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# Analysing the effect of social jetlag on burnout among shift nurse using a chained mediation model

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The purpose of the present research is to explore the relationship between social jetlag and burnout among Chinese shift nurses. Furthermore, we seek to demonstrate how perceived stress and sleep quality play as chain mediators in this relationship. A cross-sectional study. There are 429 Chinese shift nurses data records included through one-on-one format using the subjects' sociodemographic information, the Munich Chronotype Questionnaire for shift workers (MCTQshift), the Chinese version of the 14-item Perceived Stress Scale (CPSS-14), the Pittsburgh Sleep Quality Index (PSQI), and the Chinese version of Maslach Burnout Inventory-General Survey. The positive correlations are found between social jetlag and burnout among Chinese shift nurses; perceived stress and sleep quality, respectively, play a partial mediating role in this relationship. Furthermore, perceived stress and sleep quality play a chain mediating role between social jetlag and burnout. These findings contribute to understanding the impact mechanism of social jetlag on shift nurses' burnout and provide a theoretical foundation for nurses managers to develop programs designed for reducing the burnout that affects shift nurses.

Burnout is a psychological syndrome characterized by a delayed response to prolonged emotional and interpersonal stress in the workplace[1]. Burnout comprises three dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment[2]. Burnout is highly prevalent in the nursing profession[3], Evidence suggests that over half of the four million nurses in the United States and more than one-tenth of nurses worldwide have reported experiencing burnout[4]. Burnout can significantly impact an individual's physical and mental health and is a strong predictor of heart disease, chronic pain, anxiety, depression, and even mortality[3]. Research further indicates that burnout contributes to reduced productivity and increased employee turnover[5,6], adversely affecting nursing organizations. Moreover, evidence suggests that burnout is more pronounced among shift nurses than non-shift nurses[7]. Therefore, addressing burnout among shift nurses is essential for protecting their physical and mental well-being and fostering the sustainable development of nursing organizations[8].

Social jetlag refers to the misalignment of the circadian rhythm resulting from disparities in sleep-wake patterns between work or school days and rest days[9], driven by social obligations such as occupational or academic responsibilities[10]. According to the The Multidimensional Association of Occupational Sleep Loss–Health Conditions–Burnout factors Model proposed by Geurts et al., occupational factors that disrupt sleep can exacerbate social jetlag and other circadian rhythm misalignments[11]. These disruptions may activate burnout-related mechanisms, including heightened environmental stressors, lack of personal time, and failure to control schedule, ultimately leading to burnout and negatively impacting individual health[12]. Therefore, the Hypothesis 1 is proposed: Social jetlag significantly predicts burnout among shift nurses.

Perceived stress refers to the degree to which an individual interprets a stimulus or evaluates a stressful event as stressful[13]. According to the Cognitive-Relational Theory of Emotion and Coping, both stable internal factors and external environmental factors influence the cognitive appraisal of stress when individuals encounter stressful events, shaping subjective stress perceptions and physiological and psychological stress responses[14]. Therefore, circadian misalignments, such as social jetlag—a common external environmental factor in nursing workplaces—may contribute to varying levels of perceived stress[15]. Furthermore, research suggests that stress is a key determinant of burnout, influencing all its dimensions[16]. Empirical studies have also demonstrated a

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positive correlation between perceived stress and burnout levels[17–19]. Therefore, the Hypothesis 2 is proposed: Perceived stress mediates the relationship between social jetlag and burnout among shift nurses.

Sleep quality refers to an individual's subjective assessment of their own sleep, encompassing various aspects such as sleep duration, sleep continuity, and the sense of refreshment upon waking[20]. According to the two-process model of sleep regulation, sleep is modulated by both Sleep-wake homeostatic and circadian mechanisms[21]. Social jetlag, a key marker of circadian rhythm misalignment, may disrupt the circadian regulation of sleep, contributing to impaired sleep quality and other sleep disturbances[22]. Evidence suggests a bidirectional relationship between sleep quality and burnout[23]. Difficulties initiating sleep, poor sleep quality, and fatigue upon awakening may exacerbate physical and psychological exhaustion, diminishing nurses' resilience to occupational stressors[24]. Consequently, this may perpetuate burnout and further exacerbate sleep disturbances. Therefore, Hypothesis 3 is proposed: Sleep quality mediates the relationship between social jetlag and burnout among shift nurses.

