

Anxiety Impairs Sleep Quality Through Executive Function: Evidence from Chinese Police Officers

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Abstract

Police officers face elevated risks of sleep disturbances due to occupational stress and trauma exposure. Although anxiety has been consistently linked to poor sleep quality, the cognitive mechanisms underlying this relationship remain underexplored. This study examined whether executive function mediates the relationship between anxiety and sleep quality among police officers, and whether depression serves as an alternative mediator. A cross-sectional survey was conducted among 278 police officers in China. Participants completed the Pittsburgh Sleep Quality Index (PSQI), Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS), and Adult Executive Functioning Inventory (ADEXI). Anxiety was significantly correlated with sleep quality ($r = .489, p < .01$), depression ($r = .712, p < .01$), and executive dysfunction ($r = .447, p < .01$). Hierarchical regression revealed that anxiety independently predicted sleep quality ($\beta = .367, p < .001$), while depression did not ($\beta = .059, p = .456$). Executive function explained an additional 2.0% of the variance in sleep quality beyond demographic and emotional factors ($\Delta R^2 = .020, p = .007$). Mediation analyses showed that executive function partially mediated the anxiety-sleep quality relationship (indirect effect = 0.027, 95% CI [0.006, 0.051]), accounting for 15.67% of the total effect. In contrast, depression did not mediate this relationship. Executive dysfunction is a significant cognitive pathway through which anxiety impairs sleep quality among police officers. Depression does not serve as a mediator, suggesting distinct mechanisms for anxiety and depression in affecting sleep. Interventions targeting both anxiety and executive function—such as cognitive training and mindfulness-based programs—may be more effective in improving sleep than addressing emotional symptoms alone.

Introduction

Police officers represent a professional group particularly susceptible to chronic stress due to the demanding nature of their job (Violanti et al., 2017). They are frequently exposed to traumatic events, work irregular shifts, and face high-stakes decision-making situations that activate their threat systems (Alves et al., 2023; Magnavita et al., 2018). These occupational stressors place officers at elevated risk for mental health difficulties, including anxiety, depression, and poor sleep quality (Jetelina et al., 2020; Syed et al., 2020; Tsehay et al., 2021).

Sleep disturbances are particularly prevalent among police officers. Research has shown that shift work, hypervigilance, and cumulative stress exposure contribute to clinically significant sleep problems in this population. The Meta-analysis showed that the prevalence of poor sleep quality among police officers was 51%, substantially higher than the general population (Garbarino et al., 2019). Poor sleep not only affects physical health and cognitive performance but also increases the risk of burnout, compassion fatigue, and suicidal ideation (Fan et al., 2024; Jetelina et al., 2020). Jetelina et al. (2020) found that 26% of police officers screened positive for mental health symptoms, yet only 17% sought help in the past year, highlighting a critical treatment gap.

Anxiety is a well-established predictor of sleep disturbances. The cognitive control framework suggests that anxiety weakens prefrontal top-down control over threat-related information (Bishop et al., 2004; Bishop, 2009). Individuals with anxiety exhibit greater error monitoring and conflict detection (Cavanagh et al., 2017; Tobias & Ito, 2021), which may render them hypervigilant to potential 'errors' such as inability to fall asleep, further exacerbating sleep difficulties. The hyperarousal model of insomnia posits that anxiety, characterized by excessive worry, rumination, and physiological activation, directly disrupts sleep onset and maintenance (Riemann et al., 2010). Police officers are exposed to stress event, anxiety symptoms are common (Acquadro Maran et al., 2015), with screening rates is 34% in past 2 weeks (Jetelina et al., 2020). However, the mechanisms linking anxiety to sleep quality in this population remain insufficiently understood.

Executive function is the ability to overcome conflicts to achieve intrinsic goals, including inhibitory control, working memory and cognitive flexibility (Cohen, 2017; Diamond, 2013). Executive function has been functionally impaired in a variety of psychological diseases (Basu et al., 2023; McTeague et al., 2017), including depression and anxiety (Warren et al., 2021; Yeung et al., 2021). Parra-Díaz et al. (2021) found that although bivariate analyses showed a significant correlation between depression and executive function, this association became non-significant after controlling for anxiety, suggesting that the effect of depression on executive function may be primarily explained by its comorbidity with anxiety.

Sen and Tai (2023) systematically reviewed the literature on sleep duration and executive function, concluding that sleep duration displays a quadratic (inverted U-shaped) relationship with executive function, with approximately 7 hours of sleep associated with optimal cognitive performance. Importantly, they also highlighted that sleep quality may be more relevant to long-term cognitive outcomes than absolute sleep duration alone. These findings suggest poor sleep impairs executive function, and impaired executive function may in turn disrupt sleep regulation. It remains unclear whether these relationships hold in high-occupational-stress populations, particularly police officers. Police officers face shift work, trauma exposure, and sustained hypervigilance (Alves et al., 2023; Violanti et al., 2017), factors that may exacerbate the associations among anxiety, sleep disturbance, and executive function.

