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Night shift work and abnormal defecation among physicians: The chain mediating effect of hindrance stress and anxiety

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Abstract

Background

Epidemiological evidence links night shift work to gastrointestinal dysfunction, yet research focused on clinical physicians is insufficient, with existing studies mostly targeting nurses and focusing on physiological mechanisms. Based on the Challenge-Hindrance Stressor Model, this study explored the relationships between night shift work, hindrance stress, anxiety and abnormal defecation among clinical physicians, as well as the chain mediating effects of hindrance stress and anxiety.

Methods

A cross-sectional survey was conducted from April to May 2026. 447 clinical physicians from 17 hospitals across 9 Chinese provinces were recruited via convenience sampling. SPSS 29.0 and PROCESS macro 5.0 were used for statistical analysis including correlation analysis, serial mediation test and gender subgroup analysis.

Results

74.3% of physicians worked regular night shifts, 39.1% had abnormal defecation, and 46.8% had anxiety. Night shift work had no direct effect on abnormal defecation, but exerted influence via three indirect pathways, among which only the chain mediation pathway (night shift work → hindrance stress → anxiety → abnormal defecation) was statistically significant, with an effect size of 0.050 and total indirect effect of 0.142. Gender differences were found in mediation effects.

Conclusion

Night shift work indirectly increases the risk of abnormal defecation in clinical physicians through the chain mediating pathway of hindrance stress and anxiety, which is the core mechanism. This study provides evidence for medical institutions to optimize shift schedules and protect physicians' health.

Introduction

Night shift work is defined as a work schedule that includes no less than three working hours between 23:00 and 06:00. Due to the continuity of medical services, night shifts have become a prevalent work pattern for clinical physicians. Gastrointestinal secretion, intestinal peristalsis, defecation rhythm and intestinal immune function are all regulated by the human circadian rhythm. Disruption of circadian rhythms caused by night work can directly disturb normal gastrointestinal physiological activities(Alyami SH et al., 2025). According to the White Paper on the Professional Status of Chinese Physicians, more than 70% of clinical physicians in China work night shifts on average every six days; 76% of them have

less than four hours of rest during night duties, and nearly half fail to get sufficient sleep after night shifts. Accumulating epidemiological evidence has demonstrated that shift workers exhibit a higher incidence of irritable bowel syndrome (IBS) and chronic abdominal pain(Alsadah MA et al.,2021). Particularly, healthcare workers on rotating shifts have a markedly higher prevalence of IBS than day-shift staff(Cavanaugh MA et al.,2000). Additionally, gut microbiota imbalance induced by night shifts acts as a critical physiological trigger for the onset and progression of functional bowel symptoms(Clark AB et al.,2023).

Based on the Challenge-Hindrance Stressor Model, occupational stress can be classified into two categories. Challenge stressors are accompanied by professional development, while hindrance stressors, including role conflict, staffing shortages, clinical decision-making risks and organizational constraints, hinder goal attainment and deplete psychological resources, serving as core inducers of negative emotions(First MB.,2013;Folkman S.,2013). The high decision-making risks, understaffing and multiple role conflicts experienced by physicians during night shifts are typical hindrance stressors. Anxiety refers to a negative emotional state characterized by excessive tension, worry and autonomic hyperactivity. As a bidirectional neuroendocrine pathway connecting the brain and gastrointestinal tract, the brain-gut axis is the core mechanism linking psychological emotions to gastrointestinal function. Anxiety can aggravate visceral hypersensitivity and disrupt intestinal peristalsis via the brain-gut axis, ultimately leading to defecation disorders(Jin D et al.,2021;Kim HI er al.,2013). In the present study, abnormal defecation is defined as two major symptoms: constipation and diarrhea.

Existing studies on shift work and gastrointestinal health mainly focus on nursing populations, while empirical research targeting clinical physicians remains scarce. Furthermore, most relevant studies interpret the association from physiological perspectives such as circadian rhythm disturbance(Kim O et al.,2021) and gut microbiota dysbiosis(Konturek PC et al.,2011), and insufficient attention has been paid to psychosocial factors including different types of work stress and negative emotions. The complete mechanistic pathway underlying the relationship between night shift work and physicians' defecation problems has not been fully clarified. Therefore, this study adopts the Challenge-Hindrance Stressor Model to explore the associations and potential mechanisms among night shift work, hindrance stress, anxiety and abnormal defecation. The findings are expected to provide empirical evidence for healthcare institutions to optimize shift arrangements, develop targeted stress management and psychological interventions, and improve the occupational health of clinical physicians.

