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Research article

Sleep quality and the associated factors among in-hospital nursing assistants in general hospital: A cross-sectional study☆

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ABSTRACT

Background: Sleep quality and the associated factors in professional nurses have been extensively investigated. However, as an important part of the workforce in hospitals, sleep quality and influencing factors among in-hospital nursing assistants is rarely investigated.

Aim: This study aimed to assess the sleep quality and the associated factors of in-hospital nursing assistants in general hospital.

Methods: A cross-sectional survey study was conducted in a tertiary general hospital. Data were collected from 187 in-hospital nursing assistants using convenience sampling from June to July 2018. The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate participants' sleep quality. A multiple linear regression was performed to identify associated factors with sleep quality.

Results: This study revealed a mean PSQI score of 5.96 ± 3.64 among all participants, of which 62.3% (114/187) participants suffered from impaired sleep quality. In-hospital nursing assistants with significant medical condition, low monthly income, irregular diet and high family burden reported more worse sleep quality.

Conclusion: The study showed that poor sleep quality is a highly prevalent issue among Chinese in-hospital nursing assistants in general hospital. Measures to enhance nursing assistants' wellbeing status (health and burden) and improve their salary (monthly income) are recommended.

1. Introduction

With China's population ageing rapidly, the need for professional nurses continues to grow, but the demand is never met [1]. As an alternative strategy, the training of in-hospital nursing assistants has been gradually emphasized for fully meeting the in-hospital nursing care needs of the elderly by filling the shortage of registered nurses [2, 3]. The nursing assistants, an important part of the workforce in hospitals, refers to persons who have ability of undertaking the un-skilled work of the nurse and providing daily living care for the inpatient under the guidance of professional nurse [4]. Studies suggested that addition of in-hospital nursing assistants to inpatient nursing care can reduce the workload of professional nurses and also benefits reduction of medical expenditure [5, 6]. Meanwhile, it is also a necessary measure in promoting the development of unattended wards in hospitals, improving the quality of nursing, and creating a working environment in where the professional nurses can focus on highly clinical work [7]. The in-hospital nursing assistants have always been an indispensable labor supplement to the health care workforce [8].

Sleep disorder has been a common health problem worldwide [9, 10] and associated with a series of adverse health and social consequences [11, 12]. It has been suggested that healthcare professionals, especially professional nurses, appeared to be more susceptible to sleep disorders than the general population [13, 14]. The shift work schedule can disrupt

☆ **Core tip:** In-hospital nursing assistants have been proposed as an effective source to professional nurses, sharing with many similar burdens with professional nurses. Through this study, we demonstrated poor sleep quality is also a highly prevalent issue in in-hospital nursing assistants. Furthermore, strategies focusing on the enhancement of wellbeing status and improvement of salary are recommended.

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circadian rhythms that lead to disrupted sleep schedules and severely impair sleep quality and quantity [15, 16]. Correspondingly, poor sleep quality, which may be associated with increased risk of distractibility, restlessness, fatigue, and depression, is a serious issue because it interferes with the quality of work such as nurse's decision-making, thereby affecting the nursing quality and increasing work-related adverse events [17, 18, 19].

Poor sleep quality of professional nurses has been a concern and there is lots of research on it [14]. The overall prevalence of sleep problems among clinical nurses working in general hospitals in mainland China was found to be high, reporting an incidence of 55% [20]. Similarly, in-hospital nursing assistants also need to provide nursing care for patients on a 24-hour model, so they are vulnerable to sleep problems as well. There are few studies assessing sleep problems among in-hospital nursing assistants working in general hospital in China, and the risk factors related to these sleep problems are not well understood currently [21]. The purpose of this study is to assess sleep quality and associated factors of in-hospital nursing assistants working in general hospitals in China, so as to provide strategies for in-hospital nursing assistants' daily routine and implications for hospitals' managerial practice.

2. Methods

2.1. Design

We conducted a descriptive, cross-sectional survey study to assess the sleep quality and associated factors among Chinese in-hospital nursing assistants working in general hospital.