Sterling and Eyer's allostasis model of stress responses posits that prolonged and excessive stress can lead to functional dysregulation and exhaustion, thereby resulting in an allostatic state of physiological and psychological imbalance. This state may contribute to a deterioration in sleep quality[25]. A substantial body of empirical research has established that perceived stress is a significant predictor of sleep quality[26–28]. Therefore, Hypothesis 4 is proposed: perceived stress and sleep quality play a chain mediating effect in the relationship between social jetlag and burnout among shift nurses.

## Materials and methods
### Participants and procedure
The study adopted a cross-sectional design, with individual surveys conducted in a one-on-one format. The sample size calculation formula is $\frac{\mu_{\alpha/2}^2 \pi(1-\pi)}{\delta^2}$, based on the prevalence rates of nurse burnout from previous studies, The value of $\pi$ taking the prevalence rate of 0.11[4]and the value of $\delta$ level is 0.05, considering the possibility of invalid questionnaires, the sample size was increased by 20%. This calculation resulted in a cross-sectional survey smallest sample size of 151 cases.

A total of 450 nurses from 82 nursing units in five tertiary medical centers in Southwest China were recruited for the study. Every participant was provided with information regarding the purpose and procedures of the study and subsequently completed an informed consent form. The inclusion criteria were as follows: (a) those who had acquired a vocational qualification certificate from the People's Republic of China; (b) participants who had been assigned to workday, evening, and night shifts on a shiftwork schedule for at least six months. Individuals with a chronic noncommunicable condition, those who were participating in a weight-loss program, or those who were pregnant were excluded.

### Measures
*Demographic data*
The subjects' sociodemographic information, such as their gender, age, marital status, work experience, history of smoking, alcohol consumption, coffee consumption, and family responsibilities (i.e., any children or disabled people in need of care), was gathered using a self-made demographic data questionnaire.

In the field of shift work, three domains of shift work (timing, intensity, and speed) were derived from published work schedules collected[29]. Shift timing was a day-level measure based on the time when a participant started their work-shift (e.g., day or evening shifts). Shift intensity was assessed using two day-level measures: number of consecutive work-shifts and number of consecutive night shifts. The number of consecutive work-shifts or "work-shift intensity was measured daily by retrospectively counting the total number of consecutive work-shifts (including all-day, evening, and night shifts) over two weeks. Any off-duty day stopped the accumulation of work-shift intensity and was considered as a day with a work-shift intensity of "0" Shift speed was a person-level measure and was assessed by evaluating how many changes in shift timing (i.e., one change: from days to evenings, two changes: from days to evenings, then from evenings to nights, or from evenings to days) a participant had in the past two weeks, according to the published work schedules collected during the visit. Based on Hall et al.'s schema, we categorized shift speed as slow (i.e., up to one change), medium (i.e., two to three changes), or rapid (i.e., four or more changes)[29].

*Social jetlag*
Roenne et al., developed the Munich Chronotype Questionnaire (MCTQ) in 2003. This tool measures the midpoint of sleep and sleep duration and describes social jetlag based on the absolute difference between the midpoint of sleep on weekdays and weekends[30]. Juda et al. developed the MCTQ for shift workers (MCTQ^shift) as a tool to assess the social jetlag on shift workers. This tool employed six visual aids and seven questions to evaluate the sleep patterns of the participants at different time intervals during various shift schedules and on days off. The formula for calculating the social jetlag of shift workers is as follows: it involves summing the product of each shift social jetlag and the corresponding number of shifts, and then dividing this sum by the total number of days over which the computation is performed[31]. The MCTQ^shift was adapted for the present study.

*Perceived stress*
The present study used the Chinese version of the 14-item Perceived Stress Scale (CPSS-14)[32,33]. The overall score spans from 0 to 56. The scale is comprised of two subscales. The negative subscale consists of questions 1, 2, 3, 8, 11, 12, and 14, which assess the feeling of tension. On the other hand, the positive subscale consists of items 4, 5, 6, 7, 9, 10, and 13, which assess the sense of feeling out of control. A 5-point Likert scale was employed

to evaluate each item, with a range from 0, representing "never," to 4, indicating "very often." The Cronbach's α coefficient of this scale in this study was 0.75.