Therefore, the present study aims to: (1) examine the relationships among anxiety, depression, executive function, and sleep quality in a sample of police officers; (2) test whether executive function mediates the relationship between anxiety and sleep quality; and (3) compare the mediating effects of executive function versus depression in the anxiety-sleep relationship. We hypothesize that executive function will significantly mediate the relationship between anxiety and sleep quality, whereas depression will not serve as a mediator.

Method

Participants

A cross-sectional survey was conducted among police officers in China. A total of 278 officers completed the survey. The sample consisted of 79 female officers (28.4%) and 199 male officers (71.6%), with a mean age of 30.20 years ($SD = 7.21$, range: 22–55).

Materials

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a 19-item self-report measure assessing sleep quality over the past month (Buysse et al., 1989). It yields a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality. Scores > 7 indicate clinically significant sleep problems. Cronbach's α in this sample = .83.

Self-Rating Anxiety Scale (SAS)

The SAS is a 20-item self-report measure of anxiety symptoms (Zung, 1971). Items are rated on a 4-point Likert scale. Raw scores are converted to standard scores (range: 25–100), with scores ≥ 50 indicating clinically significant anxiety. Cronbach's α in this sample = .89.

Self-Rating Depression Scale (SDS)

The SDS is a 20-item self-report measure of depressive symptoms (Zung, 1965). Items are rated on a 4-point Likert scale. Raw scores are converted to standard scores (range: 25–100), with scores ≥ 53 indicating clinically significant depression. Cronbach's α in this sample = .87.

Adult Executive Functioning Inventory (ADEXI)

The ADEXI is a 14-item self-report measure assessing everyday executive function difficulties, including working memory and inhibitory control. Items are rated on a 5-point Likert scale (1 = not at all true to 5 = very true), with higher scores indicating greater executive dysfunction. Cronbach's α in this sample = .85.

Procedure

Participants were recruited through police departments and completed the survey anonymously. Informed consent was obtained from all participants. Descriptive statistics and Pearson correlations were computed for all study variables. Hierarchical regression analysis was conducted to examine the incremental predictive power of each variable block on PSQI scores: Step 1 included demographic variables (gender, age), Step 2 added emotional variables (SAS, SDS), and Step 3 added executive function (ADEXI). Mediation analyses were conducted using PROCESS (Model 4) with 5,000 bootstrap resamples to test the indirect effects of SAS on PSQI via ADEXI and SDS. The significance of indirect effects was determined by 95% confidence intervals not containing zero.

Results

Descriptive Statistics

The sample consisted of 278 police officers (79 female, 28.4%; 199 male, 71.6%), with a mean age of 30.20 years ($SD = 7.21$, range: 22–55). Descriptive statistics for all study variables are presented in Table 1. The mean PSQI score was 7.60 ($SD = 3.37$), with scores ranging from 0 to 16. The mean SAS score was 42.00 ($SD = 9.46$), and the mean SDS score was 50.23 ($SD = 11.37$). The mean ADEXI score was 36.14 ($SD = 10.44$).

Table 1
Demographic characteristics and descriptive statistics of study variables (N = 278)

Characteristic	Category / Variable	M ± SD / n (%)	Min	Max
Demographics				
Gender	Female	79 (28.4%)	—	—
	Male	199 (71.6%)	—	—
Age (years)		30.20 ± 7.21	22	55
Study variables				
PSQI	Total score	7.60 ± 3.37	0	16
	PSQI > 7 (poor sleep)	124 (44.6%)	—	—
SAS	Standard score	42.00 ± 9.46	25.00	82.50
	SAS ≥ 50 (anxiety)	46 (16.5%)	—	—
SDS	Standard score	50.23 ± 11.37	25.00	83.75
	SDS ≥ 53 (depression)	98 (35.3%)	—	—
ADEXI	Total score	36.14 ± 10.44	14.00	70.00
Note: M = mean; SD = standard deviation; PSQI = Pittsburgh Sleep Quality Index; SAS = Self-Rating Anxiety Scale; SDS = Self-Rating Depression Scale; ADEXI = Adult Executive Functioning Inventory.				

Bivariate Correlations

Pearson correlation coefficients were calculated to examine the relationships among study variables (Table 2). PSQI scores were significantly positively correlated with SAS ($r = .489, p < .01$), SDS ($r = .407, p < .01$), and ADEXI ($r = .364, p < .01$). SAS and SDS were highly correlated ($r = .712, p < .01$), and both were significantly correlated with ADEXI ($r = .447$ and $.557$, respectively, $p < .01$). Age was weakly but significantly correlated with PSQI ($r = .145, p < .05$). Gender was not significantly associated with any of the study variables.