2.2. Participants

In-hospital nursing assistants working in a tertiary general hospital in Tianjin, China were recruited using convenience sampling method. Demographic data collection was conducted between June and July 2018 using self-report questionnaire designed by investigators. Participants were selected for questionnaire survey if: (a) they received systematic training and were then qualified as in-hospital nursing assistants; (b) they were employed as nursing assistants in this hospital for at least six months; and (c) they had ability to understand the objectives of this study and were willing to sign informed consents independently. Investigators informed participants on the objective and process of this study before conducting questionnaire survey. Then all participants who signed written inform consent were invited to answer questionnaires in a studying room, and toothpaste and water cup was offered to participants as an incentive strategy after completed questionnaires were returned to investigators.

2.3. Sample size

The sample size was calculated using the G*Power 3.1 program with a linear multiple regression model. A statistical significance level was set at $\alpha = 0.05$, a medium effect size of 0.15, and a statistical power (1-β) of 0.90. Theoretically, a minimum sample size of 166 was calculated.

2.4. Ethical considerations

This study was approved by Institutional Review Board of Tianjin Hospital, with an approval number of 2021003. All participants were asked to participate voluntarily in the study via self-report questionnaires distributed by each head nurse.

2.5. Measures

2.5.1. General characteristics

The following general characteristics, which was selected from our clinical experiences and a previous study [22], were collected using a questionnaire designed by the investigators, including gender, age, marital status, education, domicile place, roommate, position, number of night shifts, medical condition (defined as the presence of definitive diseases according to medical diagnosis), monthly income (defined as the total amount of income from work in hospital each month), work unit, diet schedule (defined as the time to eat three meals each day according to the specified time, including have breakfast between 7:30 and 8:00, lunch between 12:00 and 13:00, and dinner between 18:00 and 19:00) and perceived family burden (defined as household expenditure greatly more than household income).

2.5.2. Sleep quality

The Pittsburgh Sleep Quality Index (PSQI), developed by Buysse et al. (1989), is a self-rating instrument to evaluate participants' sleep quality over the previous month [23]. PSQI has been recognized as a standardized instrument for sleep quality assessment with a satisfactory reliability and validity in differentiating sleep quality into "good sleep" or "bad sleep" [23]. The PSQI consists of 19 items in 7 dimensions including subjective sleep quality (one item), sleep duration (one item), sleep latency (two items), habitual sleep efficiency (two items), use of sleeping medications (one item), daytime dysfunction (two items), and sleep disturbances (nine items). Each dimension is weighted equally on a scale from 0 to 3, and the scores for all seven dimensions were summed to produce a total score between 0 and 21. Higher score indicates more worse sleep quality. The Chinese version of the PSQI has a good reliability for overall scale ($r = 0.82$–0.83) and test-retest reliability ($r = 0.77$–0.85), and a score of >5 implies bad sleep quality, with a diagnostic sensitivity of 90.0% and specificity of 67.0% [24].

2.6. Statistical analysis

Data analyses were performed using the Statistical Package for the Social Sciences (SPSS) software version 25.0. Descriptive and summary statistics such as frequency, percentage, mean and standard deviation were used to determine the socio-demographic factors of the participants. According to the Kolmogorov-Smirnov normality test result, the distribution of scores from quality of sleep was abnormal. However, differences of quality of sleep between participants with different categories were tested using independent *t*-test and one-way ANOVA due to the following reasons [25, 26]: (a) parametric tests are more powerful than the non-parametric tests; (b) the results of Kolmogorov–Smirnov test are not necessarily true; and (c) the data were normally distributed according to histograms and plot (Figure 1). We also determine which factors should be included in the linear regression based on *t*-value and one-way ANOVA results [27]. Multivariate linear regression analysis with enter strategy was performed after inspection of normality using histogram and plots to identify factors related to sleep quality of nursing assistants based on a significance level of <0.05. Adjusted R-squared and F-statistic was used to evaluate the degree of fit and the significance of the regression equations, respectively.

3. Results

3.1. Participants' characteristics

Out of 187 questionnaires, 183 questionnaires were recycled for final analysis, with an effective response rate of 97.86%. The majority of in-hospital nursing assistants who returned the validated questionnaires were female (n = 111, 60.7%). Only 42 (23.0%) of the participants had graduated from technical schools. The age of all participants ranged from 20 to 60, with an average age of 48.84 ± 5.92 years. About half of the participants were sharing a house with other people, remained married (n = 107, 58.5%), and worked in the orthopedic department (n = 102, 55.7%). Over 75.0% of participants (n = 139, 76.0%) were not local residents, 138 (75.4%) bore the burden of their families. At the time of data collection, only 18 (9.8%) participants had monthly income less

