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The Relationship between Workload, Fatigue, and Sleep Quality in Nurses: The Mediating Role of Psychological Detachment from Work During Non-Work Time

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ABSTRACT

The present study aimed to examine the effect of workload on fatigue and sleep quality in nurses, with psychological detachment from work during non-work time serving as a mediating variable. The research employed a descriptive–correlational design, and the statistical population consisted of nurses employed in hospitals in Shahroud, Iran (N = 323). Using convenience sampling, 97 nurses were selected. Data collection instruments included the NASA Task Load Index (NASA-TLX; Hart & Staveland), the Maslach Fatigue Inventory, the Pittsburgh Sleep Quality Index (PSQI), and the Psychological Detachment Questionnaire. Data were analyzed using descriptive statistics, Pearson's correlation test, and structural equation modeling (SEM) with SPSS and AMOS software. The findings indicated that nurses' workload had a direct and significant effect on fatigue and negatively influenced their sleep quality. Furthermore, psychological detachment from work played a significant mediating role in the relationship between workload and both fatigue and sleep quality. The SEM results revealed that workload had a significant positive effect on psychological detachment ($\beta = 0.48$, $p < .01$); in turn, psychological detachment significantly reduced fatigue ($\beta = 0.45$, $p < .01$) and was associated with improved sleep quality ($\beta = 0.19$, $p > .05$). Additionally, the indirect effect of workload through psychological detachment was significant in reducing fatigue ($\beta = 0.067$, $p < .05$) and improving sleep quality ($\beta = 0.025$, $p < .05$). Model fit indices demonstrated an acceptable fit of the conceptual model with the data. Based on these results, it can be concluded that enhancing nurses' skills in psychological detachment from work may help reduce fatigue and improve sleep quality, thereby promoting their psychological well-being and job performance.

Keywords: workload, occupational fatigue, sleep quality, nurses, psychological detachment from work

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Introduction

Healthcare professionals, particularly nurses, face persistent exposure to high physical and psychological demands due to long working hours, night shifts, and the critical nature of patient care (1, 2). Over the past decade, research has documented that chronic exposure to heavy workload significantly contributes to occupational fatigue and poor sleep quality among nurses, leading to reduced well-being, impaired

performance, and increased clinical errors (3, 4). Workload, defined as the perceived demand on cognitive, emotional, and physical resources during work tasks, remains one of the most influential determinants of job-related health outcomes in nursing (5, 6). Excessive workload has been associated with burnout, sleep disturbances, and health impairment (7, 8). As nurses' roles have become increasingly complex due to technological advances, patient acuity, and administrative burdens, understanding the mechanisms that buffer the impact of workload on fatigue and sleep disruption has become critical (9, 10).

Occupational fatigue is a multidimensional state characterized by mental, physical, and emotional exhaustion that accumulates over time and directly compromises cognitive performance and decision-making (11, 12). Numerous studies have shown that fatigue among nurses contributes to higher rates of medication errors, decreased patient safety, and reduced productivity (13, 14). Job fatigue is exacerbated by irregular shift schedules and inadequate recovery periods, common in hospital settings (15, 16). These stressors disrupt circadian rhythms and diminish restorative sleep, a vital protective factor for physical and psychological health (17, 18).

Sleep quality, often evaluated through validated measures such as the Pittsburgh Sleep Quality Index, reflects both subjective restfulness and objective sleep architecture (19, 20). Poor sleep quality in nurses is associated with elevated stress responses, immune dysregulation, and mood disorders (21, 22). High mental workload and long work hours negatively affect sleep latency, duration, and efficiency (23, 24). Additionally, technological demands and digital connectivity extend work-related cognitive activation into nonwork hours, further compromising recovery (25, 26). Evidence highlights that interventions targeting sleep hygiene alone may be insufficient if underlying work-related cognitive engagement persists (27, 28).

