ± 1.39	2.74 ± 0.79	1.59 ± 0.58
p value		0.001	0.026	0.712	0.174	0.113
Marital status						
Married	478 (70.1)	2.46 ± 1.35	1.68 ± 1.15	4.01 ± 1.37	2.82 ± 0.79	1.31 ± 0.57
Unmarried	204 (29.9)	3.02 ± 1.24	1.63 ± 1.37	4.04 ± 1.33	2.65 ± 0.82	1.37 ± 0.59
p value		0.001>	0.759	0.849	0.054	0.355
Employment						
Permanent	185 (27.1)	3.25 ± 1.28	1.65 ± 1.52	4.18 ± 1.25	2.92 ± 0.81	1.38 ± 0.6
Contract	497 (72.9)	2.7 ± 1.27	1.67 ± 1.46	3.96 ± 1.39	2.71 ± 0.79	1.31 ± 0.57
p value		0.001	0.9	0.155	0.023	0.314
Position						
Nurse	599 (87.9)	2.86 ± 1.31	1.69 ± 1.46	3.95 ± 1.34	2.78 ± 0.8	1.35 ± 0.58
Co-nurse	33 (4.8)	2.63 ± 1.38	1.23 ± 1.36	4.59 ± 1.16	2.74 ± 0.97	1.24 ± 0.48
Head nurse	50 (7.3)	2.93 ± 1.11	1.64 ± 1.67	4.5 ± 1.5	2.63 ± 0.64	1.17 ± 0.56
p value		0.726	0.407	0.019	0.637	0.221
Clinical experience						
<10	421 (61.7)	2.6 ± 1.28	1.71 ± 1.44	3.87 ± 1.37	2.72 ± 0.78	1.33 ± 0.58
10–20	223 (32.7)	3.22 ± 1.16	1.62 ± 1.54	4.24 ± 1.32	2.82 ± 0.81	1.31 ± 0.58
20<	38 (5.6)	3.52 ± 1.45	1.42 ± 1.49	4.33 ± 1.27	3.03 ± 0.94	1.43 ± 0.51
p value		0.001>	0.629	0.026	0.139	0.655
Shift						
Regular	179 (26.3)	2.67 ± 1.33	1.51 ± 1.44	4.04 ± 1.38	2.59 ± 0.75	1.22 ± 0.71
Irregular	503 (73.7)	2.91 ± 1.28	1.72 ± 1.48	4.01 ± 1.35	2.83 ± 0.81	1.37 ± 0.52
p value		0.107	0.215	0.818	0.008	0.025
Ward						
General ward	288 (42.3)	2.84 ± 1.23	1.58 ± 1.47	3.96 ± 1.35	2.75 ± 0.75	1.33 ± 0.54
Intensive care unit	145 (21.3)	2.91 ± 1.35	1.57 ± 1.37	4.17 ± 1.27	2.68 ± 0.9	1.21 ± 0.61
Surgery ward	202 (29.6)	2.85 ± 1.28	1.94 ± 1.41	3.87 ± 1.4	2.84 ± 0.74	1.38 ± 0.57
Emergency ward	46 (6.8)	2.69 ± 1.63	1.35 ± 1.3	4.53 ± 1.41	2.81 ± 1.03	1.5 ± 0.67
p value		0.891	0.107	0.095	0.544	0.078
Weekly working hours						
<40	191 (28)	2.48 ± 1.13	1.06 ± 1.37	4.57 ± 1.45	2.42 ± 0.38	0.91 ± 0.35
≥40	491 (72)	2.66 ± 1.3	1.75 ± 1.46	4.13 ± 1.34	2.77 ± 0.82	1.24 ± 0.59
p value		0.621	0.089	0.245	0.007	0.005

(Continues)

TABLE 1 (Continued)

Variables	Frequency (%)	Burnout syndrome				Dissatisfaction
		EE	Cy	PE	BS score	
Circadian rhythm						
Amplitude						
Vigorous	513 (75.2)	2.63 ± 1.22	1.59 ± 1.48	4.21 ± 1.24	2.63 ± 0.74	1.25 ± 0.54
Languid	169 (24.8)	3.51 ± 1.31	1.91 ± 1.42	3.95 ± 1.39	3.19 ± 0.84	1.56 ± 0.62
p value		0.001>	0.069	0.093	0.001>	0.001>
Stability						
Rigid	523 (76.7)	2.97 ± 1.27	1.63 ± 1.4	3.93 ± 1.32	2.79 ± 0.78	1.36 ± 0.57
Flexible	159 (23.3)	2.47 ± 1.31	1.79 ± 1.71	4.31 ± 1.44	2.69 ± 0.87	1.23 ± 0.61
p value		0.001	0.403	0.017	0.29	0.053
Total		2.48 ± 1.45	1.46 ± 1.37	3.97 ± 1.32	2.62 ± 0.83	1.28 ± 0.64