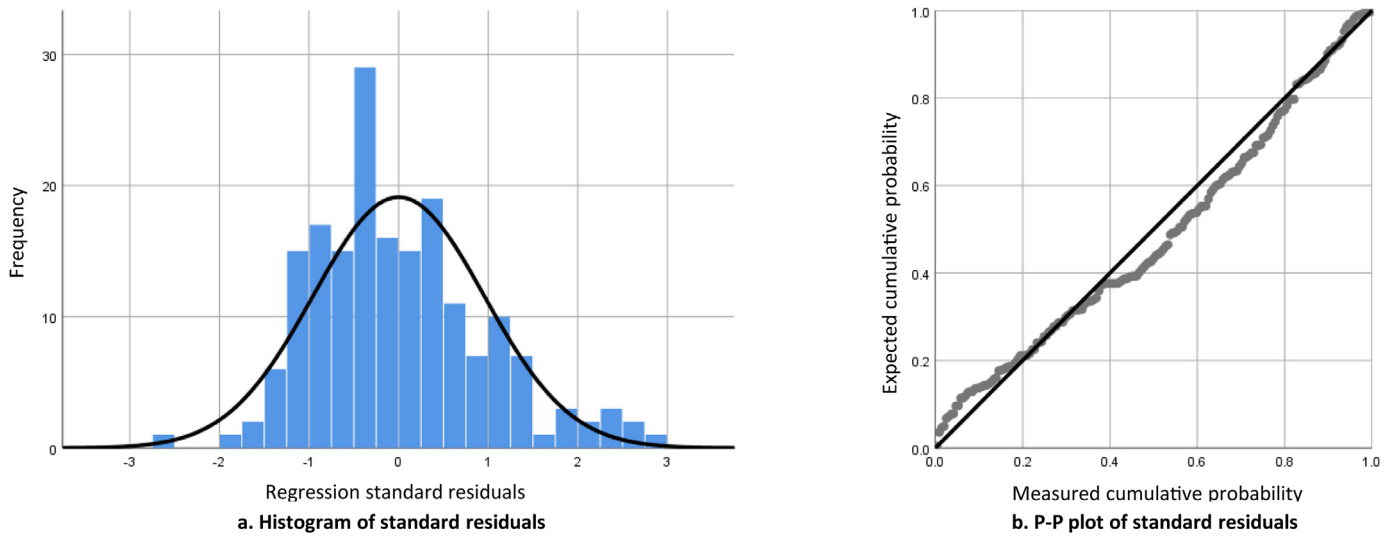

Figure 1. Normality examination for score of sleep quality based on histogram and P–P plot of standard residuals.

than ¥3000 (ranging from ¥2600 to ¥3850), 23 (12.6%) complained of physical problems, 55 (30.1%) had a regular diet and 72 (39.3%) had worked less than one year. Most of them were staff nursing assistants, and had at least 10 shifts per month. Table 1 shows the demographic information of all participants.

3.2. Sleep quality

Kolmogorov-Smirnov normality test result was statistically significant ($z = 0.140$, $p < 0.001$), however histogram and P–P plot of standard residuals indicated the normality of score of sleep quality. The overall average score of all in-hospital nursing assistants was (5.96 ± 3.64) in PSQI, indicating bad sleep quality. Specifically speaking, 62.3% participants (114/183) had a global sleep quality score of >5. The score of subjective sleep quality was (0.97 ± 0.85), with 82 (44.8%) participants reported "fairly good" and 11 (6.0%) answered "very bad". The sleep latency showed a mean score of (1.10 ± 0.86), indicating the highest one of all dimensions. The average score of sleep duration was (1.06 ± 0.74), indicating 35 (19.1%) participants had a sleep time of >7h/night. Besides, 110 (60.1%) reported a habitual sleep efficiency of ≥85%, and the mean score was (0.72 ± 1.02). The average score of sleep disturbances was (0.99 ± 0.62). Approximately 15.8% of nursing assistants reported no sleep disturbances of any kind. The majority of the participants denied taking any sleep medication. The daytime dysfunction showed an average score of (0.99 ± 0.92), and 71 (38.8%) participants did not report daytime dysfunction.