*Sleep quality*
The Pittsburgh Sleep Quality Index (PSQI) was used to assess subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disruptions, use of sleep medications, and daytime dysfunction[34]. The scoring system assigns a value between 0 and 3 to each component. The total score ranges from 0 to 21, with higher composite scores indicating lower sleep quality. Good validity (factor loading of each component: >0.5) and reliability (Cronbach's α: 0.84) have been confirmed for the Chinese version of the PSQI. The Cronbach's α coefficient for this scale in this study was 0.83.

*Burnout*
The Maslach Burnout Inventory - General Survey (MBI-GS) was created by Maslach et al.[35] and subsequently translated into Chinese by cheng et al. in 2013[36]. Its purpose was to assess the psychological, emotional, and interpersonal stress experienced by an individual in a work environment. The scale comprises 22 items and is organized into three dimensions: emotional exhaustion (9 items), depersonalization (5 items), and personal accomplishment (8 items). The scoring of each item is based on a 7-point Likert-type scale that ranges from 0 (indicating never) to 6 (indicating every day). The emotional exhaustion dimension measures the level of burnout. The depersonalization dimension measures the extent to which one has a negative attitude towards work. The personal accomplishment dimension assesses an individual's self-esteem in relation to their employment, personal accomplishment dimension is reverse scored. The Cronbach α coefficient in this study was 0.83.

### Statistical analysis
The data analysis for this study used SPSS 21.0 and the Hayes' PROCESS 3.5.2 plug-in. The chain mediation model was tested using Process model 6. Descriptive statistics were used to analyze participants' sociodemographic data. Normally distributed continuous parameters are described as mean and standard deviation. Those with a non-normal distribution are presented as median and interquartile range (IQR). Categorical variables were summarized using participant counts and percentages. The study used Pearson correlation analysis or Spearman correlation analysis to examine the relationship between social jetlag, perceived stress, sleep quality, and burnout. Version 3.5.2 of the process Model 6 is used to conduct chain mediation and regression analysis. Following the control of age, gender, family responsibility, history of smoking, alcohol consumption, and coffee consumption, the dependent variable was burnout, while the independent variable was social jetlag. Perceived stress and sleep quality served as mediating variables. The bootstrap approach is used to estimate the 95% confidence interval through 5,000 repeated sampling. The inspection level is set at $\alpha = 0.05$ for two-sided testing.

## Results
In this study, 429 nurses adequately filled out the questionnaire. The remaining participants were excluded due to incomplete data or not meeting the criteria for inclusion. Consequently, the effective response rate was 95.3%. The total valid sample consisted of 92.3% women and 7.7% men. In terms of age distribution, 99.1% of the nurses in the sample are below the age of 40. Within this survey, a majority of the nurses, specifically 60.1%, possessed a bachelor's degree or a higher level of education. Out of the total number of nurses, 59.0% are married. The majority of these nurses have been working for a period of 10 years or less. Also, 28.7% of them have family responsibilities. In addition, only 4.4% had history of smoking, 26.4% had alcohol consumption, and 49.3% had coffee consumption. In the domains of shift work, 86.2% of participants had 8 h shift timing, 42.4% had a shift intensity of 4, and 37.1% had a shift intensity of 5. We categorized 19.3% of the participants' shift speeds as rapid. In this sample, the social jetlag level of shift nurses was 82 (45, 130) min, the perceived stress was $24.61 \pm 8.89$, the sleep quality was 9 (6, 15), the burnout was $57.28 \pm 20.50$ (Tables 1 and 2).

### The correlation analysis
Since the levels of social jetlag and sleep quality did not follow a normal distribution, Spearman correlation analysis was used for variables with a non-normal distribution, while Pearson correlation analysis was applied for variables with a normal distribution. The results indicate that the variables of social jetlag, perceived stress, sleep quality, and burnout by shift nurses were significantly and positively correlated (Table 3).