Table 2
Pearson correlation matrix among study variables (N = 278)

Variable	M	SD	1	2	3	4	5	6
1. PSQI	7.60	3.37	1					
2. Gender	1.72	0.45	.017	1				
3. Age	30.20	7.21	.145*	.048	1			
4. SAS	42.00	9.46	.489**	.106	.060	1		
5. SDS	50.23	11.37	.407**	.067	– .040	.712**	1	
6. ADEXI	36.14	10.44	.364**	.053	– .007	.447**	.557**	1

Note: M = mean; SD = standard deviation. PSQI = Pittsburgh Sleep Quality Index; SAS = Self-Rating Anxiety Scale; SDS = Self-Rating Depression Scale; ADEXI = Adult Executive Functioning Inventory. * $p < .05$. ** $p < .01$.

Hierarchical Regression Analysis

Hierarchical linear regression was conducted to examine the incremental predictive power of each variable block on PSQI scores. Results are summarized in Table 3. In Step 1, demographic variables (gender and age) explained only 2.1% of the variance in PSQI ($R^2 = .021$, $p = .053$). In Step 2, adding SAS and SDS significantly increased the explained variance ($\Delta R^2 = .243$, $p < .001$). SAS was a significant predictor ($\beta = .384$, $p < .001$), whereas SDS was not ($\beta = .142$, $p = .058$). In Step 3, adding ADEXI further increased the explained variance by 2.0% ($\Delta R^2 = .020$, $p = .007$), with ADEXI emerging as a significant predictor ($\beta = .170$, $p < .01$). The final model explained 28.4% of the variance in PSQI ($R^2 = .284$, $F(5, 272) = 21.539$, $p < .001$).

Table 3
Hierarchical Regression Analysis Predicting Sleep Quality (PSQI)

Predictor	Model 1	Model 2	Model 3
	<i>B</i> [95% CI]	<i>B</i> [95% CI]	<i>B</i> [95% CI]
Step 1			
Gender	0.075 [-0.802, 0.952]	-0.295 [-1.062, 0.472]	-0.307 [-1.066, 0.451]
Age	0.067* [0.013, 0.122]	0.060* [0.012, 0.109]	0.060* [0.012, 0.108]
Step 2			
SAS		0.137** [0.085, 0.189]	0.131** [0.079, 0.183]
SDS		0.042 [-0.001, 0.085]	0.018 [-0.029, 0.064]
Step 3			
ADEXI			0.055** [0.015, 0.094]
<i>R</i> ²	.021	.264	.284
ΔR^2	.021	.243***	.020**
<i>F</i>	2.961	24.462***	21.539***
ΔF	2.961	45.015***	7.514**

Note: N = 278. PSQI = Pittsburgh Sleep Quality Index; SAS = Self-Rating Anxiety Scale; SDS = Self-Rating Depression Scale; ADEXI = Adult Executive Functioning Inventory. Gender was coded as 1 = female, 2 = male. Unstandardized regression coefficients (*B*) are reported with 95% confidence intervals in brackets. **p* < .05. ***p* < .01. ****p* < .001.

Mediation Analysis

Mediation analyses were conducted using PROCESS (Model 4) with 5,000 bootstrap resamples to test whether ADEXI mediates the relationship between SAS and PSQI. Results are presented in Table 4. The total effect of SAS on PSQI was significant (*c* = 0.173, 95% CI [0.136, 0.210]). SAS significantly predicted ADEXI (*a* = 0.494, 95% CI [0.376, 0.612]), and ADEXI significantly predicted PSQI (*b* = 0.055, 95% CI [0.015, 0.094]), controlling for SAS. The indirect effect via ADEXI was 0.027 (95% CI [0.006, 0.051]), indicating a significant mediation effect. The direct effect of SAS on PSQI remained significant (*c'* = 0.131, 95% CI [0.079, 0.183]), suggesting partial mediation. The mediation effect accounted for 15.67% of the total effect.

In contrast, SDS did not mediate the SAS-PSQI relationship (indirect effect = 0.015, 95% CI [-0.026, 0.059]), as the confidence interval contained zero. Although SAS significantly predicted SDS (*a* = 0.862, *p* < .001), SDS did not significantly predict PSQI (*b* = 0.018, *p* = .456). These results suggest that depressive symptoms do not mediate the anxiety-sleep relationship in this model.