TABLE 2 The distribution of BS dimensions in classified groups

Scale	Low	Moderate	High
Emotional exhaustion	178 (26.1%)	240 (35.2%)	264 (38.7%)
Cynicism	308 (45.1%)	167 (24.5%)	207 (30.4%)
Professional efficacy	345 (50.6%)	169 (24.8%)	168 (24.6%)
Burnout syndrome	43 (6.3%)	542 (79.5%)	97 (14.2%)

TABLE 3 The types of circadian rhythm or occupational stress reported by nurses

Variable (PJCQ)	Mean ± *SD*	Min-Max	95% CI	
			Lower	Upper
Psychological demand	35.62 ± 5.2	22–48	34.83	35.99
Task variety	28.72 ± 5.22	12–40	28.07	29.23
Autonomy	26.99 ± 5.74	8–40	26.23	27.52
Job control	55.82 ± 8.93	30–80	54.56	56.55
Peer support	7.75 ± 1.98	2–12	7.59	8.03
Supervisor support	7.12 ± 2.51	0–12	6.75	7.33
Workplace support	14.88 ± 3.71	3–24	14.44	15.28

relation with EE (Adjusted OR = 1.7, CI 95% = 1.2–2.3) in Thai healthcare workers (Wisetborisut et al., 2014). But a Chinese study reported no relation between EE and shift work (Wu et al., 2014).

Nurses who work in irregular working schedules often have poor sleep quality due to repeated disturbance of the circadian rhythm and improper social interaction, and this may cause irritability and isolation and then more perceived EE.

This study found that languid nurses who are unable to tolerate sleepiness report more EE than vigorous nurses. But, Willis, O'Connor, and Smith (2008) did not find a significant difference between burnout and morning–evening type in police employees, when they used a Composite Scale of Morningness (CSM) for classification of participants into morning and evening types (Willis et al., 2008). In line with this study, Demir Zencirci and Arslan (2011) showed that nurses who had a lower Petersburg sleep quality score suffered from higher EE ($r = 0.308$, $p < 0.001$; Demir Zencirci & Arslan, 2011). Few studies have been conducted about the relation between the circadian type of shift workers and burnout. However, irregular shift schedules are common among healthcare workers, especially nurses who have to wake up at night and sleep during the day. As a result, their circadian clock is misaligned and adverse health effects, such as gastrointestinal symptoms may occur.

Our results also indicate that psychological demand and workplace support were significant predictors of EE. Similar to this, Wu et al. (2014) found that psychological job demands and workplace support (including supervisor support and coworker support) were predictors of EE. They suggested that nursing shortage, high workload and low wages, lead to adverse effects on nurses' physical and mental health, and cause burnout (Wu et al., 2014). A systematic review showed that high job demand played a key role in the increase of EE, and workplace support was negatively associated with EE (Seidler et al., 2014). Probably, if nurses do not have their supervisor and

TABLE 4 The results of backward multiple linear regression to predict variables related to burnout syndrome and job dissatisfaction