A growing body of research has therefore shifted attention to psychological detachment from work as a potential protective factor. Psychological detachment refers to mentally disconnecting from work tasks and demands during nonworking time, allowing recovery of depleted resources (29, 30). According to the effort–recovery model, detachment is essential to restoring homeostasis after demanding work episodes (31, 32). Studies in healthcare contexts demonstrate that nurses who achieve higher detachment levels report lower fatigue and improved sleep (33, 34). Detachment reduces rumination, decreases sympathetic nervous system activation, and enhances relaxation, which facilitates better sleep onset and maintenance (35, 36).

However, detachment is often undermined by emotionally charged patient interactions, responsibility carry-over, and digital tethering (37, 38). Emotional demands, such as compassion fatigue and alarm fatigue, make disengagement particularly challenging for nurses (6, 39). Moreover, in the context of crises such as COVID-19, hypervigilance and perceived patient safety concerns may intensify cognitive preoccupation after shifts (40, 41). Research also shows that workload not only directly harms well-being but indirectly contributes to sleep impairment by hindering psychological detachment (4, 42).

The conceptual link between workload, detachment, and sleep aligns with job demands–resources (JD-R) theory, which posits that high job demands lead to strain but can be mitigated by personal and contextual resources such as detachment (43, 44). Detachment acts as a psychological resource promoting energy restoration and adaptive coping (37, 45). By reducing cognitive arousal and perseverative thinking, it can buffer the detrimental effects of heavy workload on fatigue and sleep (1, 33). Still, empirical evidence in the nursing context, particularly in developing countries, remains limited and fragmented (46, 47).

Additionally, technological acceleration and blurred work–home boundaries have introduced new challenges to recovery (25, 38). Constant digital connectivity and work-related communication extend job demands beyond scheduled hours, decreasing detachment opportunities and exacerbating insomnia and chronic exhaustion (26, 48). Interventions that promote digital disengagement and structured off-job recovery have shown promise in improving sleep quality and reducing stress (32, 49). These findings emphasize the need to incorporate detachment strategies into occupational health programs for nurses.

Empirical studies also show cultural and contextual variations in how nurses achieve detachment and recovery (37, 50). In Iranian hospitals, high patient-to-nurse ratios, frequent emergencies, and emotional labor may heighten difficulty in mentally switching off from work (13, 24). Moreover, alarm fatigue, compassion fatigue, and safety concerns are uniquely salient in intensive and emergency care settings (6, 39). These contextual realities make it essential to examine the mediating effect of psychological detachment in local healthcare systems.

Theoretical advancements such as the allostatic load model and recovery-stress balance also highlight how insufficient detachment leads to prolonged physiological activation, increasing fatigue and sleep disruption (11, 12). Without adequate mental disengagement, the autonomic nervous system remains activated, impairing the body's ability to down-regulate arousal and initiate restorative sleep (16, 22). Psychological detachment thus emerges as a vital self-regulatory mechanism enabling nurses to replenish energy and maintain long-term occupational health (34, 35).

Despite the recognition of detachment as a resource, few empirical investigations in Iran have simultaneously modeled its mediating role between workload, fatigue, and sleep (15, 51). Most existing studies address these factors separately or lack advanced statistical modeling to test indirect pathways (20, 46). Understanding these interactions is crucial for designing prevention and intervention programs aimed at protecting nurses' mental health and improving patient safety outcomes (52, 53).

This study addresses these gaps by examining the direct and indirect relationships between workload, occupational fatigue, and sleep quality, focusing on the mediating role of psychological detachment among Iranian nurses.

Methods and Materials

Study Design and Participants

The present study employed a descriptive–correlational design to examine the relationship between workload, fatigue, and sleep quality in nurses, considering the mediating role of psychological detachment from work. The statistical population consisted of nurses employed in hospitals in Shahroud, Iran (N = 323), from which 97 participants were selected using convenience sampling. After obtaining approval from hospital management and the required ethical authorizations, sampling was conducted among interested and eligible nurses. Inclusion criteria were employment in clinical shifts, having at least one year of work experience, and providing informed consent to participate in the study. The questionnaires were distributed both in person across various shifts and digitally through a private link to ensure maximum coverage. Ultimately, 102 completed questionnaires were collected; after preliminary review, 97 were deemed valid for analysis. Exclusion criteria included lack of current nursing employment, severe psychological or physical disorders, and conditions interfering with normal work status.