Night shift work and abnormal defecation

The correlation between shift work and gastrointestinal dysfunction has been well documented in previous research. In a cross-sectional study of 399 nurses in the United States, Nojkov et al.(Nojkov et al.,2020) found that nurses working rotating night shifts had a significantly higher prevalence of IBS than day-shift nurses, and this association was independent of sleep quality. This result indicates that circadian rhythm disruption is a key contributor to functional bowel diseases. Multiple systematic reviews have further confirmed a stable positive correlation between shift work and defecation

abnormalities such as constipation, diarrhea and IBS, and verified that night shift-induced gut dysbiosis can directly mediate the occurrence of functional bowel symptoms(Lazarus RS.,1984). Data released by the U.S. Centers for Disease Control and Prevention and the National Institute for Occupational Safety and Health (CDC/NIOSH) revealed that shift workers suffer from a higher burden of gastrointestinal symptoms including abdominal pain, diarrhea, constipation and dyspepsia than day workers. Notably, gastrointestinal discomfort can trigger psychological stress, which in turn exacerbates digestive problems and forms a vicious cycle. Current literature has identified three major pathways through which night shifts affect defecation: circadian rhythm disturbance, gut microbiota imbalance and psychological stress. Nevertheless, most existing investigations have targeted nurses. Research specifically focusing on clinical physicians and in-depth exploration of psychosocial mechanisms in this field are still limited.

Mediating effect of hindrance stress

Proposed by Cavanaugh et al.(Cavanaugh et al.,2000), the Challenge-Hindrance Stressor Model divides occupational stress into two types. Challenge stressors (e.g., heavy workload, time pressure) consume personal resources but facilitate the improvement of professional competencies. By contrast, hindrance stressors (e.g., role conflict, role ambiguity, organizational constraints) obstruct work progress and are strongly associated with psychological tension and physical discomfort(Lee EY.,2011). The decision-making risks, staff shortages and role conflicts encountered by physicians during night shifts are typical hindrance stressors. From a neurobiological perspective, occupational stress activates the hypothalamic-pituitary-adrenal (HPA) axis and corticotropin-releasing hormone (CRH) pathway, thereby interfering with intestinal peristalsis. Meanwhile, stress can increase visceral hypersensitivity through the brain-gut axis and trigger functional bowel disorders, which provides a solid theoretical basis for stress-related defecation abnormalities(Li Z et al.,2025;Liu Q et al.,2022). To date, empirical studies combining the Challenge-Hindrance Stressor Model with gastrointestinal health research are still inadequate. Most related studies adopt general perceived stress scales and fail to distinguish between challenge and hindrance stressors(Lu S et al.,2025;Ma T et al.,2018;Mazzola JJ er al.,2019). A systematic review by Alyami et al(Alyami SH et al., 2025). pointed out that only a small number of studies on gastrointestinal symptoms among shift workers have applied validated stress classification models. In a study conducted among Saudi nurses using this model, Alsadah et al(Alsadah MA et al.,2021). reported that elevated work stress was linked to a higher risk of gastrointestinal symptoms, proving that standardized stress classification models can more accurately reveal the relationship between stress and gastrointestinal health. On this basis, the present study selects clinical physicians as research subjects and employs the Challenge-Hindrance Stress Scale to examine the independent mediating effect of hindrance stress in the association between night shift work and abnormal defecation. The outcomes aim to offer theoretical support for healthcare organizations to carry out precise stress intervention strategies.

Mediating effect of anxiety

Anxiety is a negative emotional state accompanied by excessive worry, nervousness and autonomic arousal, and it acts as a vital psychological mediator between shift work and gastrointestinal dysfunction(Pennaneach C et al.,2021;Nojkov B et al.,2010). A body of studies has proven that shift work can induce anxiety and depression, and night shift workers generally report higher anxiety levels than their day-shift counterparts(Pindek S et al.,2024;Podsakoff NP et al.,2007). In a literature review, Sugaya et al.(Sugaya et al.,2024) demonstrated a significant correlation between shift work and IBS, and emphasized that anxiety is not only a common comorbidity of IBS but also a crucial psychological factor that aggravates gastrointestinal symptoms. Multiple epidemiological surveys have shown that night shift populations have a higher prevalence of IBS and functional dyspepsia, along with elevated scores on depression, anxiety and stress scales, which confirms the close linkage between anxiety and gastrointestinal symptoms(Rogers AE et al.,2021;Roman P et al.,2023). Among healthcare workers, night shift work, psychological stress and gastrointestinal symptoms interact intricately(Rotenstein LS et al.,2018;Saberi HR et al.,2010). Accordingly, anxiety can independently mediate the adverse impact of night shift work on physicians' defecation status.