Variable	*B*	*t*	95% CI		*p* value	R^2
			Lower	Upper		
Emotional exhaustion						
Age						0.64
30–40 vs. 30>	−0.313	−1.76	−0.668	−0.018	0.049	
Gender						
Male vs. Female	−0.504	−2.69	−0.86	−0.16	0.008	
Marital status						
Unmarried vs. Married	0.44	2.1	0.037	0.914	0.037	
Clinical experience						
10–20 vs. 10>	0.859	4.52	0.501	1.252	<0.001	
>20 vs. 10>	1.475	3.48	0.739	2.28	0.001	
Shift						
Irregular vs. Regular	0.391	2.08	0.018	0.741	0.039	
Circadian rhythm						
Languid vs. Vigorous	0.936	4.87	0.574	1.303	<0.001	
Flexible vs. Rigid	−0.435	−2.37	−0.823	−0.018	0.019	
Psychological demand	0.029	1.73	−0.061	−0.002	0.048	
Workplace support	−0.046	−2.21	−0.084	−0.004	0.029	
Cynicism						
Gender						0.34
Male vs. Female	−0.513	−2.04	−0.998	−0.023	0.043	
Number of working hours						
40≥ vs. 40<	1.153	2.54	0.069	2.663	0.012	
Psychological demand	0.053	2.41	0.005	0.09	0.027	
Professional efficacy						
Ward						0.38
Emergency vs. General	0.864	2.31	0.149	1.611	0.061	
Circadian rhythm						
Languid vs. Vigorous	−0.61	−2.5	−1.097	−0.122	0.013	
Flexible vs. Rigid	0.438	1.88	0.059	0.829	0.022	
Psychological demand	−0.049	−2.34	−0.094	−0.016	0.02	
Burnout syndrome						
Gender						0.52
Male vs. Female	−0.297	−2.45	−0.474	−0.01	0.014	
Shift						
Irregular vs. Regular	0.24	1.87	0.041	0.438	0.009	
Circadian rhythm						
Languid vs. Vigorous	0.67	5.11	0.368	0.877	<0.001	
Psychological demand	0.022	1.95	0.003	0.047	0.043	
Workplace support	−0.043	−2.09	−0.097	−0.003	0.037	

(Continues)

coworker's support, they would not be able to express their problems and feelings and this may lead to more EE.

According to our results, gender, number of working hours and psychological demand were predictors of Cy. Female nurses experienced more Cy than male nurses; nurses who worked <40 hr per week reported less Cy; and psychological demand was positively associated with Cy. In contrary to us, Schadenhofer et al. (2017) reported higher Cy among men. They explained the reason for their finding that female nurses often establish a deeper relationship with patients and have lower levels of Cy (Schadenhofer et al., 2017). But,

TABLE 4 (Continued)

Variable	*B*	*t*	95% CI		*p* value	R^2
			Lower	Upper		
Job Dissatisfaction						
Age						0.47
30–40 vs. 30>	−0.261	−3.04	−0.439	−0.056	0.005	
Gender						
Male vs. Female	0.207	2.29	0.032	0.376	0.023	
Shift						
Irregular vs. Regular	0.237	2.57	0.082	0.391	0.011	
Circadian rhythm						
Languid vs. Vigorous	0.208	2.12	0.005	0.407	0.035	
Psychological demand	0.016	1.87	0.001	0.032	0.049	
Workplace support	−0.025	−2.32	−0.046	−0.006	0.021	

Li et al. (2014) did a study among 1,559 nurses in five hospitals of Shenyang, China, and found that female nurses reported more than 2 times cynicism compared to males (Li et al., 2014). One possible reason for experiencing more Cy in female nurses than male nurses is that female nurses, particularly the married ones, have to do household work as well, and this causes suspicion about their performance and enhances cynicism about the value of their occupation. A significant relation between weekly work time, psychological demand and Cy was found by Wu et al. (2014) and, in their study, shift work and coworker support were significantly related to Cy as well (Wu et al., 2014). Cy is related to occupational values and is feeling unmotivated or uncertain to be able to perform correctly. It seems that workplace variables can affect Cy by different mechanisms. One of the most possible mechanism is that work stressors such as high workload and psychological conflict cause frustration and insecurity about one's performance and productivity, and lead to Cy (Nayeri et al., 2009).

The results of our study showed a significant relation between circadian rhythm types, psychological demand and PE. Nurses classified as languid reported less PE than vigorous nurses, and psychological demand was negatively associated with PE. In Turkey, rotating shift working nurses reported an inverse significant relation between PE and the Petersburg sleep quality score. Also, poor sleep quality had a strong impact on burnout levels and feeling drowsy at work (Demir Zencirci & Arslan, 2011). Vedaa et al. (2016) found that languidity was a predictor of increased symptoms of insomnia over a 2-year period (Vedaa et al., 2016), and it seems like languid nurses who do shift work suffer from sleep disorders that leads to low PE.

Marcoen, Vandekerckhove, Neu, Pattyn, and Mairesse (2015) found that individuals with high flexibility have less sleepiness (Marcoen et al., 2015). Also, if rigid nurses who prefer to have regular sleep and eat time work in irregular shifts, they will suffer from low PE, because they are easily affected by sleep disorders.

