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Factors Influencing Sleep Quality and Their Effects on Health Outcomes: A Cross-Sectional Analysis of Night-Shift Nurses

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Abstract

The objective of this research was to examine the factors influencing sleep quality and investigate related negative health effects in nurses working night shifts in China. Using convenience sampling, this cross-sectional investigation recruited 711 nurses on night shifts, aged between 20 and 55 years. Participants filled out surveys providing information on sociodemographic details, health-related factors, and sleep quality assessed via the Pittsburgh Sleep Quality Index (PSQI). Generalized linear regression was applied to determine elements impacting sleep quality, while Pearson correlation was employed to evaluate links between sleep quality and chronic fatigue.

Poor sleep quality was reported by 90.1% of the night-shift nurses. Key influences on sleep quality included educational attainment, duration of professional experience, adequacy of compensatory sleep prior to and following night duties, regular daily habits, and nutritional patterns (p < 0.01). Chronic fatigue in nurses showed strong positive associations with aspects such as perceived sleep quality, time to fall asleep, length of sleep, interruptions during sleep, use of sleep aids, daytime impairment, and overall PSQI score (p < 0.01). In contrast, sleep efficiency demonstrated a notable inverse relationship with fatigue (p < 0.01). Risk elements for diminished sleep quality in these nurses encompassed advanced education, extended career length, inferior compensatory sleep around night shifts, irregular daily habits, and unhealthy eating habits. Impaired sleep in night-shift nurses exhibited a robust connection to persistent fatigue.

Keywords: Cross-sectional study, Night-shift nurses, Sleep quality, Chronic fatigue, Influencing factors

Introduction

Healthcare facilities operate continuously around the clock, every day of the week, requiring nurses to adhere to rosters that incorporate nighttime duties [1]. In China's hospital categorization system, top-tier and high-grade institutions handle substantial patient volumes, yet nurse-to-bed ratios continue to be inadequate [2]. Shortages in nursing staff combined with intense workloads in clinical settings compel most nurses to engage in night shift rotations starting early in their professional lives [3].

Regular nighttime work disrupts sleep patterns, making adjustment challenging [3]. Experts in sleep describe primary phases of alertness and rest, with rest divided into shallow sleep, profound sleep, and rapid eye movement (REM) phases; optimal sleep features a substantial portion dedicated to profound sleep [4]. Working at night interferes with cortisol and melatonin rhythms, reduces profound sleep duration, results in insufficient rest, and impairs overall sleep [5, 6].

One investigation in China involving 3,206 nurses indicated that those on night shifts had inferior sleep (55.1%) and greater health concerns (20.7%) compared to colleagues on other schedules [7]. A retrospective two-year review from the National Nurse Health Study revealed that increased night shift demands correlated with heightened sleep issues, including reduced sleep time, low quality sleep, and rest deprivation [6]. Research from Saudi Arabia demonstrated that night-duty nurses

experienced worse sleep compared to day-duty ones [8]. A Korean study reported a substantial rate (79.8%) of inadequate sleep among nurses, potentially reducing work efficiency [9]. A meta-analysis and systematic review covering 29 investigations, encompassing 3,935 day-fixed nurses, 3,777 rotating-shift nurses, and 1,559 night-fixed nurses [10], concluded that rotating and fixed-night schedules led to poorer sleep than fixed-day ones [10]. Conversely, an American study detected no notable sleep differences between day and night shift nurses [11].

In contrast to daytime duties, nighttime work links to deteriorated physical and psychological well-being via impacts on rest, biological clocks, eating and drinking behaviors, and reduced mental sharpness that heightens error risks for nurses [12]. Prior research indicated night-shift nurses had lower sleep standards and almost double the depression likelihood versus day-shift ones [1]. Reduced sleep can contribute to various bodily ailments, including migraines, digestive issues, weight gain, diabetes, high blood pressure, heart disease, and even breast cancer [13]. Moreover, studies suggest night-shift nurses face elevated risks of mental challenges like job-related tension and worry [14, 15]. A survey in Chongqing covering nurses from 18 top-level and 16 mid-level hospitals identified that 3-4 night shifts monthly, 9-12 hour night durations, at least 2-hour post-shift sleep delays, and under 4 hours total post-shift rest were elements raising occupational tension and worry [16].