Chain mediating effect of hindrance stress and anxiety

Hindrance stress serves as an important antecedent of anxiety. Individuals exposed to higher levels of hindrance stress tend to experience more severe anxious emotions. A meta-analysis by Podsakoff et al. (Podsakoff NP et al.,2007) indicated that hindrance stress is a stronger predictor of anxiety and nervous tension than challenge stress, and it is a major trigger of emotional problems in occupational populations. Another meta-analysis conducted by Mazzola and Disselhorst further verified that hindrance stress is positively correlated with anxiety and negatively associated with physical health(Saviano A et al.,2025). A longitudinal study by Pindek et al.(Pindek S et al.,2024) validated the pathway of "hindrance stress → emotional response → health outcomes", suggesting that hindrance stress can induce anxiety and subsequently lead to various health problems. These findings lay a theoretical foundation for exploring the health-related transmission pathways among clinical physicians(Skene DJ et al.,2018). As summarized above, both hindrance stress and anxiety can independently mediate the relationship between night shift work and abnormal defecation, and there exists a sequential association between the two variables(Sugaya N.,2024). Therefore, this study hypothesizes that hindrance stress and anxiety exert a chain mediating effect on the association between night shift work and abnormal defecation, with the specific pathway as follows:Night shift work → Hindrance stress → Anxiety → Abnormal defecation

Material and methods

Procedure and partcipants

From April to May 2026,Using the convenient sampling method, doctors from 17 second-and third-level hospitals in 9 provinces across the country were selected as research subjects. Included criteria:

Registered doctors who hold a medical practice qualification certificate and are engaged in clinical work; Informed consent and voluntary participation in this study. Exclusion criteria: Those who are on sick leave, maternity leave or personative leave for more than 1 month during the survey period; Those who go out to study or study during the survey period; Those who have been diagnosed with organic gastrointestinal diseases such as inflammatory bowel disease, irritable bowel syndrome, chronic constipation/chronic diarrhea. According to Kendall's multi-factor sample size estimation method, the sample size should be 5–10 times the number of independent variables, and more than 15 times better. Combined with the statistical requirements of chain intermediary Bootstrap analysis, the sample size of mediation effect analysis is recommended to be not less than 400 cases. In the end, a total of 447 questionnaires were included in this study.

Measures

General Information Questionnaire

Developed independently by researchers based on literature review and expert opinions, this questionnaire includes items such as age, gender, department of employment, educational background, years of work experience, average monthly income, requirement for night shifts, and average number of night shifts per month.

Challenge–Hindrance Stressor Scale (C-HSS)

The Chinese version of the Challenge-Hindrance Stress Scale, originally developed by Cavanaugh et al. (Cavanaugh MA et al.,2000) and revised by Zhang Yi et al.(Zhang Y et al.,2024), was employed in this study. The scale comprises two dimensions: challenge stress (6 items) and hindrance stress (5 items). Only the hindrance stress dimension was used to assess participants' perceived work stress over the past month. Each item was rated on a 5-point Likert scale (1 = no stress, 5 = extreme stress), with higher scores indicating greater hindrance stress. In the present study, the Cronbach's α coefficient for the hindrance stress dimension was 0.861.

Generalized Anxiety Scale (GAD-7)

The GAD-7 was employed to assess participants' emotional changes over the past two weeks. The scale consists of 7 anxiety-related items, each rated on a 4-point Likert scale. Total scores range from 0 to 21, with score ranges of 0–4, 5–9, 10–14, and 15–21 indicating no anxiety, mild anxiety, moderate anxiety, and severe anxiety symptoms, respectively. Higher scores reflect more severe anxiety. In the present study, the Cronbach's α coefficient for the GAD-7 was 0.956.