A study by Wu et al. (2014) in Shanghai hospitals showed that high psychological demand was inversely related to PE (Wu et al., 2014). But, in contrast to our study, a positive significant relation between psychological demand and PE was found by Xie, Wang, and Chen (2011) (Xie et al., 2011). Xie et al used the 19-item Maslach Burnout Inventory which is different from our questionnaire (13-item MBI-GS) and found that the PE was inversely related to burnout syndrome. In addition, their study had been conducted on 527 nurses who were not selected randomly, from 41 hospitals in a densely populated district in Shanghai with only 20%–30% response rate.

In this study, the predictors of burnout syndrome were gender, shift, circadian rhythm type, psychological demand and workplace support. Male nurses suffered less from burnout than females. Cheng and Cheng (2016) found that rotating night shift workers significantly experienced more burnout than fixed day workers. They also found that workers with high job demands reported about 5 times more burnout than worker with low job demands (Cheng & Cheng, 2016). A systematic review done by Adriaenssens, De Gucht, and Maes (2015) found that about 26% of emergency nurses suffered from burnout; and job demands, job control and workplace support were related to burnout (Adriaenssens et al., 2015). Another systematic review found an association between low workplace support, emotional demands and high workload and burnout (Seidler et al., 2014).

We found that job dissatisfaction had a significant relation with age, gender, shift, circadian rhythm, psychological demand and workplace support; and female nurses, aged 30–40, with regular shifts, and vigorous nurses were more satisfied. Also psychological demand had a negative and workplace support had a positive relation with JD.

A study by Ge, Fu, Chang, and Wang (2011) among 2,100 Chinese community health workers showed a significant relation between job demands, workplace support, night shift and job satisfaction. In their study, job satisfaction increased by increased workplace support and decreased job demand, and night shift nurses experienced less job satisfaction than day working nurses (Ge et al., 2011). Korompeli, Sourtzi, Tzavara, and Velonakis (2009) indicated that in rotating shift nurses, job satisfaction was

significantly higher than morning shift nurses (Korompeli et al., 2009). In study done by Masuda et al. (2012), a significant relation was found between gender, age and job satisfaction (Masuda et al., 2012). Hwang et al. (2009) studied major factors influencing job satisfaction in Korean and Chinese nurses and reported significant relations between increased age and increased job satisfaction. They also found job satisfaction related to job position and working department (Hwang et al., 2009). Job satisfaction is a multidimensional index which shows the general attitude or feels about a job and can change over the time. If selection of shift workers is done according to their capacities and limitations, there is little doubt that workers will be satisfied. This study showed that some personal characteristics such as age, gender, shift work and circadian rhythm type highly affect job satisfaction. However, the amplitude and stability of the circadian rhythm are often neglected in selecting shift workers, and nurses who do not tolerate sleepiness suffer more from adverse health effects, especially burnout and job dissatisfaction. The limitation of the study was that we did not consider the time of the working shifts. Nurses who participated in this study worked in three shifts (morning, evening and night). So we could not determine that working in which shift had a stronger effect on burnout syndrome or job dissatisfaction.

5 | CONCLUSION

This study showed that about 15% of the nurses suffer from burnout syndrome (BS), and emotional exhaustion had a stronger impact on BS than other factors. Among demographic variables, gender and shift work were related to burnout syndrome and job dissatisfaction. Languid nurses reported more EE, burnout syndrome and job dissatisfaction and less PE than vigorous nurses. Psychological demand and workplace support were two of the most important predictors for burnout and job dissatisfaction. This study also showed that vigorous nurses are less affected by burnout syndrome and job dissatisfaction, and are more suitable for irregular shift work. Shift work must be designated by considering the amplitude and stability of the circadian rhythm, and this will alleviate the adverse effects of shift work on health.

6 | RELEVANCE TO CLINICAL PRACTICE

In order to reduce burnout syndrome and job dissatisfaction among irregular shift working nurses who make up a particularly large proportion of nurses and should be able to perform well, despite their inconvenient working hours, we need to identify the effect of risk factors such as individual differences on the circadian rhythm and job demand which can affect nurses who work in irregular schedules. Some people never adapt with shift work, so interventions should include selection based on their circadian rhythm type and creating a balance between job demands and the nurses' capacity.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

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REFERENCES

Adriaenssens, J., De Gucht, V., & Maes, S. (2015). Determinants and prevalence of burnout in emergency nurses: A systematic review of 25 years of research. *International Journal of Nursing Studies*, *52*(2), 649–661. https://doi.org/10.1016/j.ijnurstu.2014.11.004

Al-Imam, D. M., & Al-Sobayel, H. I. (2014). The prevalence and severity of burnout among physiotherapists in an Arabian setting and the influence of organizational factors: an observational study. *Journal of Physical Therapy Science*, *26*(8), 1193–1198. https://doi.org/10.1589/jpts.26.1193