A meta-analysis and systematic review found that individuals with chronic fatigue syndrome exhibit extended time in bed, prolonged onset to sleep, increased awakenings after onset, and lowered sleep efficiency [17]. Yet, limited investigations address the interplay of sleep and fatigue in night-shift nurses. In China's southwestern areas, primarily Sichuan, Yunnan, and Guizhou provinces, economic progress trails coastal regions, medical resources are unevenly allocated [18], and nurses endure significant job strain. Few population-based studies have assessed sleep difficulties in southwestern clinical nurses, with incomplete coverage of contributing elements. Thus, this investigation sought to pinpoint determinants of sleep in night-shift nurses from southwest China and examine connections between their sleep and persistent fatigue.

Materials and Methods

Participants
This cross-sectional investigation enlisted 881 nurses through convenience sampling between March 18, 2023, and April 13, 2024, in Sichuan Province, China. Inclusion requirements comprised: holding a registered nurse license; possessing experience with clinical nighttime duties; being older than 18 years; and providing voluntary consent. Exclusion applied to nursing trainees and those absent on medical leave exceeding three months. The research adhered to the ethical guidelines of the Declaration of Helsinki and received approval from the Biomedical Research Ethics Committee at West China Hospital, Sichuan University (Approval No. 1581).

Measures
General information
Participants completed a custom-designed questionnaire gathering sociodemographic details (including gender, age, marital status, education, years in profession, professional title, and monthly income on average), information on night duties (such as typical length per night shift, consecutive night shift days, weekly night shift count on average, interval days between night shifts on average, compensatory sleep quality before and after night shifts, and overall night shift involvement), and habits related to lifestyle (covering regularity of daily schedule, physical activity, and eating patterns).

Scale evaluation
Pittsburgh sleep quality index—Chinese version (PSQI-C)
The Chinese adaptation of the PSQI, developed and refined by Liu *et al.* [19] in 1996, serves as a reliable tool for assessing sleep patterns and quality. This 19-item self-assessment questionnaire evaluates sleep over the past month. The items contribute to seven components: subjective sleep quality, time to initiate sleep, total sleep time, sleep efficiency, disturbances during sleep, reliance on sleep aids, and impairment during daytime. Each of the seven components receives a score from 0 to 3 on a Likert scale, with equal weighting. Summing these yields a global score between 0 and 21, where elevated values reflect poorer sleep [20]. Scores of 7 or higher indicate sleep disturbances [21]. Typically, the Cronbach's alpha for the PSQI ranges from 0.70 to 0.83 across studies, demonstrating strong reliability [22].

Brief fatigue inventory-Chinese version (BFI-C)

The instrument consists of two sections [23]. The initial section assesses overall fatigue intensity using a 0-10 scale for current fatigue, peak fatigue in the last 24 hours, and typical fatigue, with the mean serving as the overall fatigue score. The subsequent section evaluates fatigue's impact on aspects like general activities, emotional state, mobility, work performance (both professional and domestic), social interactions, and life enjoyment. Elevated scores denote greater fatigue severity, with levels of 7 or more signifying intense fatigue.

Data collection
Surveys were distributed via Wen Juan Xing (www.wjx.cn), a widely used online platform for data gathering. To maintain data integrity, every question was mandatory, ensuring full responses, and submissions were restricted to one per IP address or device to prevent duplicates. Prior to collection, investigators reached out to nursing department heads in involved hospitals, explained the study's aims and procedures, and requested promotion among staff. Questionnaire links were then shared anonymously via WeChat with these directors, who disseminated them through hospital-specific WeChat groups. An informed consent statement appeared at the questionnaire's beginning. Completion typically required 10-15 minutes. Responses were exported from the platform to Excel for review. Of the 881 accesses, exclusions removed incomplete submissions, those from non-night-shift nurses (143), and patterns of uniform answers suggesting inattention (27), resulting in 711 usable responses.