Bristol Stool Form Scale (BSFS)

The BSFS is the most widely used classification scale for stool consistency, comprising seven types ranging from hard stool to watery stool, scored from 1 to 7. The classification criteria are as follows:

Type 1 indicates hard, lumpy stool resembling nuts; Type 2 indicates sausage-shaped but lumpy stool; Type 3 indicates sausage-shaped stool with cracks on the surface; Type 4 indicates soft, smooth, sausage-like stool; Type 5 indicates soft blobs with clear edges; Type 6 indicates mushy stool; and Type 7 indicates watery stool with no solid pieces. Types 1 and 2 suggest constipation, Types 3 and 4 represent ideal stool forms (with Type 4 being the most ideal), and Types 5 to 7 indicate possible diarrhea. In the present study, bowel movements during the preceding week were assessed. Stool types 3 and 4 were categorized as normal defecation, while all other types were classified as abnormal defecation.

Data Analysis

Data were collected using the online survey platform Questionnaire Star. The research team contacted administrators at various hospitals, who then distributed the electronic questionnaire link to eligible physicians under their coordination. Each IP address was allowed to submit the questionnaire only once. After the survey, the researchers excluded questionnaires that clearly did not meet the inclusion criteria (e.g., completion time less than one minute, or identical responses to all items indicating straightlining). A total of 453 questionnaires were returned, of which 447 were deemed valid, yielding a valid response rate of 98.6%.

All data were processed and analyzed using SPSS version 29.0. Continuous variables that followed a normal distribution were expressed as mean ± standard deviation ($\bar{X} \pm S$). Categorical variables were described using frequencies and percentages.Common method bias was assessed using Harman's single-factor test. A variance explained by the first unrotated factor of less than 40% indicated the absence of significant common method bias. Pearson correlation analysis was performed to examine the bivariate relationships among the study variables. A serial mediation analysis was conducted using Model 6 in the PROCESS macro (version 5.0). The significance of the indirect effects was tested using the bootstrap method with 5,000 resamples, and 95% non-parametric percentile confidence intervals (95% CI) were calculated. An indirect effect was considered statistically significant if the 95% CI did not include zero. A two-tailed $P < 0.05$ was considered statistically significant.

Results

Common method bias test

The Harman single-factor test was used to examine common method bias. The results showed that there were four factors with eigenvalues greater than 1, and the variance explained by the first factor was 38.526%, which was below the critical threshold of 40%. This indicated that common method bias was not a significant concern among the measured variables in this study.

Univariate analysis of physicians' general characteristics and defecation abnormalities

Among the 447 physicians in this study, there were 290 males and 157 females; ages ranged as follows: ≤30 years (69),31–40 years (178),41–50 years (141), and ≥ 51 years (59); educational backgrounds included associate degrees or below (22), bachelor's degrees (274), and master's degrees or higher (151); years of work experience were < 5 years (68),5–15 years (192),16–29 years (138), and ≥ 30 years (49); departments of practice were internal medicine (94), surgery (185), obstetrics/gynecology or pediatrics (88), emergency/ICU (45), and other specialties (35); average monthly income was < 5,000 yuan (146),5,000–9,999 yuan (219), and ≥ 10,000 yuan (82); 332 physicians worked night shifts while 115 did not; average monthly night shift frequency was ≤ 4 times (177),5–7 times (184), and ≥ 8 times (86). Single-factor analysis of bowel movement abnormalities among all 447 physicians is presented in Table 1.

Table 1
Univariate analysis of abnormal bowel movements in physicians

Variables	Hindrance Stress Score($\bar{X} \pm S$)	Normal defecation [n (%)]	Constipation [n (%)]	Diarrhea [n (%)]	χ^2	P
sex					7.662	0.022
woman	13.54 ± 4.12	106(67.5)	14(8.9)	37(23.6)		
man	14.26 ± 4.65	166(57.2)	19(6.6)	105(36.2)		
Age(years)					3.253	0.776
≤ 30	13.97 ± 4.74	41(59.4)	5(7.2)	23(33.3)		
31–40	14.19 ± 4.20	109(61.2)	14(7.9)	55(30.9)		
41–50	13.62 ± 4.76	90(63.8)	11(7.8)	40(28.4)		
≥ 51	14.41 ± 4.32	32(54.2)	3(5.1)	24(40.7)		
academic degree					0.343	0.987
Associate degree or lower	14.64 ± 4.62	13(59.1)	2(9.1)	7(31.8)		
undergraduate degree	13.75 ± 4.48	165(60.2)	21(7.7)	88(60.2)		
Master's degree or higher	14.37 ± 4.46	94(62.3)	10(6.6)	47(31.1)		
Work experience (years)					4.732	0.580
<5	13.40 ± 4.18	42(61.8)	5(7.4)	21(30.9)		
5–15	14.46 ± 4.37	123(64.1)	10(5.2)	59(30.7)		
16–29	13.62 ± 4.94	77(55.8)	15(10.9)	46(33.3)		
≥ 30	14.16 ± 3.85	30(61.2)	3(6.1)	16(32.7)		
Working Department					2.078	0.979
Internal medicine	13.35 ± 8.80	62(66.0)	6(6.4)	26(27.7)		
Surgery	14.46 ± 4.48	107(57.8)	14(7.6)	64(34.6)		
Obstetrics and Gynecology/Pediatrics	13.39 ± 4.18	53(60.2)	7(8.0)	28(31.8)		
Emergency /ICU	14.60 ± 4.59	28(62.2)	3(6.7)	14(31.1)		