Amiri, M., Khosravi, A., Eghtesadi, A. R., Sadeghi, Z., Abedi, G., Ranjbar, M., & Mehrabian, F. (2016). Burnout and its influencing factors among primary health care providers in the North East of Iran. *PLoS One*, *11*(12), e0167648. https://doi.org/10.1371/journal.pone.0167648

Anothaisintawee, T., Reutrakul, S., Van Cauter, E., & Thakkinstian, A. (2016). Sleep disturbances compared to traditional risk factors for diabetes development: Systematic review and meta-analysis. *SleepMedicine Reviews*, *30*, 11–24. https://doi.org/10.1016/j.smrv.2015.10.002

Baron, K. G., & Reid, K. J. (2014). Circadian misalignment and health. *International Review of Psychiatry*, *26*(2), 139–154. https://doi.org/10.3109/09540261.2014.911149

Cañadas-De la Fuente, G. A., Vargas, C., San Luis, C., García, I., Cañadas, G. R., & Emilia, I. (2015). Risk factors and prevalence of burnout syndrome in the nursing profession. *International Journal of Nursing Studies*, *52*(1), 240–249. https://doi.org/10.1016/j.ijnurstu.2014.07.001

Caruso, C. C. (2014). Negative impacts of shiftwork and long work hours. *Rehabilitation Nursing*, *39*(1), 16–25. https://doi.org/10.1002/rnj.107

Chan, Z. C., Tam, W. S., Lung, M. K., Wong, W. Y., & Chau, C. W. (2013). A systematic literature review of nurse shortage and the intention to leave. *Journal of Nursing Management*, *21*(4), 605–613. https://doi.org/10.1111/j.1365-2834.2012.01437.x

Cheng, W.-J., & Cheng, Y. (2016). Night shift and rotating shift in association with sleep problems, burnout and minor mental disorder in male and female employees. *Occupational and Environmental Medicine*, *74*(7), 483–488. https://doi.org/10.1136/oemed-2016-103898

Dall'Ora, C., Griffiths, P., Ball, J., Simon, M., & Aiken, L. H. (2015). Association of 12h shifts and nurses' job satisfaction, burnout and intention to leave: findings from a cross-sectional study of 12 European countries. *British Medical Journal Open*, *5*(9), e008331. https://doi.org/10.1136/bmjopen-2015-008331.

Demir Zencirci, A., & Arslan, S. (2011). Morning-evening type and burnout level as factors influencing sleep quality of shift nurses: A questionnaire study. *Croatian Medical Journal*, *52*(4), 527–537. https://doi.org/10.3325/cmj.2011.52.527

Demirci, S., Yildirim, Y. K., Ozsaran, Z., Uslu, R., Yalman, D., & Aras, A. B. (2010). Evaluation of burnout syndrome in oncology employees. *Medical Oncology*, *27*(3), 968–974. https://doi.org/10.1007/s12032-009-9318-5

Di Milia, L., Smith, P. A., & Folkard, S. (2004). Refining the psychometric properties of the circadian type inventory. *Personality and Individual Differences*, *36*(8), 1953–1964. https://doi.org/10.1016/j.paid.2003.08.003

Di Milia, L., Smith, P. A., & Folkard, S. (2005). A validation of the revised circadian type inventory in a working sample. *Personality and Individual Differences*, *39*(7), 1293–1305. https://doi.org/10.1016/j.paid.2005.04.012

Faseleh Jahromi, M., Moattari, M., & Sharif, F. (2013). Novice nurses' perception of working night shifts: A qualitative study. *Journal of Caring Sciences*, *2*(3), 169–176. https://doi.org/10.5681/jcs.2013.021

Folkard, S., Monk, T. H., & Lobban, M. C. (1979). Towards a predictive test of adjustment to shift work. *Ergonomics*, *22*(1), 79–91. https://doi.org/10.1080/00140137908924591

Ge, C., Fu, J., Chang, Y., & Wang, L. (2011). Factors associated with job satisfaction among Chinese community health workers: A cross-sectional study. *BMC Public Health*, *11*, 884. https://doi.org/10.1186/1471-2458-11-884

Guo, Y.-F., Luo, Y.-H., Lam, L., Cross, W., Plummer, V., & Zhang, J.-P. (2017). Burnout and its association with resilience in nurses: A cross-sectional study Nurse burnout and resilience. *Journal of Clinical Nursing*, *27*(1-2), 441–449. https://doi.org/10.1111/jocn.13952