### The chain mediating analysis
The results showed the total effect ($\beta = 0.259$, $t = 21.926$, $P < 0.001$) and the direct effect ($\beta = 0.126$, $t = 5.213$, $P < 0.001$) of social jetlag on the burnout were both significant (Tables 4 and 5). The regression analysis results are shown in Table 3; after demographic variables such age, gender, family responsibility, history of smoking, alcohol consumption, and coffee consumption were controlled, social jetlag could significantly positively predict burnout ($\beta = 0.126$, $P < 0.001$); social jetlag could significantly positively predict perceived stress ($\beta = 0.132$, $P < 0.001$) and sleep quality ($\beta = 0.056$, $P < 0.001$); perceived stress could significantly positively predict both the sleep quality ($\beta = 0.244$, $P < 0.001$) and burnout ($\beta = 0.556$, $P < 0.001$); and sleep quality could significantly positively predict burnout ($\beta = 0.687$, $P < 0.001$).

The Bootstrap method was used to calculate 95% confidence intervals for each of the 5,000 repeated draws in the mediating effects test. The findings from the mediating effect analysis (Table 5), indicated that Bootstrap's 95% CI of total indirect effect did not contain 0 [Bootstrap 95% *CI*: 0.087, 0.187], accounting for 51.51% of the total effect. The impact of social jetlag on burnout of the shift nurses via three mediating pathways. The Bootstrap 95% *CI* for the first path "social jetlag → perceived stress → burnout," is 0.033 to 0.120 (excluding 0), the mediating effect is significant, and the effect value is 0.074. The Bootstrap 95% *CI* for the second path

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| Variables | Frequency | Percentage |
|---|---|---|
| Age Median (IQR): 26(24,30); min-max: 19–42 [years] | | |
| < 20 | 2 | 0.5% |
| 20–29 | 325 | 75.8% |
| 30–39 | 98 | 22.8% |
| ≥40 | 4 | 0.9% |
| Gender | | |
| Female | 396 | 92.3% |
| Male | 33 | 7.7% |
| Education level | | |
| High school | 4 | 0.9% |
| Associate degree | 167 | 38.9% |
| Bachelor's degree | 257 | 59.9% |
| Postgraduate | 1 | 0.2% |
| Marital status | | |
| Married | 253 | 59.0% |
| Single | 176 | 41.0% |
| Working experience Median (IQR): 5(3,9); min-max: 1–22 [years] | | |
| < 5 | 190 | 44.3% |
| 5–10 | 169 | 39.4% |
| >10 | 70 | 16.3% |
| Have family responsibility | | |
| Yes | 123 | 28.7% |
| No | 306 | 71.3% |
| Household income (per capita) [yuan] | | |
| <3000 | 53 | 12.4% |
| 3000–5000 | 120 | 28.0% |
| 5000–10,000 | 241 | 56.2% |
| >10,000 | 15 | 3.4% |
| History of smoking | | |
| Yes | 19 | 4.4% |
| No | 410 | 95.6% |
| Alcohol consumption | | |
| Yes | 114 | 26.4% |
| No | 315 | 73.6% |
| Coffee consumption | | |
| Yes | 212 | 49.3% |
| No | 217 | 50.7% |
| Domains of shift work | | |
| Shift timing | | |
| 8 h | 370 | 86.2% |
| 9 h | 53 | 12.4% |
| 12 h | 6 | 1.4% |
| Shift intensity | | |
| 2 | 4 | 0.9% |
| 3 | 66 | 15.4% |
| 4 | 182 | 42.4% |
| 5 | 159 | 37.1% |
| 6 | 18 | 4.2% |
| Shift speed | | |
| 2 | 15 | 3.5% |
| 3 | 331 | 77.2% |
| 4 | 83 | 19.3% |

**Table 1**. Sociodemographic data.

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| Variables | $\bar{X}$ | M | SD | IQR |
|---|---|---|---|---|
| 1. Social jetlag | | 82.00 | | (45.00,130.00) |
| 2. Perceived stress | 24.61 | | 8.89 | |
| 3. Sleep quality | | 9.00 | | (6.00,15.00) |
| 4. Burnout | 57.28 | | 20.50 | |