Variables	Hindrance Stress Score($\bar{X} \pm S$)	Normal defecation [n (%)]	Constipation [n (%)]	Diarrhea [n (%)]	χ^2	P
other	14.14 ± 3.99	22(62.9)	3(8.6)	10(28.6)		
Per capita monthly income (yuan)					0.915	0.922
<5000	14.05 ± 4.64	93(63.7)	11(7.5)	42(28.8)		
5000 ~ 9999	13.76 ± 4.28	130(59.4)	16(7.3)	73(33.3)		
≥ 10000	14.59 ± 4.69	49(59.8)	6(7.3)	27(32.9)		
Night shift duty (yes/no)					0.890	0.641
Yes	14.40 ± 4.52	206(62.0)	23(6.9)	103(31.0)		
No	12.86 ± 4.17	66(57.4)	10(8.7)	39(33.9)		
Average number of night shifts per month					7.260	0.123
≤ 4	13.40 ± 4.42	97(54.8)	15(8.5)	65(36.7)		
5–7	14.13 ± 4.29	125(67.9)	10(5.4)	49(26.6)		
≥ 8	14.99 ± 4.85	50(58.1)	8(9.3)	28(32.6)		

Scores regarding physicians' night shift work, abnormal bowel movements, and obstructive stress or anxiety.

A total of 332 physicians were assigned to night shifts, accounting for 74.3% of the total; 175 physicians reported abnormal bowel movements (39.1%), among which constipation accounted for only 7.3%. The predominant type of abnormal bowel movement was diarrhea (approximately 31.8%). The overall obstructive stress score among physicians was (14.00 ± 4.48) points, indicating a moderately high level. The anxiety score was (4.69 ± 5.04) points, with 209 physicians assessed as anxious, yielding an anxiety detection rate of 46.8%. Correlation analysis between physicians' night shifts, obstructive stress, anxiety, and bowel dysfunction, are shown in Table 2.

Table 2
Correlation coefficients between night shift work, obstructive stress, anxiety, and bowel dysfunction (n = 447)

Night job	Night job	Hindrance Stressor	Anxious	Abnormal defecation
	1.000			
Hindrance Stressor	0.150**	1.000		
Anxious	0.130**	0.442**	1.000	
Abnormal defecation	-0.042	0.119*	0.179**	1.000
$^{**}p<0.01;^{*}p<0.05$				

A chain mediation model of the impact of night work on abnormal defecation

The regression analysis results demonstrated that night work positively predicts hindrance stressor (B = 1.540, P < 0.01); hindrance stressor positively predicts anxiety (B = 0.487, P < 0.01); and anxiety positively predicts abnormal defecation (B = 0.066, P < 0.01)(Table 3).

Table 3
Regression analysis results of physicians' night work, hindrance stressor, anxiety, and abnormal defecation.

Outcome variable	Predictive variable	*β*	SE	t/Z	*P*
Hindrance Stressor	Night job	1.540	0.480	3.209	0.0014
Anxious	Night job	0.746	0.495	1.506	0.133
	Hindrance Stressor	0.487	0.048	10.077	<0.001
Abnormal defecation	Night job	-0.347	0.228	-1.526	0.127
	Hindrance Stressor	0.028	0.025	1.129	0.259
	Anxious	0.066	0.022	3.030	0.0024

The chain mediation effect test results demonstrated that obstructive stress and anxiety exhibit a full mediating effect between night shift work and bowel dysfunction, with a direct effect size of 0.142 (95% CI: -0.793 to 0.099). The indirect effects consist of three pathways: (1) night work → hindrance stressor → abnormal defecation (B = 0.043,95% CI: -0.019 to 0.138); (2) night work → anxiety →abnormal defecation (B = 0.049,95% CI: -0.005 to 0.135); (3) night work →hindrance stressor → anxiety →abnormal defecation (B = 0.050,95% CI: 0.015 to 0.109). are shown in Fig. 1 and Table 4.