3.3. Multiple linear regression analysis of influencing factors

The sleep quality of participants significantly differed based on their general characteristics except for age, gender, marital status, roommate, position and years of service. In-hospital nursing assistants who were healthy, local residents and had a regular diet, and had no family burdens were more likely to show better sleep quality than subjects in other characteristics. Participants with higher levels of education and monthly income had better sleep quality compared to the other groups. The incidence of poor sleep quality was lower among the subjects with fewer night shifts per month and worked in the oncology department in comparison to the other groups.

Table 2 displays the results from the multiple linear regression analysis. Nine factors with a p-value of <0.05, showing statistically significant association with a t-test or ANOVA were selected in the multiple linear regression model. Four variables-health problems, monthly income, diet, and family burden were included in the final model ($F = 5.912$, $p < 0.001$). The Durbin-Watson value was 2.130, indicating no autocorrelation. Multi-collinearity was not found with tolerance value, which ranged from 0.303 to 0.915, and variance inflation factors ranged from 1.093 to 3.304. These variables explained 30.2% of the total variance in sleep quality. It indicates that the final four variables were the statistically significant influencing factors of nursing assistants' sleep quality.

4. Discussion

We performed this study to firstly investigate the sleep quality and associated factors among in-hospital nursing assistants, and results suggested that most participants (62.3%) suffered from impaired sleep quality with a mean PSQI score of 5.96. Moreover, in-hospital nursing assistants were more suspectable to poor sleep quality under the presence of obvious medical problems, low monthly income, irregular diet and high family burden.

Sleep disturbance is a highly prevalent issue among healthcare professionals [13], indicating a prevalence of 39.2% among Chinese healthcare workers, which was higher than that in general population in China. A study by Dong found that 55% of clinical professional nurses experienced sleep problems in general hospitals in mainland China [20]. In the present study, 62.3% of in-hospital nursing assistants reported experienced "poor" sleep quality. A study by Wang et al. found that 58.1% of nursing assistants slept less than 6h per night [28]. Generally speaking, as one of the auxiliary nursing personnel, In-hospital nursing assistants were prone to sleep disturbances, which became a prominent problem worthy of attention. According to the results of our study, the sleep quality of in-hospital nursing assistants may be mainly affected by the four factors including diet schedule, monthly income, health status and family burden.

First, the present study suggested a positive association between irregular diet and poor sleep quality, which was consistent with the results from the study performed by Kim et al. [29]. Meanwhile, another study focused on Japanese female workers also suggested that irregular eating was significantly associated with poor sleep quality [30]. Moreover, Pot et al. performed a study to investigate the relationship between sleep and dietary habits in the urban environment, and found an interaction between sleep quality of and diet schedule [31]. These results consistently implicated that, as nursing administrator in hospital, efforts (e.g., optimizing caring tasks) should be made for facilitating in-hospital nursing assistants to develop a regular diet schedule so that sleep quality among in-hospital nursing assistants would be improved.

Table 1. Average score of sleep quality according to various characteristics (n = 183).