Statistical analysis
Sociodemographic data were presented as counts and proportions (%), while PSQI-C and BFI-C results appeared as means with standard deviations (M ± SD).

Differences in sleep quality across participant traits were examined using independent t-tests and one-way ANOVA. Associations between fatigue and sleep quality were tested via Pearson correlation coefficients. Factors affecting sleep quality were identified through generalized linear regression. Analyses utilized SPSS version 21.0 (IBM Corp., Armonk, NY, USA), with two-tailed tests and significance set at $p < 0.05$.

Results and Discussion

Participant characteristics
Findings indicated that 642 of the 711 nurses on night shifts exhibited poor sleep quality, yielding a rate of 90.1%. **Table 1** outlines the sociodemographic profiles of these nurses. Their average age was 29.52 years (SD = 5.29), spanning 20 to 55 years. Most were women (n = 646, 90.9%), younger than 40 (n = 677, 95.2%), single (n = 315, 44.3%), college graduates (n = 501, 70.5%), and held entry-level titles (n = 501, 80.3%). Work experience distributed as follows: under 5 years (340 nurses), 6-9 years (132), 10-19 years (215), and more than 20 years [24]. Monthly earnings for the majority (n = 427, 60.1%) ranged from 5,000 to 10,000 yuan. Night shift lengths were under 8 hours for 480 nurses, 9-16 hours for 260, and over 17 hours for 25. A majority (n = 407, 57.2%) handled two consecutive night shifts, with 346 (48.7%) averaging two per week. For 413 nurses (58.1%), intervals between night shifts averaged fewer than 5 days. Approximately one-sixth reported inadequate compensatory sleep around night duties. Over half (n = 367, 51.6%) had performed night shifts for more than 5 years. Regarding lifestyle, 122 (17.2%) described highly irregular daily schedules, 393 (55.3%) exercised daily, and 57 (8.0%) viewed their eating habits as highly irregular.

Table 1. Characteristics of nurses working night shifts and univariate analysis of poor sleep quality across various demographic and work-related factors (n=711)

Variables	Group	n (%)	PSQI Score (Mean ± SD)	t/F	P value
General demographic factors					
Gender	Male	65 (9.14)	9.62 ± 3.035	-2.234	0.026
	Female	646 (90.86)	10.52 ± 3.132		
Age (years)	18–29	421 (59.21)	10.30 ± 3.026	6.682	0.001
	30–39	256 (36.01)	10.42 ± 3.180		
	≥40	34 (4.78)	12.32 ± 3.531		
Marital status	Unmarried	315 (44.30)	10.32 ± 2.866	0.802	0.449
	Married	383 (53.87)	10.51 ± 3.310		