Table 4
Chain-mediated mediation analysis of hindrance stressor and anxiety between night work and abnormal defecation.

Mediation Path	Effect Size	BootSE	Boot95% CI
Direct effect	-0.347	0.228	-0.793 ~ 0.099
Indirect effect	0.142	0.057	0.048 ~ 0.269
Pathway 1:night work → hindrance stressor → abnormal defecation	0.043	0.040	-0.019 ~ 0.138
Pathway 2:night work → anxiety → abnormal defecation	0.049	0.035	-0.005 ~ 0.135
Pathway 3:night work →hindrance stressor → anxiety →abnormal defecation	0.050	0.024	0.015 ~ 0.109

Subgroup analysis

The results of single-factor analysis show that gender is the influencing factor of abnormal defecation of doctors. The abnormal defecation rate of male doctors (42.8%) is higher than that of female doctors (32.5%), of which diarrhea is the main one. In order to further test the stability of the chain intermediary model among doctors of different genders, this study conducted a subgroup analysis of male doctors (n = 290) and female doctors (n = 157) respectively. The results suggest that the chain intermediary effect exists in both male and female doctors, but there is a certain difference in the amount of effect, which may be related to the small sample size of female doctors (n = 157), which leads to insufficient statistical efficacy(Table 5).

Table 5
Subgroup Analysis Results

Effect	Male physician(n = 290)			Female Physician(n = 157)		
	Effect Size	BootSE	Boot95% CI	Effect Size	BootSE	Boot95% CI
Direct effect	-0.346	0.280	-0.895 ~ 0.203	-0.335	0.398	-1.115 ~ 0.445
Indirect effect	0.129	0.070	0.021 ~ 0.305	0.125	0.121	-0.084 ~ 0.413
Pathway 1:night work → hindrance stressor → abnormal defecation	0.053	0.048	-0.012 ~ 0.192	-0.040	0.104	-0.309 ~ 0.124
Pathway 2:night work → anxiety → abnormal defecation	0.038	0.040	-0.022 ~ 0.144	0.082	0.083	-0.027 ~ 0.310
Pathway 3:night work→hindrance stressor→anxiety→abnormal defecation	0.038	0.027	0.003 ~ 0.116	0.083	0.053	0.011 ~ 0.230

Discussion

This study explored the relationship between night shift work and abnormal defecation among clinical physicians and further examined the chain mediating roles of hindrance stress and anxiety. Several noteworthy findings emerged.

First, nearly three-quarters of physicians in this study routinely worked night shifts, and almost half reported symptoms of anxiety(Sun Y.,2023). The prevalence of anxiety observed in our sample was comparable to that reported among healthcare professionals in previous studies, yet remained substantially higher than estimates reported for the general population(Voigt RM et al.,2019;Wang S.,2024). In addition, more than one-third of participants experienced abnormal defecation, with diarrhoea being considerably more prevalent than constipation. Physicians engaged in night shift work also reported higher levels of hindrance stress than day workers, and hindrance stress increased progressively with greater night-shift frequency(Xu M et al.,2023). Collectively, these findings suggest that night shift work may constitute an important occupational context contributing to psychological burden and gastrointestinal disturbances among physicians.

Second, our findings provide evidence supporting the sequential relationships among night shift work, hindrance stress, anxiety, and abnormal defecation. Correlation analyses demonstrated that night shift work was positively associated with both hindrance stress and anxiety, whereas hindrance stress and anxiety were positively associated with abnormal defecation. More importantly, mediation analyses indicated that night shift work did not exert a significant direct effect on abnormal defecation. Instead, its influence operated entirely through indirect pathways involving hindrance stress and anxiety. Among

these pathways, the sequential pathway of “night shift work → hindrance stress → anxiety → abnormal defecation” emerged as the principal mechanism, suggesting that gastrointestinal symptoms among physicians may arise primarily through a stress–emotion process rather than through night work exposure alone.