Variable	Categories	N (%)	Average score of sleep quality		
			Mean ± SD	*Statistic*	*p-value*
Gender	Male	72 (39.3)	5.42 ± 3.41	1.697*	0.09
	Female	111 (60.7)	6.32 ± 3.76		
Age, years	≤50	123 (67.2)	6.41 ± 3.57	−2.709*	0.007
	51–60	60 (32.8)	5.05 ± 3.66		
Marital status	Single	16 (8.7)	5.25 ± 3.89	0.397#	0.637
	Married	107 (58.5)	5.95 ± 3.59		
	Divorced/separated	60 (32.8)	6.17 ± 3.70		
Education	Technical school or above	42 (23.0)	4.93 ± 2.92	3.793#	0.026
	Middle school	91 (49.7)	5.86 ± 3.38		
	Under middle school	50 (27.3)	7.02 ± 4.37		
Domicile place	Tianjin	44 (24.0)	4.39 ± 2.72	−3.466*	0.001
	Other places	139 (76.0)	6.46 ± 3.76		
Roommate	No	79 (43.2)	5.43 ± 3.64	−1.893*	0.058
	Yes	104 (56.8)	6.37 ± 3.62		
Position	Staff	134 (73.2)	6.16 ± 3.78	−1.017*	0.309
	Charge	49 (26.8)	5.43 ± 3.22		
No. night shifts	<10 shifts/month	33 (18.0)	4.64 ± 3.10	−2.275*	0.023
	≥10 shifts/month	150 (82.0)	6.25 ± 3.70		
Medical condition	Yes	23 (12.6)	9.87 ± 4.56	−4.346*	<0.001
	No	160 (87.4)	5.40 ± 3.13		
Monthly income, CNY	<3000	18 (9.8)	5.39 ± 4.63	5.454#	0.005
	3000–4000	129 (70.5)	6.50 ± 3.58		
	≥4000	36 (19.7)	4.33 ± 2.76		
Work unit	Internal medicine	23 (12.6)	7.65 ± 3.51	2.620#	0.037
	Surgical department	22 (12.0)	5.14 ± 3.09		
	Oncology department	2 (1.1)	4.00 ± 1.41		
	Orthopedic department	102 (55.7)	6.17 ± 3.83		
	Ward management	34 (18.6)	4.85 ± 3.16		
Diet schedule	Frequent	55 (30.1)	4.38 ± 2.92	12.442#	<0.001
	Sometime	57 (31.1)	5.67 ± 3.31		
	Few	71 (38.8)	7.42 ± 3.86		
Family burden	No	45 (24.6)	4.42 ± 3.17	9.471#	<0.001
	Light	90 (49.2)	5.88 ± 3.45		
	Heavy	48 (26.2)	7.56 ± 3.81		
Years of service	<1	72 (39.3)	5.81 ± 3.39	0.359#	0.699
	1–3	43 (23.5)	6.37 ± 3.77		
	≥3	68 (37.2)	5.87 ± 3.85		

*t-test statistic, #one-way ANOVA statistic (F statistic).

Table 2. Multivariate linear regression analysis of sleep quality among in-hospital nursing assistants (n = 183).

Variable	*B*	*SE*	*β*	*t*	*p*-value
Constant term	1.880	0.768	-	2.449	0.015
Medical condition	3.751	0.707	0.342	5.308	<0.001
Monthly income	1.807	0.677	0.227	2.670	0.008
Few regular diet schedule	1.493	0.600	0.200	2.489	0.014
Light family burden	1.255	0.594	0.173	2.111	0.036
Heavy family burden	2.114	0.714	0.256	2.960	0.004

Adjusted $R^2 = 0.302$; $F = 6.322$, p-value < 0.001.

Second, medical condition was found as an important influencing factor of in-hospital nursing assistants' sleep quality in the present study, which was consistent with findings in previous studies, suggesting a higher number of medical conditions implied poorer sleep quality and shorter sleep duration [32, 33]. Some studies found that physical and psychological problems such as pulmonary and cardiovascular diseases, arthritis and depression were related to sleep disturbances [34, 35]. However, a study performed by Chaiard et al. suggested that physical and psychological problems did not have impact on sleep disorders [36]. Although variations in questionnaires and participants among published studies may partially contribute to the conflicting results, more studies are still required for demonstrating the association between medical condition of nursing assistants and their sleep quality.

Third, we also found that low monthly income was associated with poor sleep quality in in-hospital nursing assistants. In-hospital nursing assistants are paid at a lower level than other healthcare workers, such as doctors and nurses, but have the heaviest workload [28]. A literature review by Yao et al. found that in-hospital nursing assistants in Beijing earned around 4000 CNY each month and there was no statistical difference in the salary level among them with different working years [37]. Another study showed the average monthly income of in-hospital nursing assistants in upper first-class hospitals ranged from 2500 to 3000 CNY [38], which was lower than monthly income of nursing assistants in the present study, ranging from 2600 to 3850 CNY. The high labor intensity but relatively low wages may cause them to suffer from psychological pressure, which in turn affects their sleep quality. However, no

association was found between income and sleep disorders among day and night shift nurses in the United States [39]. This difference in conclusions may be due to differences in countries and jobs.

Lastly, the association between the family burden and in-hospital nursing assistants' sleep quality was also found in our study. As we can draw from the descriptive statistic, most in-hospital nursing assistants had family burdens. In-hospital nursing assistants in China are mainly female rural migrant workers belonging to the low-income group [38]. Due to the specific nature of the job, in-hospital nursing assistants have less time at their disposal and there were some difficulties in balancing work and life [40]. A previous study by Berkman et al. indicated that higher levels of work-family conflict were strongly associated with shorter sleep duration [41].