	Divorced	13 (1.83)	11.31 ± 3.924		
Educational level	Junior college or below	210 (29.54)	10.03 ± 2.750	-2.412	0.016
	Bachelor's degree or higher	501 (70.46)	10.61 ± 3.267		
Years of work experience	≤5 years	340 (47.82)	10.20 ± 3.034	4.775	0.003
	6–9 years	132 (18.57)	10.61 ± 3.041		
	10–19 years	215 (30.24)	10.47 ± 3.194		
	≥20 years	24 (3.37)	12.63 ± 3.681		
Professional title	Junior	571 (80.31)	10.37 ± 3.062	-1.125	0.261
	Intermediate or higher	140 (19.69)	10.71 ± 3.402		
Average monthly income (yuan)	<5000	190 (26.72)	10.93 ± 2.748	4.314	0.014
	5000–10000	427 (60.06)	10.36 ± 3.151		
	>10000	94 (13.22)	9.82 ± 3.631		
Night shift-related factors					
Average length of each night shift (hours)	≤8	480 (67.51)	10.26 ± 3.246	6.269	0.002
	9–16	206 (28.97)	10.61 ± 2.747		
	≥17	25 (3.52)	12.44 ± 3.229		
Number of consecutive night shifts	1 day	80 (11.25)	9.81 ± 3.094	2.265	0.105
	2 days	407 (57.24)	10.43 ± 3.100		
	≥3 days	224 (31.50)	10.68 ± 3.185		
Average weekly night shift frequency	≤1 time	271 (38.12)	9.80 ± 3.180	10.080	0.001
	2 times	346 (48.66)	10.75 ± 2.945		
	≥3 times	94 (13.22)	11.15 ± 3.360		
Average interval between night shifts (days)	≤5	413 (58.09)	10.98 ± 3.088	15.001	0.001
	6–9	256 (36.01)	9.71 ± 3.067		
	≥10	42 (5.91)	9.60 ± 2.947		
Quality of compensatory sleep before night shift	Good	73 (10.27)	7.73 ± 1.960	63.966	0.001
	Fair	509 (71.59)	10.32 ± 2.968		
	Poor	129 (18.14)	12.45 ± 2.995		
Quality of compensatory sleep after night shift	Good	90 (12.66)	7.81 ± 2.087	67.086	0.001
	Fair	511 (71.87)	10.45 ± 2.984		
	Poor	110 (15.47)	12.55 ± 2.914		
Duration of night shift work (years)	≤5	367 (51.62)	10.24 ± 2.967	1.919	0.148
	6–9	131 (18.42)	10.46 ± 3.097		
	≥10	213 (29.96)	10.77 ± 3.406		
Lifestyle factors					
Regularity of daily routine	Very regular	43 (6.05)	7.93 ± 3.390	36.343	0.001
	Mostly regular	305 (42.90)	9.76 ± 3.060		
	Somewhat irregular	241 (33.90)	10.73 ± 2.615		

	Very irregular	122 (17.16)	12.46 ± 2.966		
Daily exercise	No	318 (44.73)	10.56 ± 3.062	0.939	0.348
	Yes	393 (55.27)	10.34 ± 3.188		
Regularity of daily diet	Very regular	33 (4.64)	9.85 ± 3.914	21.460	0.001
	Mostly regular	385 (54.15)	9.69 ± 3.049		
	Somewhat irregular	236 (33.19)	11.33 ± 2.826		
	Very irregular	57 (8.02)	12.14 ± 2.825		

PSQI = Pittsburgh Sleep Quality Index

PSQI across participant traits

The overall average PSQI score among the nurses was 10.44 (SD ± 3.13). Significant variations in PSQI scores emerged across most participant attributes, with the exceptions of marital status, professional title, consecutive night shift days, overall night shift involvement in career, and regular physical activity. Compared to their counterparts, diminished sleep quality was observed in nurses who were women (p < 0.05), aged above 40 years (p < 0.01), held a bachelor's degree or higher (p < 0.05), and earned less than 5,000 yuan monthly on average (p < 0.05). Regarding occupational factors, inferior sleep was reported by those with 20 or more years of professional experience (p < 0.01), night shifts typically lasting more than 17 hours (p < 0.01), at least three night shifts weekly on average (p < 0.01), intervals shorter than 5 days between night shifts on average (p < 0.01), and inadequate compensatory sleep around night duties (p < 0.01). In terms of lifestyle aspects, individuals with highly disrupted daily schedules (p < 0.01) and highly irregular eating patterns (p < 0.01) exhibited worse sleep quality relative to others **(Table 1)**.

Predictors of sleep quality

To identify elements forecasting sleep quality, generalized linear regression was performed. Variables demonstrating significance in prior t-tests and ANOVA were entered into the model. Findings revealed that educational attainment, length of professional tenure, adequacy of compensatory rest before and following night duties, regularity of daily schedule, and dietary habits emerged as the main influences on sleep quality (p < 0.01) **(Table 2)**.

Table 2. Multivariate analysis of factors affecting sleep quality among night-shift nurses (n=711).