**Table 2**. Descriptive statistics of various variables and associations between the variables ($N = 429$). $**P < 0.01$.

| Variables | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Social jetlag | 1 | | | |
| 2. Perceived stress | 0.864** | 1 | | |
| 3. Sleep quality | 0.795** | 0.771** | 1 | |
| 4. Burnout | 0.738** | 0.718** | 0.686** | 1 |

**Table 3**. Correlation analysis of various variables. $**P < 0.01$.

| Outcome variable | Predictor variable | β | t | LLCI | ULCI | p | $R^2$ | F |
|---|---|---|---|---|---|---|---|---|
| Perceived stress | Social jetlag | 0.132 | 34.471 | 0.125 | 0.140 | <0.001 | 0.747 | 176.350 |
| Sleep quality | Social jetlag | 0.056 | 8.804 | 0.042 | 0.067 | <0.001 | 0.665 | 103.928 |
| | Perceived stress | 0.244 | 6.070 | 0.165 | 0.323 | <0.001 | | |
| Burnout | Social jetlag | 0.126 | 5.213 | 0.078 | 0.173 | <0.001 | 0.590 | 66.738 |
| | Perceived stress | 0.556 | 3.711 | 0.262 | 0.851 | <0.001 | | |
| | Sleep quality | 0.687 | 3.936 | 0.344 | 1.030 | <0.001 | | |
| Burnout | Social jetlag | 0.259 | 21.926 | 0.236 | 0.282 | <0.001 | 0.550 | 73.173 |

**Table 4**. Regression analysis of the relationship between variables ($N = 429$).

| Path | Effect | Boot SE | Boot LLCI | Boot ULCI | Relative effect |
|---|---|---|---|---|---|
| Total effect | 0.259 | 0.012 | 0.236 | 0.282 | 100.00% |
| Direct effect | 0.126 | 0.024 | 0.078 | 0.173 | 48.49% |
| Total indirect effect | 0.133 | 0.026 | 0.087 | 0.187 | 51.51% |
| Ind1 social jetlag→perceived stress→burnout | 0.074 | 0.022 | 0.033 | 0.120 | 28.44% |
| Ind2 social jetlag→sleep quality→burnout | 0.038 | 0.012 | 0.016 | 0.066 | 14.49% |
| Ind3 social jetlag→perceived stress→sleep quality→burnout | 0.022 | 0.007 | 0.001 | 0.036 | 8.58% |
| C1 (Ind1 minus Ind2) | 0.036 | 0.026 | -0.012 | 0.089 | |
| C2 (Ind1 minus Ind3) | 0.051 | 0.025 | 0.004 | 0.103 | |
| C3 (Ind2 minus Ind3) | 0.015 | 0.011 | 0 | 0.042 | |

**Table 5**. The chain mediating effect of perceived stress and sleep quality.

"social jetlag → sleep quality → burnout," is 0.016 to 0.066 (excluding 0), the mediating effect is significant, and the effect value is 0.038. The Bootstrap 95% CI for the third path "social jetlag → perceived stress → sleep quality → burnout," is 0.001 to 0.036 (excluding 0), has a significant chain multi-mediating effect, and the effect value is 0.022. In brief, perceived stress and sleep quality not only play an independent mediating role between social jetlag and burnout but also play a chain mediating role (Fig. 1).

To assess whether the various paths of indirect effects was different significantly, a pairwise comparison of these paths was used. The results showed that Comparison 2 [Bootstrap 95% *CI*:0.004,0.103] and 3 [Bootstrap 95% *CI*: 0,0.042] was significant, except Comparison 1 [Bootstrap 95% *CI*: −0.012,0.089].