Table 4
Mediation analysis results

Path	Effect	SE	95% CI	<i>p</i>
SAS → ADEXI → PSQI				
Total effect (<i>c</i>)	0.173	0.019	[0.136, 0.210]	< .001
SAS → ADEXI (<i>a</i>)	0.494	0.060	[0.376, 0.612]	< .001
ADEXI → PSQI (<i>b</i>)	0.055	0.020	[0.015, 0.094]	.007
Direct effect (<i>c'</i>)	0.131	0.026	[0.079, 0.183]	< .001
Indirect effect (<i>ab</i>)	0.027	0.012	[0.006, 0.051]	.018
SAS → SDS → PSQI				
Indirect effect	0.015	0.022	[-0.026, 0.059]	.484
Note: CI = confidence interval (bias-corrected). Bootstrap resamples = 5,000. PSQI = Pittsburgh Sleep Quality Index; SAS = Self-Rating Anxiety Scale; SDS = Self-Rating Depression Scale; ADEXI = Adult Executive Functioning Inventory.				

Discussion

This study examined the mediating role of executive function in the relationship between anxiety and sleep quality among police officers. Our findings provide three key contributions to the literature.

Anxiety directly predicts poor sleep quality

First, we found that anxiety directly predicts poor sleep quality, consistent with the hyperarousal model (Riemann et al., 2010). This direct pathway may reflect the physiological and cognitive hyperarousal characteristic of anxiety, such as excessive worry, somatic tension, and difficulty disengaging from threat-related thoughts, all of which disrupt sleep initiation and maintenance.

This aligns with the cognitive control framework: anxiety can impair cognitive control function and reduce top-down control of PFC (Bishop et al., 2004; Bishop, 2009). This diminished control may extend to the management of sleep-related cognitive processes. Anxious individuals are more sensitive to both internal negative information (errors) and external negative information (negative feedback), reflected in the increment of post-error slowing (Rueppel et al., 2021) and larger ERN (error-related component) and FRN (negative feedback-related component) amplitude which means that anxiety is related to greater error monitoring and conflict detection (Cavanagh et al., 2017; Tobias & Ito, 2021), which may render them hypervigilant to potential "errors" such as inability to fall asleep, further exacerbating sleep difficulties.

Executive Function as a Cognitive Mediator

Second, we demonstrated that executive function partially mediates the anxiety-sleep quality relationship. This finding suggests that anxiety impairs sleep not only through direct arousal mechanisms but also indirectly by compromising executive function—particularly inhibitory control and working memory. Anxious individuals with poor executive function may struggle to suppress worry-related intrusions, engage in cognitive reappraisal of anxious thoughts, and maintain consistent sleep-related routines. These findings, combined with evidence that poor sleep quality in turn impairs executive function (Sen & Tai, 2023), suggest a potential vicious cycle in police officers: greater anxiety leads to worse executive function, which leads to poorer sleep, which further impairs executive function, which in turn exacerbates anxiety.

This finding suggests that interventions targeting executive function—such as working memory training, inhibitory control training, or mindfulness-based programs—may improve sleep quality among police officers beyond what would be expected from anxiety reduction alone (Navarrete et al., 2022). Given the barriers to mental health help-seeking in this population (Jetelina et al., 2020), cognitive-based interventions may be perceived as less stigmatizing than traditional psychotherapy.

The Non-Significant Role of Depression

Third, our findings clarify the distinct roles of anxiety and depression. Despite their strong correlation ($r = .712$), depression did not mediate the anxiety-sleep relationship. This pattern suggests that while anxiety and depression share substantial variance, their pathways to sleep impairment diverge: anxiety operates partly through executive function, whereas depression's effect on sleep may be more directly through anhedonia, fatigue, or circadian disruption rather than executive control processes.

This non-significant finding is theoretically important. It suggests that despite their phenomenological comorbidity, anxiety and depression have fundamentally different mechanisms in affecting sleep. The core feature of depression is impaired reward processing (anhedonia), with blunted reward responses in the ventral striatum (Halahakoon et al., 2020; Keren et al., 2018). In contrast, anxiety is characterized by heightened sensitivity to punishment and avoidance behavior (Pittig et al., 2018; Zorowitz et al., 2020). Anxiety is associated with higher punishment learning rates and greater punishment sensitivity (Katz et al., 2020; Pike & Robinson, 2022), which may render individuals hypervigilant to potential sleep-disrupting factors (e.g., environmental noise, physical discomfort). Depression's reward processing deficits may more directly affect daytime functioning and motivation rather than directly affecting sleep through cognitive control pathways.

Conclusion

In summary, this study identified executive function as a significant cognitive pathway through which anxiety impairs sleep quality among police officers. Depression did not mediate this relationship, suggesting distinct mechanisms for anxiety and depression. These findings highlight the importance of addressing cognitive function in interventions aimed at improving sleep and mental health in law

enforcement populations. Future research should employ longitudinal designs and objective measures to further elucidate these mechanisms and inform evidence-based occupational health policies.

Declarations

Ethical Approval: This study was approved by the Ethics Committee of Hunan Police Academy. All procedures performed were in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all individual participants included in the study.

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Availability of data and materials: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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