Variables	Group	b	SE	Waldc^2	P value	95%CI Lower limit	95%CI Upper limit
	General demographic factors						
Gender	Male	-0.268	0.3429	0.611	0.434	-0.940	0.404
	Female (reference)						
Age	18~29	-0.808	0.7630	1.121	0.290	-2.303	0.688
	30~39	-0.549	0.6688	0.675	0.411	-1.860	0.761
	≥40 (reference)						
Educational level	Junior high school and below	-0.671	0.2317	8.398	0.004	-1.125	-0.217
	Bachelor degree or above (reference)						
Working life	≤5 years	-2.170	0.881	5.970	0.015	-3.911	-0.429
	6~9 years	-2.350	0.8674	7.339	0.007	-4.050	-0.650
	10~19 years	-2.195	0.7843	7.831	0.005	-3.732	-0.658
	≥20 years (reference)						
Average monthly income	<5000 yuan	0.491	0.3669	1.788	0.181	-0.229	1.210
	5000~10000 yuan	0.290	0.3192	0.826	0.363	-0.336	0.851
	>10000 yuan (reference)						

	Night shift factor						
Average duration of each night shift	≤8 hours	-0.959	0.5425	3.127	0.077	-2.022	0.104
	9~16 hours	-1.028	0.5557	3.421	0.064	-2.117	0.061
	≥17 hours (reference)						
Average weekly night shift frequency	Less than or equal to once	-0.043	0.3452	0.015	0.902	-0.719	0.634
	2 times	0.236	0.3136	0.566	0.452	-0.379	0.851
	Greater than or equal to 3 times (reference)						
Average night shift interval days	≤5 days	0.820	0.4540	3.264	0.071	-0.070	1.710
	6~9 days	0.166	0.4421	0.140	0.708	-0.701	1.032
	≥10 days (reference)						
Quality of make-up sleep the day before night shift	Good	-2.233	0.4724	22.342	0.000	-3.159	-1.307
	Generally	-0.992	0.3070	10.433	0.001	-1.594	-0.390
	Poor (reference)						
Quality of make-up sleep the day after night shift	Good	-2.283	0.4576	24.887	0.000	-3.180	-1.386
	Generally	-1.056	0.3261	10.495	0.001	-1.695	-0.417
	Poor (reference)						
	Life rules						
Is the daily routine regular	Very regular	-3.194	0.4969	41.309	0.000	-4.167	-2.220
	More regular	-1.398	0.3125	20.031	0.000	-2.011	-0.786
	Less irregular	-1.116	0.2982	14.010	0.000	-1.701	-0.532
	Very irregular (reference)						

Associations between sleep quality, persistent fatigue, and job-related burnout

A large proportion of the nurses (n = 642, 90.1 percent) exhibited impaired sleep quality, consistent with the study's observation of a global PSQI score of 7 or higher. The average scores (with standard deviations) for the individual PSQI components were: subjective sleep quality, 1.56 (± 0.755); time to fall asleep, 1.08 (± 0.734); total sleep time, 1.44 (± 0.808); sleep efficiency, 2.89 (± 0.502); interruptions during sleep, 1.25 (± 0.683); reliance on sleep medications, 0.33 (± 0.778); and daytime impairment, 1.89 (± 0.879) **(Table 3)**. The participants recorded an average BFI score of 5.05 (± 2.30). For the BFI subscales, the means (SD) were 5.66 (± 2.28) for overall fatigue intensity and 4.74 (± 2.45) for the impact of fatigue on daily functioning. In particular, levels of fatigue among nurses displayed strong positive correlations with perceived sleep quality, onset latency, sleep length, sleep interruptions, use of sleep aids, daytime functional issues, and the overall PSQI score (p < 0.01). In contrast, sleep efficiency showed a significant inverse correlation with fatigue (p < 0.01).