## Discussion

After adjusting for confounders, including smoking and alcohol consumption, which have been identified in previous studies as influencing social jetlag, sleep quality, and related variables[37,38], this study found that there is a significant positive correlation between social jetlag and burnout among shift nurses, supporting Hypothesis 1 and corroborating prior research[39]. Due to the characteristics of shift work, nurses often work at night and rest during the day, resulting in reduced exposure to sunlight—a key indicator of increased social jetlag[40,41]. Diminished sunlight exposure may lead to decreased melatonin secretion[42], and alterations in melatonin
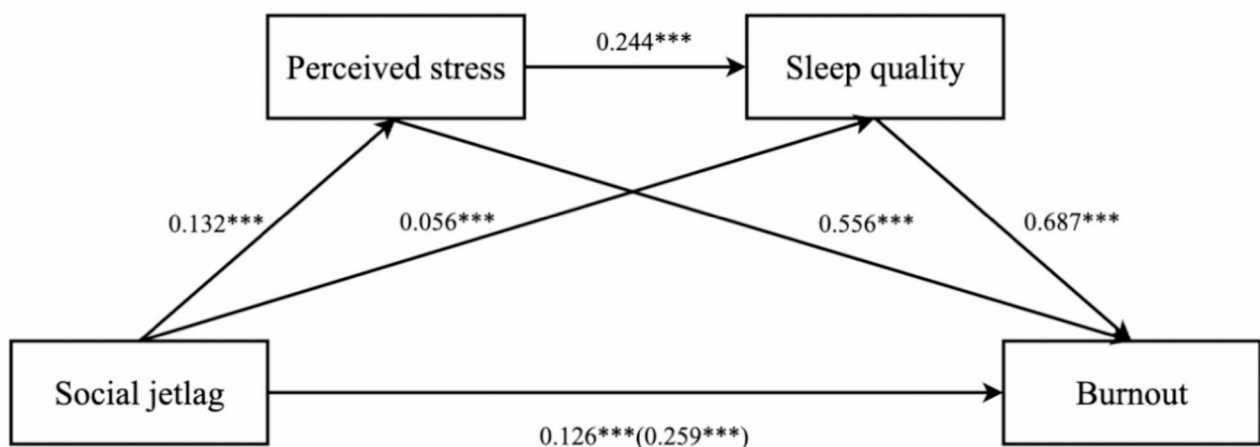
**Fig. 1.** Model of the mediator role of perceived stress and sleep quality in the relationship between social jetlag and burnout. ***$P < 0.001$, significant regression coefficient.

levels have been identified as a critical factor influencing mental health[43]. Furthermore, shift work necessitates compensatory sleep following night shifts. However, misalignment with the schedules of family members or other social contacts may contribute to work-family conflict or disruptions in personal plans[44,45], ultimately leading to burnout[46]. These findings are consistent with Multidimensional Association of Occupational Sleep Loss–Health Conditions–Burnout factors Model. Nursing managers should prioritize addressing burnout among shift nurses and consider implementing intervention programs informed by circadian rhythm principles.

The findings suggest that perceived stress serves as a mediator in the relationship between social jetlag and burnout, supporting Hypothesis 2. Shift nurses are exposed to multiple stressors, with social jetlag—an important indicator of circadian rhythm misalignment—serving as a significant occupational stressor[47] that may heighten perceived stress[48]. Within the Chinese cultural context, nurses are often regarded as embodying a sacred, noble, and selfless professional identity[49,50]. Many nurses perceive shift work as an intrinsic duty of the nursing profession[51]. Consequently, when experiencing circadian misalignment, such as increased social jetlag due to shift work, they often endure these challenges without complaint[52]. Furthermore, healthcare organizations tend to overlook the stress associated with such disruptions[53]. This lack of recognition may exacerbate perceived stress among nurses, and prolonged exposure to elevated stress levels can lead to emotional exhaustion[18], ultimately contributing to burnout. Nursing managers should consider adopting evidence-based stress management strategies, such as Balint group interventions[54] and cognitive-behavioral interventions[55], to mitigate perceived stress among shift nurses and reduce burnout levels.