Hadizadeh Talasaz, Z., Nourani Saadoldin, S., & Taghi Shakeri, M. (2014). The relationship between job satisfaction and job performance among midwives working in healthcare centers of Mashhad, Iran. *Journal of Midwifery and Reproductive Health*, *2*(3), 157–164. https://doi.org/10.22038/jmrh.2014.2623

Han, K., Trinkoff, A. M., & Geiger-Brown, J. (2014). Factors associated with work-related fatigue and recovery in hospital nurses working 12-hour shifts. *Workplace Health & Safety*, *62*(10), 409–414. https://doi.org/10.3928/21650799-20140826-01

Health Workforce Australia (2012). *Health Workforce 2025: Doctors, nurses and midwives Volume 1*. Adelaide, South Australia: Health Workforce Australia.

Hu, Q., Schaufeli, W. B., & Taris, T. W. (2017). How are changes in exposure to job demands and job resources related to burnout and engagement?. A longitudinal study among Chinese nurses and police officers. *Stress and Health*, *33*(5), 631–644. https://doi.org/10.1002/smi.2750

Hwang, J. I., Lou, F., Han, S. S., Cao, F., Kim, W. O., & Li, P. (2009). Professionalism: The major factor influencing job satisfaction among Korean and Chinese nurses. *International Nursing Review*, *56*(3), 313–318. https://doi.org/10.1111/j.1466-7657.2009.00710.x

Jafari Roodbandi, A., Hasheminejad, N., Sadeghi, M., Baneshi, M. R., Haji Maghsoudi, S., & Rastegari, A. (2013). Internal consistency and confirmatory factor analysis of Persian version circadian type inventory in iranian day worker and shift worker, 2011–2012. *Iran Occupational Health Journal*, *10*(3), 45–51.

Jiang, H., Ma, L., Gao, C., Li, T., Huang, L., & Huang, W. (2017). Satisfaction, burnout and intention to stay of emergency nurses in Shanghai. *Emergency Medicine Journal*, *34*(7), 448–453. https://doi.org/10.1136/emermed-2016-205886.

Johnstone, B., Kaiser, A., Injeyan, M. C., Sappleton, K., Chitayat, D., Stephens, D., & Shuman, C. (2016). The relationship between burnout and occupational stress in genetic counselors. *Journal of Genetic Counseling*, *25*(4), 731–741. https://doi.org/10.1007/s10897-016-9968-3

Kalimo, R., Pahkin, K., Mutanen, P., & Topipinen-Tanner, S. (2003). Staying well or burning out at work: Work characteristics and personal resources as long-term predictors. *Work & Stress*, *17*(2), 109–122. https://doi.org/10.1080/0267837031000149919

Korompeli, A., Sourtzi, P., Tzavara, C., & Velonakis, E. (2009). Rotating shift-related changes in hormone levels in intensive care unit nurses. *Journal of Advanced Nursing*, *65*(6), 1274–1282. https://doi.org/10.1111/j.1365-2648.2009.04987.x

Lajoie, P., Aronson, K. J., Day, A., & Tranmer, J. (2015). A cross-sectional study of shift work, sleep quality and cardiometabolic risk in female hospital employees. *British Medical Journal Open*, *5*(3), 007327. https://doi.org/10.1136/bmjopen-2014-

Lee, H. Y., Kim, M. S., Kim, O., Lee, I. H., & Kim, H. K. (2016). Association between shift work and severity of depressive symptoms among female nurses: The Korea Nurses' Health Study. *Journal of Nursing Management*, *24*(2), 192–200. https://doi.org/10.1111/jonm.12298

Li, X., Guan, L., Chang, H., & Zhang, B. (2014). Core self-evaluation and burnout among Nurses: The mediating role of coping styles. *PLoS One*, *9*(12), e115799. https://doi.org/10.1371/journal.pone.0115799

Lin, Q. H., Jiang, C. Q., & Lam, T. H. (2013). The relationship between occupational stress, burnout, and turnover intention among managerial staff from a Sino-Japanese joint venture in Guangzhou, China. *Journal of Occupational Health*, *55*(6), 458–467. https://doi.org/10.1539/joh.12-0287-OA

Lin, S. H., Liao, W. C., Chen, M. Y., & Fan, J. Y. (2014). The impact of shift work on nurses' job stress, sleep quality and self-perceived health status. *Journal of Nursing Management*, *22*(5), 604–612. https://doi.org/10.1111/jonm.12020