Table 3. Descriptive statistics and correlation analysis of variables

Variables	Mean (M)	Standard Deviation (SD)	Overall Fatigue Level	Overall Fatigue Impact	BFI
Sleep Quality	1.56	0.755	0.433**	0.388**	0.420**
PSQI	10.44	3.132	0.532**	0.486**	0.522**
Sleep Duration	1.44	0.808	0.287**	0.249**	0.272**
Sleep Latency	1.08	0.734	0.369**	0.341**	0.364**
Sleep Efficiency	2.89	0.502	-0.142**	-0.143**	-0.149**
Sleep Disturbance	1.25	0.683	0.467**	0.473**	0.491**
Sleep Medication Use	0.33	0.778	0.190**	0.171**	0.184**
Daytime Dysfunction	1.89	0.879	0.501**	0.448**	0.485**

Notes: PSQI = Pittsburgh Sleep Quality Index; BFI = Brief Fatigue Inventory-Chinese Version; *P<0.05, **P<0.01.

High prevalence of poor sleep quality among night-shift nurses

The present study revealed that up to 90.1% of nurses working night shifts experienced poor sleep quality, a prevalence considerably higher than that reported in prior studies. For comparison, a large-scale survey in Norway found that around 40% of night-shift nurses exhibited symptoms consistent with shift work disorder, such as insomnia, excessive daytime sleepiness, and difficulty initiating sleep [24]. Another study reported prevalence rates of 62.11% among nurses working consecutive night shifts and 55.75% among those with prior night-shift experience [3], which may reflect regional differences between healthcare institutions. Shift schedules are highly variable, typically organized as either two-shift systems (day/night) or three-shift rotations (day, evening, night) [7], and these patterns can influence the incidence of sleep disturbances. The mechanism by which shift work disrupts sleep involves stress from irregular work hours that interfere with the suprachiasmatic nucleus of the hypothalamus, leading to misalignment between endogenous circadian rhythms and external environmental cues [25]. Night shifts exacerbate this misalignment, as repeated disruptions prevent the restoration of normal biological rhythms, contributing to persistently high rates of poor sleep quality in this workforce.

Determinants of poor sleep quality in night-shift nurses

The analysis identified several factors significantly associated with sleep quality (p < 0.01), including educational level, professional experience, sufficiency of compensatory sleep surrounding night shifts, lifestyle behaviors, and dietary practices.

Nurses with higher educational attainment (bachelor's degree or above) were more prone to sleep disturbances after night shifts. As nursing education advances, highly educated nurses often possess a broader skill set and place greater emphasis on personal well-being, emotional satisfaction, and career development. Unlike less-qualified nurses, who primarily focus on direct patient care, these individuals frequently take on administrative, educational, and research responsibilities, reducing available recovery time after night duties and increasing stress-related sleep problems.

Longer professional tenure was also linked to poorer sleep quality, corroborating findings by Dong *et al*. (26). In China, the Ministry of Health classifies nurses based on years of service, skill competency, and research contributions, with progression from registered to senior levels [26]. More experienced nurses typically bear heavier workloads and greater responsibilities, intensifying stress during night shifts. Age-related reductions in physical resilience may further hinder adaptation to demanding nocturnal schedules.

The duration and quality of sleep obtained before and after night shifts emerged as crucial determinants of overall sleep quality. Limited prior research has explored pre-shift sleep among this population; however, one study noted average sleep times of approximately 414 minutes (under 7 hours) before workdays and 497 minutes (over 8 hours) before days off, potentially affecting well-being and performance [27]. Daytime sleep is often compromised due to light-induced melatonin suppression, which promotes alertness [28]. Recovery following night shifts is equally important; sufficient post-shift rest facilitates fatigue resolution and repayment of sleep debt, whereas short recovery periods can lead to chronic sleep deprivation [16]. Additional post-shift obligations, including training, meetings, evaluations, or family responsibilities such as childcare or eldercare, frequently limit restorative sleep [27], which may result in selective rapid-eye-movement sleep loss followed by rebound effects that further impair sleep quality.

Lifestyle factors were also strongly associated with sleep outcomes. Evidence suggests that female nurses on rotating schedules often adjust daily routines, causing circadian disruptions that contribute to fatigue and sleep disturbances [29]. Night work creates circadian misalignment, increases stress, reduces physical activity, and accumulates sleep debt, all of which negatively impact health [30, 31]. While a U.S. study found no significant differences in sleep or dietary patterns between day- and night-shift nurses, the present findings highlight the importance of maintaining consistent routines to support sleep among night-shift nurses.