The findings suggest that sleep quality serves as a mediator in the relationship between social jetlag and burnout, supporting Hypothesis 3. Among shift nurses, increased social jetlag results from the misalignment between intrinsic circadian rhythms and work schedules[56]. A substantial body of research has identified this misalignment as a key contributor to reduced sleep quality[57–59]. The nurse sample in this study was drawn from the southwestern region of China, where shift schedules follow the APN shift pattern, consisting of alternating A shifts (8:00 AM–4:00 PM), P shifts (4:00 PM–12:00 AM), and N shifts (12:00 AM–8:00 AM). This shift scheduling pattern may significantly increase shift speed and intensity, both of which are significantly associated with the level of social jetlag, and resulting in nurses with greater social jetlag exhibiting a morning-type chronotype. Existing research suggests that evening-type individuals demonstrate greater adaptability to frequent night shift rotations[60], whereas morning-type individuals experience poorer sleep quality when working night shifts[61]. Furthermore, declining sleep quality can lead to fatigue[62], reduced job performance, and a diminished sense of professional achievement, further exacerbating burnout among nurses[63]. These findings underscore the importance of nursing managers addressing the adverse effects of circadian rhythm misalignment on sleep quality among shift nurses. When developing shift schedules, managers should consider individual chronotypes to minimize the misalignment between chronotype and work shifts, thereby reducing health risks among shift nurses[56].

This study also found that perceived stress and sleep quality serve as a chain mediator in the relationship between social jetlag and burnout, confirming Hypothesis 4. One potential explanation is that sleep plays a critical role in restoring daily functioning and regulating emotional experiences. It serves to modulate the negative effects of stress on burnout and aids the brain in adaptively processing emotionally stressful events[64]. Specifically, nurses' physiological and psychological responses to stressors during wakefulness may disrupt the initiation of normal sleep processes, while insufficient or poor-quality sleep can heighten sensitivity to stressors

and events, ultimately contributing to burnout[65]. This chain mediation pathway offers valuable insights into the impact of social jetlag induced by shift work on nurse burnout. It underscores the importance of implementing interventions aimed at reducing burnout among shift nurses, as such interventions are critical for the stability and sustainable development of the nursing workforce. The design and execution of these interventions should prioritize the pivotal role of circadian rhythms. It is recommended that nursing managers consider the impact of social jetlag on the mental health of shift nurses and integrate individual chronotypes into shift scheduling. For instance, minimizing night shifts for morning-type individuals and day shifts for evening-type individuals may help mitigate social jetlag[66].

## Limitations

This study presents several limitations. Firstly, as a cross-sectional design, it does not permit the examination of causal relationships between the independent and dependent variables, and future studies should conduct longitudinal or experimental research to validate this relationship. Secondly, the predominance of lower-seniority nurses among shift workers, coupled with the relatively low proportion of male nurses in China[67], results in a sample with a limited representation of male and older nurses, which may impact the generalizability of the findings. Thirdly, previous research suggests that the direction of social jetlag (clockwise or counterclockwise) may differentially affect individual health[68]. Evidence indicates that morning-type individuals are more likely to adopt healthier lifestyles[69]. Social jetlag induced by shift work appears to have a more substantial impact on disrupting the lifestyles of morning-type individuals. Consequently, these disruptions may further exacerbate burnout among shift nurses experiencing counterclockwise social jetlag; hence, future research should explore the influence of social jetlag direction on nurse burnout. Lastly, the similarity in age range and uniformity in scheduling type within this sample means that social jetlag primarily reflects circadian rhythm differences and work-related factors. Consequently, chronotype effects were not considered in this study; Future research should investigate the influence of chronotype on burnout among shift nurses. Specifically, studies should examine whether variations in chronotype contribute to differences in social jetlag during shift work and, consequently, impact burnout.

## Conclusion

In conclusion, this study explores the impact of social jetlag on burnout among Chinese shift nurses. In particular, we found there is a significant positive correlation between social jetlag and burnout among shift nurses and verified the mediating role of perceived stress and sleep quality in this relationship. The chain mediation model between social jetlag, perceived stress, sleep quality, and burnout has been confirmed by the results.

## Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## Author contributions

All authors contributed to the design of the study, the distribution of questionnaires, the collection of data, the writing of the manuscript, and the submission of contributions. All authors contributed to the article and approved the submitted version.

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## Declarations

## Ethics statement

Our study procedures were performed in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and the Declaration of Helsinki of 1975, as revised in 2000. This study was approved by the Institutional Review Board of The Second People's Hospital of Neijiang City (approval number: 202323). Written informed consent was obtained from all the participants.

## Competing interests

The authors declare no competing interests.

## Additional information

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