Marcoen, N., Vandekerckhove, M., Neu, D., Pattyn, N., & Mairesse, O. (2015). Individual differences in subjective circadian flexibility. *Chronobiology International*, *32*(9), 1246–1253. https://doi.org/10.3109/07420528.2015.1085387

Marquié, J.-C., Tucker, P., Folkard, S., Gentil, C., & Ansiau, D. (2014). Chronic effects of shift work on cognition: Findings from the VISAT longitudinal study. *Occupational and Environmental Medicine*, *72*(4), 258–264, https://doi.org/10.1136/oemed-2013-101993

Masuda, A. D., Poelmans, S. A., Allen, T. D., Spector, P. E., Lapierre, L. M., Cooper, C. L., … Fraile, G. (2012). Flexible work arrangements availability and their relationship with work-to-family conflict, job satisfaction, and turnover intentions: A comparison of three country clusters. *Applied Psychology*, *61*(1), 1–29. https://doi.org/10.1111/j.1464-0597.2012.00492.x

McMillan, K., Butow, P., Turner, J., Yates, P., White, K., Lambert, S., … Lawsin, C. (2016). Burnout and the provision of psychosocial care amongst Australian cancer nurses. *European Journal of Oncology Nursing*, *22*, 37–45. https://doi.org/10.1016/j.ejon.2016.02.007

Mealer, M. (2016). Burnout syndrome in the intensive care unit. Future directions for research. *Annals of the American Thoracic Society*, *13*(7), 997–998. https://doi.org/10.1513/AnnalsATS.201604-280ED

Mehrdad, R., Izadi, N., & Pouryaghoub, G. (2013). Nurse job satisfaction: is a revised conceptual framework needed? *International Journal of Hospital Research*, *2*(2), 55–60.

Moss, M., Good, V. S., Gozal, D., Kleinpell, R., & Sessler, C. N. (2016). An official critical care societies collaborative statement—Burnout syndrome in critical care health-care professionals. *Chest*, *150*(1), 17–26. https://doi.org/10.1016/j.chest.2016.02.649

Mudallal, R. H., Saleh, M. Y. N., Al-Modallal, H. M., & Abdel-Rahman, R. Y. (2017). Quality of nursing care: The influence of work conditions, nurse characteristics and burnout. *International Journal of Africa Nursing Sciences*, *7*, 24–30. https://doi.org/10.1016/j.ijans.2017.06.002

Nayeri, N. D., Negarandeh, R., Vaismoradi, M., Ahmadi, F., & Faghihzadeh, S. (2009). Burnout and productivity among Iranian nurses. *Nursing & Health Sciences*, *11*(3), 263–270. https://doi.org/10.1111/j.1442-2018.2009.00449.x

Qu, H.-Y., & Wang, C.-M. (2015). Study on the relationships between nurses' job burnout and subjective well-being. *Chinese Nursing Research*, *2*(2), 61–66. https://doi.org/10.1016/j.cnre.2015.09.003

Schadenhofer, P., Kundi, M., Abrahamian, H., Stummer, H., & Kautzky-Willer, A. (2017). Influence of gender, working field and psychosocial factors on the vulnerability for burnout in mental hospital staff: Results of an Austrian cross-sectional study. *Scandinavian Journal of Caring Sciences*, *32*(1), 335–345. https://doi.org/10.1111/scs.12467

Seidler, A., Thinschmidt, M., Deckert, S., Then, F., Hegewald, J., Nieuwenhuijsen, K., & Riedel-Heller, S. G. (2014). The role of psychosocial working conditions on burnout and its core component emotional exhaustion - A systematic review. *Journal of Occupational Medicine and Toxicology*, *9*(1), 10. https://doi.org/10.1186/1745-6673-9-10

Shamloo, Z. S., Hashemian, S. S., Khoshsima, H., Shahverdi, A., Khodadost, M., & Gharavi, M. M. (2017). Validity and reliability of the persian version of the maslach burnout inventory (general survey version) in Iranian population. *Iranian Journal of Psychiatry and Behavioral Sciences*, *11*(2), e8168.

Tabatabaee, J. S., Ghaffari, M., Pournik, O., Ghalichi, L., Tehrani, Y. A., & Motevalian, S. (2013). Reliability and validity of Persian version of job content questionnaire in health care workers in Iran. *The International Journal of Occupational and Environmental Medicine*, *4*(2), 96–101.