This research shows that the work unit, years of service, and the number of night shifts are not influencing factors of sleep disorders. This result is different from the findings of previous studies [20, 42, 43]. In those studies, nurses with higher years of service, working in the ICU or emergency department, and had more night shifts per month were demonstrated to suffer from sleep disorders more easily [20, 42, 43]. As for those differences, the reasons are mainly about a few aspects. First, the "shift work" service mode of nursing assistants is different from that of nurses; second, the work units designed in these studies were categorized differently. Third, most of the participants involved in this study had been working as nursing assistants for less than 3 years. As the working years increase, they tend to take on more work pressure. However, the average number of working years was too short to conduct a time series analysis and to draw specific conclusions.

Neither gender nor age was a significant determinant of in-hospital nursing assistants' sleep quality in this study. These results were consistent with the findings of other studies that suggested no relationship between sleep disorders and age [33, 36]. In contrast, a previous study by Bjorvatn et al. showed age was associated with sleep problems [44]. Differences among the studies may be due to the incompatible methods of categorizing subjects by age. In our study, the majority of subjects (91.8%) were aged >40 years. Other researchers have revealed that females are more easily to suffer from sleep disorders than males, which may be related to female physiological and psychological features [42, 43]. But in our study, males tended to take on more tiring work than females, which may result in the differences from other studies.

The in-hospital nursing assistants in the present study did not show significant variation in sleep quality based on position. The reason for this result may include two aspects. On the one hand, the overall education level of in-hospital nursing assistants was low, and most of them came from rural areas, which made it difficult for managers to communicate with them. On the other hand, here is a high degree of personnel mobility among in-hospital nursing assistants, which poses greater challenges for management. The pressure of managers was not less than that of in-hospital nursing assistants.

Marital status and education were also not influencing factors for sleep disorders. The main reason for the finding in our study was as follows: first, most subjects were separated from their families and rarely returned home. Second, the level of education of nursing assistants is generally low, and had little impact on their work. There was no difference between different employment positions. As a result, marital status and education barely affected in-hospital nursing assistants.

This research showed that domicile place and roommate did not demonstrate statistical significance in relationship to sleep problems. In the present research, although 24.0% of participants were local residents, most of them were economically disadvantaged and needed to rent accommodation because their homes were outside the urban area. In addition, there were subjects who lived alone without sharing with others, but in order to save money, the rented house was in poor condition. Therefore, the two variables did not have influence on subjects' sleep.

4.1. Limitations

Several limitations of the present study should be mentioned. First, the use of cross-sectional data and self-report measures as opposed to objective measurement (e.g., actigraphy), and therefore our results may be negatively by potential bias and causal association between influencing factors and sleep quality could be demonstrated. Second, convenience sampling was used in this study, which might be a source of selection bias. Third, the sample is relatively small, with only one tertiary hospital selected for investigation. Therefore, there could be recall bias, and the results might not be generalizable to all nursing assistants working in general hospitals in China. Finally, we collected these data more than 3 years ago, and therefore our findings may not completely reflect the current status. So, more multi-center studies with large-scale are required to further analyzing the influencing factors of sleep quality among in-hospital nursing assistants.

5. Conclusions

This study found that poor sleep quality is highly prevalent among in-hospital nursing assistants working in general hospitals in China. The influencing factors of sleep disorders in in-hospital nursing assistants were medical condition, irregular diet, low monthly income and family burden. As one of the auxiliary medical workers, the sleep problems among in-hospital nursing assistants are worthy of attention. Factors that influence the quality of sleep in this group of people still need to be explored.

5.1. Implications

In-hospital nursing assistants support patients with feeding, bathing, toileting, dressing, grooming, moving, turning or repositioning, taking vital signs and reporting clinical changes of patients to professional nurses. Poor sleep quality has been suggested to be associated with decreased nursing quality and increased risk of work-related adverse events. Similarly, patients will report a lower satisfaction level and suffer from impaired health outcomes if the risk of caring error was significantly increased among in-hospital nursing assistants due to poor sleep quality. Therefore, nursing administrator should make more efforts to enhance wellbeing status of in-hospital nursing assistants, optimizing caring tasks, and improve their salary.

Declarations

Author contribution statement

Chang Gao: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Guo-Min Song: Conceived and designed the experiments; Wrote the paper.

Li Wang: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Xu Tian: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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