Dietary practices were identified as another key influence on sleep quality. The irregular nature of nursing schedules often interrupts mealtimes [32], and prior studies have highlighted suboptimal nutrition, insufficient physical activity, and poor health behaviors among many nurses [33, 34]. High work demands frequently lead to skipped meals and irregular eating patterns [35], and awareness of the links between diet, exercise, and weight control may be limited [36]. Shift work-induced behavioral changes, including altered eating habits and weight gain, can exacerbate sleep

problems, creating a vicious cycle whereby poor sleep further promotes unhealthy eating, obesity, metabolic disorders, and diabetes [37].

Relationship between sleep quality and chronic fatigue in night-shift nurses

Fatigue, a common concern among nurses working night shifts, is characterized by persistent tiredness and lack of energy and is closely linked to sleepiness [38]. Ongoing poor sleep quality can exacerbate fatigue, which may compromise both patient and staff safety [39]. Evidence increasingly shows that long working hours and shift schedules are associated with medical errors and increased risk of traffic accidents during commutes [40]. Consistent with this, our findings demonstrated a significant association between sleep quality and chronic fatigue in night-shift nurses. This relationship may be partially explained by conditions such as migraines, as individuals suffering from migraines are more likely to experience poor sleep quality, insomnia, and nocturnal fatigue [41].

Following night shifts, nurses frequently shoulder numerous domestic responsibilities, including cooking, cleaning, laundry, and caregiving for family members [42], limiting opportunities for compensatory sleep. The resulting deprivation of normal sleep duration substantially diminishes overall sleep quality. Prolonged sleep loss can lead to emotional disturbances, behavioral changes, and a range of health problems. Insufficient staffing further shortens the rotation interval of night shifts for each nurse, and frequent night shifts within a compressed timeframe increase both workload and stress levels [43]. The high-paced nursing environment can induce stress, altering immune, endocrine, and neurobiochemical functions. Recurrent night shifts also heighten physical fatigue, contributing to occupational burnout, reduced motivation and alertness [44], and a higher likelihood of nursing errors, ultimately compromising the quality of patient care.

Clinical practice recommendations

Night-shift nurses can adopt several strategies to enhance sleep quality and overall well-being. These include engaging in regular exercise, taking short naps during shifts, avoiding high-fat meals after midnight, wearing dark sunglasses when commuting home, using blackout curtains, and minimizing morning light exposure in sleeping areas [7]. Inhalation aromatherapy has also been shown to improve sleep quality in shift nurses [45]. At the managerial level, adopting a people-centered approach is essential, involving optimized work systems, reasonable scheduling, burnout prevention, workload management, routine physical examinations, attention to emotional health, and measures that support both physical and mental well-being, thereby enhancing motivation, efficiency, and reducing errors. While research on sleep education for shift nurses is limited [46], nursing administrators should prioritize health education and awareness regarding sleep hygiene [47].

Strengths and limitations

This study has several limitations. First, the relatively small sample, drawn solely from nurses in Sichuan Province, limits the generalizability of the findings. Second, the cross-sectional design restricts causal inference. Third, convenience sampling was used without stratification by hospital level. Fourth, the study relied on subjective self-reported measures of sleep quality; future research could incorporate objective assessments, such as polysomnography (PSG). Multi-center longitudinal studies evaluating interventions to improve sleep among night-shift nurses are warranted to advance occupational health.

Conclusion

The prevalence of poor sleep quality among night-shift nurses was found to be as high as 90.1 percent. Risk factors affecting sleep included higher education, longer working tenure, insufficient compensatory sleep before and after shifts, irregular daily routines, and dietary patterns. Poor sleep was strongly associated with chronic fatigue. Targeted interventions, both at individual and managerial levels, are necessary to improve sleep quality and overall health among night-shift nurses.

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