Tahghighi, M., Rees, C. S., Brown, J. A., Breen, L. J., & Hegney, D. (2017). What is the impact of shift work on the psychological functioning and resilience of nurses? An integrative review. *Journal of Advanced Nursing*, *73*(9), 2065–2083. https://doi.org/10.1111/jan.13283

Vedaa, O., Krossbakken, E., Grimsrud, I. D., Bjorvatn, B., Sivertsen, B., Mageroy, N., … Pallesen, S. (2016). Prospective study of predictors and consequences of insomnia: Personality, lifestyle, mental health, and work-related stressors. *SleepMedicine*, *20*, 51–58. https://doi.org/10.1016/j.sleep.2015.12.002

Velasquez, C. A., Mazhar, R., Chaikhouni, A., Zhou, T., & Wachs, J. P. (2017). Taxonomy of Communications in the Operating Room. Paper presented at the International Conference on Applied Human Factors and Ergonomics

Vetter, C., Devore, E. E., Wegrzyn, L. R., Massa, J., Speizer, F. E., Kawachi, I., … Schernhammer, E. S. (2016). Association between rotating night shift work and risk of coronary heart disease among women. *JAMA*, *315*(16), 1726–1734. https://doi.org/10.1001/jama.2016.4454

Wegrzyn, L. R., Tamimi, R. M., Rosner, B. A., Brown, S. B., Stevens, R. G., Eliassen, A. H., … Schernhammer, E. S. (2017). Rotating night shift work and risk of breast cancer in the nurses' Health Studies. *American Journal of Epidemiology*, *186*(5), 532–540. https://doi.org/10.1093/aje/kwx140

Weiss, D. J., Dawis, R. V., & England, G. W. (1967). Manual for the Minnesota Satisfaction Questionnaire. Minnesota Studies in Vocational rehabilitation.

Weiss, H. M., & Cropanzano, R. (1996). Affective events theory: A theoretical discussion of the structure, causes and consequences of affective experiences at work. *Research in Organizational Behavior: an Annual Series of Analytical Essays and Critical Reviews*, *18*, 1–74.

West, S., Boughton, M., & Byrnes, M. (2009). Juggling multiple temporalities: The shift work story of mid-life nurses. *Journal of Nursing Management*, *17*(1), 110–119. https://doi.org/10.1111/j.1365-2834.2008.00920.x

Willis, T. A., O'Connor, D. B., & Smith, L. (2008). Investigating effort–reward imbalance and work–family conflict in relation to morningness–eveningness and shift work. *Work & Stress*, *22*(2), 125–137. https://doi.org/10.1080/02678370802180558

Wisetborisut, A., Angkurawaranon, C., Jiraporncharoen, W., Uaphanthasath, R., & Wiwatanadate, P. (2014). Shift work and burnout among health care workers. *Occupational Medicine*, *64*(4), 279–286. https://doi.org/10.1093/occmed/kqu009

Wu, H., Liu, L., Sun, W., Zhao, X., Wang, J., & Wang, L. (2014). Factors related to burnout among Chinese female hospital nurses: Cross-sectional survey in Liaoning Province of China. *Journal of Nursing Management*, *22*(5), 621–629. https://doi.org/10.1111/jonm.12015

Wu, H., Liu, L., Wang, Y., Gao, F., Zhao, X., & Wang, L. (2013). Factors associated with burnout among Chinese hospital doctors: A cross-sectional study. *BMC Public Health*, *13*, 786. https://doi.org/10.1186/1471-2458-13-786

Xie, Z., Wang, A., & Chen, B. (2011). Nurse burnout and its association with occupational stress in a cross-sectional study in Shanghai. *Journal of Advanced Nursing*, *67*(7), 1537–1546. https://doi.org/10.1111/j.1365-2648.2010.05576.x

Yoshizaki, T., Kawano, Y., Noguchi, O., Onishi, J., Teramoto, R., Sunami, A., … Togo, F. (2016). Association of eating behaviours with diurnal preference and rotating shift work in Japanese female nurses: A cross-sectional study. *British Medical Journal Open*, *6*(11), e011987. https://doi.org/10.1136/bmjopen-2016-011987

Zhang, Y., Punnett, L., Gore, R., & Team, C.-N.-R. (2014). Relationships among employees' working conditions, mental health, and intention to leave in nursing homes. *Journal of Applied Gerontology*, *33*(1), 6–23. https://doi.org/10.1177/0733464812443085

SUPPORTING INFORMATION

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