Gender subgroup analyses further revealed differences in the stability of the mediation model. Among male physicians, the complete chain mediating effect remained significant. Among female physicians, although the overall indirect effect did not reach statistical significance, the specific sequential pathway remained evident. Several explanations may account for this discrepancy. The relatively small number of female physicians in our sample may have limited statistical power to detect weaker overall indirect effects. In addition, the associations between anxiety and abnormal defecation appeared stronger among women, whereas the effect of hindrance stress on anxiety was comparatively attenuated, resulting in wider confidence intervals for the total indirect effect. Biological evidence also suggests that females may exhibit greater sensitivity of the brain–gut axis and enhanced emotional reactivity to stress. Nevertheless, these explanations remain speculative, and future studies involving larger female physician samples are required to determine whether the proposed model demonstrates gender invariance.

The observed chain mediation process can be understood within Lazarus and Folkman's cognitive appraisal theory of stress(Yang G et al.,2023). Night shift work exposes physicians to multiple occupational demands, including heightened diagnostic responsibility, staffing shortages, circadian rhythm disruption, and inadequate opportunities for recovery(Zhao Q et al.,2023). During primary appraisal, these demands may be interpreted as barriers that hinder effective goal attainment, thereby generating perceptions of hindrance stress. Subsequently, when available coping resources are perceived as insufficient to manage ongoing demands during secondary appraisal, negative emotional responses may emerge, eventually manifesting as anxiety. In this process, anxiety may function as the proximal psychological factor linking occupational stress to physiological dysfunction(Folkman S.,2013).

The brain–gut axis provides a plausible biological explanation for this association. As a bidirectional communication system connecting the central nervous system and the gastrointestinal tract, the brain–gut axis integrates neural, endocrine, immune, and microbial signalling pathways. Persistent anxiety may activate the hypothalamic–pituitary–adrenal axis and corticotropin-releasing hormone pathways, impair intestinal barrier integrity, alter gastrointestinal motility, and disrupt gut microbiota homeostasis. These changes may ultimately contribute to gastrointestinal manifestations, including diarrhoea and constipation. Our findings therefore support growing evidence that psychosocial stressors and emotional disturbances are closely intertwined with gastrointestinal functioning through neurobiological mechanisms(Zhong Y et al.,2025).

Compared with other healthcare professionals, physicians often shoulder substantial diagnostic responsibilities and face greater decision-making uncertainty. The potential consequences of clinical errors, together with intense workloads and limited recovery opportunities, may increase exposure to

hindrance stressors. Such occupational characteristics may facilitate the transition from stress perception to negative emotional responses and subsequently to somatic symptoms. This physician-specific context may partly explain the relatively high prevalence of anxiety and abnormal defecation observed in the present study(Zhang Y et al.,2024).

Interestingly, unlike previous studies among shift-working nurses that reported direct associations between night shifts and gastrointestinal disorders such as irritable bowel syndrome, our findings did not support a direct relationship between night shift work and abnormal defecation. One possible explanation is that previous studies often considered multiple physiological and psychological factors simultaneously without differentiating stressor types. By focusing specifically on hindrance stress, our study highlights the importance of psychosocial pathways through which night shift work may influence gastrointestinal health. Nevertheless, circadian rhythm disruption should not be overlooked. Night shift schedules frequently alter eating behaviours(Wang S.,2024) and daily routines(Zhang Y et al.,2024), leading to irregular meal timing and increased consumption of stimulants and energy-dense foods(Yang G et al.,2023), all of which may further exacerbate gastrointestinal dysfunction. Future studies incorporating behavioural and physiological indicators are warranted to clarify the relative contributions of these pathways.

The current findings also provide practical implications for occupational health interventions. Given that night shifts represent an unavoidable component of physicians' work arrangements, interventions targeting modifiable psychological processes may offer substantial benefits. At the organisational level, hospitals could optimise scheduling practices through flexible shift allocation, self-scheduling arrangements, and tiered staffing strategies while enhancing resource availability through decision-support systems, rapid-response backup mechanisms, and supportive facilities during night duty. Such measures may strengthen physicians' sense of control and organisational support, thereby reducing hindrance stress. At the individual level, evidence-based psychological interventions, including brief cognitive-behavioural approaches, mindfulness-based stress reduction programmes, and peer-support groups, may alleviate anxiety, particularly among physicians with frequent night shifts or elevated anxiety scores. Routine psychological screening may facilitate early identification of vulnerable individuals and interrupt the progression from stress to emotional distress. Finally, occupational health promotion efforts focusing on adequate post-shift recovery, sleep restoration, and nutritional guidance may simultaneously improve psychological well-being and gastrointestinal health.

Limitations

Several limitations should be acknowledged. First, participants were recruited using convenience sampling from secondary and tertiary hospitals in Hubei Province, which may limit the generalisability of the findings. Moreover, the cross-sectional design precludes conclusions regarding causality. Second, all variables were assessed using self-report questionnaires, rendering the findings susceptible to recall bias and social desirability bias. Third, this study focused primarily on psychological mechanisms and did not incorporate physiological pathways, including circadian rhythm alterations, gastrointestinal

motility, gut microbiota composition, or dietary behaviours. Finally, differences in night-shift intensity across clinical specialties and potential moderating influences of individual coping resources were not examined. Future multicentre longitudinal studies integrating objective measures such as sleep monitoring, faecal microbiota profiling, and cortisol assessment are warranted. Incorporating protective factors including social support, resilience, and coping styles may further refine the proposed model through moderated mediation approaches and enhance understanding of the boundary conditions underlying these associations.

Conclusion

This study demonstrated that routine night shift work among clinical physicians was not directly associated with abnormal defecation. Rather, night shift work increased the risk of abnormal defecation indirectly through a complete chain mediation pathway involving hindrance stress and anxiety. The transition from hindrance stress to anxiety appeared to represent the key mechanism underlying this process. From a theoretical perspective, this study is among the first to focus specifically on physicians and to construct a chain mediation model grounded in the Challenge–Hindrance Stressor Framework. By distinguishing the role of hindrance stress from broader occupational stress constructs, the findings extend current understanding of the psychosocial pathways linking work characteristics, emotional responses, and gastrointestinal health, while enriching the application of brain–gut axis theory in healthcare occupational health research. From a practical perspective, our findings identify several potential intervention targets for protecting physicians' gastrointestinal well-being. Healthcare organisations may reduce hindrance stress through scheduling optimisation and resource enhancement, alleviate anxiety through structured psychological support, and promote healthy behavioural routines related to sleep and nutrition. Together, these strategies may contribute to safeguarding physicians' physical and psychological health and provide empirical guidance for occupational health management and night-shift policy development.

Declarations

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Data availability

The data that support the fingdings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Author Contributions

Study design: WS, ZH, ZL. Data collection: WS, ZH, YG. Data analysis: WS, ZL. Study supervision: LZ. Manuscript writing: WS, ZH. Critical revisions for important intellectual content: LZ.

Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. There is no conflict of interest for the authors.

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Declarations Ethics approval and consent to participate

This study was approved by the Ethics Committee of Tongji Hospital affiliated with Tongji Medical College, Huazhong University of Science and Technology (Ethics Approval Number: TJ-IRB202401041). The research was conducted in accordance with the ethical principles set out in the Declaration of Helsinki. All human participants provided written informed consent. All questionnaires were completed anonymously, and participants' personal privacy was fully protected throughout the study.

Consent to Participate

All eligible human participants provided written informed consent prior to participation. All questionnaires were completed anonymously, and participants' personal privacy was fully protected throughout the study.

Consent for publication

Not applicable.

Clinical trial number

Not applicable.

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Figures

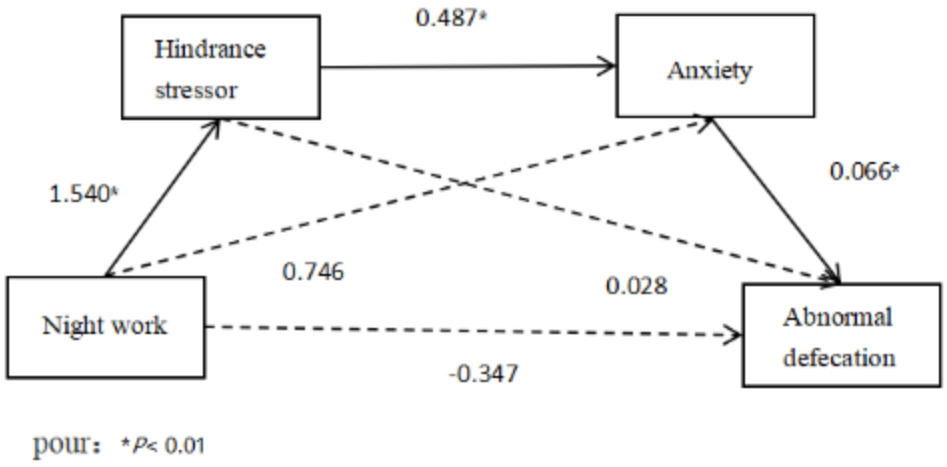


Figure 1

The chain-mediated mediation pathway between hindrance stressor, anxiety and abnormal defecation patterns in night work