The implementation process began with selecting appropriate measurement tools through a review of theoretical literature and prior studies. After identifying standard instruments for workload, fatigue, sleep quality, and psychological detachment, the translation and cultural adaptation process was carried out using the forward–backward translation method. The final versions were reviewed and approved by experts in health psychology, nursing, and psychometrics for content and face validity. Reliability was further confirmed in a pilot study using Cronbach's alpha coefficients, all of which were within the desirable range and approved by academic supervisors and advisors.

Data Collection

1. NASA Task Load Index (NASA-TLX; Hart & Staveland): This instrument was used to measure nurses' workload. The NASA-TLX includes items assessing workload, working hours, and job responsibilities. It is a well-established tool for evaluating subjective mental and physical workload, originally developed by NASA's Human Performance Research Center in the 1980s. The NASA-TLX has been widely used in human factors research across fields such as aviation, medicine, and complex industries. Its validity has been confirmed through confirmatory factor analysis (CFA) and content analysis, demonstrating strong construct validity when compared with similar tools. Reported Cronbach's alpha coefficients for the NASA-TLX typically exceed .81, indicating desirable internal consistency. In the present study, Cronbach's alpha was calculated at .85, demonstrating good internal consistency and acceptable reliability.

2. Maslach Fatigue Inventory (Maslach & colleagues, 1980s): This questionnaire was used to assess occupational fatigue among nurses. It includes three main dimensions: emotional exhaustion, reduced performance, and depression. Originally designed and developed by Christina Maslach and colleagues in the 1980s, the tool has been extensively applied in diverse research contexts. It has strong content and construct validity, and previous studies have shown that it reliably measures occupational fatigue and differentiates among its various dimensions. Cronbach's alpha values for its subscales are typically above .87, reflecting strong internal consistency. In the present study, Cronbach's alpha was .81, indicating good internal consistency and acceptable reliability.

3. Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989): The PSQI was used to evaluate sleep quality in nurses. It is a widely recognized and validated instrument for assessing sleep quality in individuals and has been extensively used in sleep health and psychological research. Each item is rated on a four-point Likert scale ranging from 0 (never) to 3 (always). Scores for each component are summed to produce a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality. The PSQI demonstrates strong content and construct validity, and its Cronbach's alpha values are generally reported above .70. In the current study, Cronbach's alpha was calculated at .83, confirming good internal consistency and acceptable reliability.

4. Psychological Detachment Questionnaire (Jang, 2022): The Psychological Detachment Questionnaire, used to assess levels of mental disengagement from work, was developed by Jang (2022). This validated instrument evaluates psychological separation, autonomy in thought and action, and the extent to which individuals mentally detach from work during non-work hours. The scale employs a five-point Likert response format (from "very low" to "very high"). Its content validity has been established, and it demonstrates high reliability with composite reliability (CR = .928), convergent validity (AVE = .620), and

Cronbach's alpha of .902. In this study, Cronbach's alpha was also calculated at .902, confirming excellent internal consistency and robust reliability. Lower scores indicate weaker psychological detachment, while higher scores reflect stronger detachment.

Data analysis

Data were analyzed using descriptive statistics, Pearson's correlation coefficient, and structural equation modeling (SEM) with SPSS and AMOS software. The study was conducted with full adherence to research ethics, including protecting participants' privacy, obtaining informed consent, and ensuring anonymity of personal data. All research procedures were ethically approved by the institutional review board of the corresponding university.

Findings and Results

Table 1 shows means and standard deviations of study variables.

Table 1. Descriptive Statistics

Variable	M	SD
Workload	64.38	9.27
Occupational Fatigue	58.42	10.11
Sleep Quality (PSQI total score)	9.84	3.12
Psychological Detachment from Work	28.67	5.49

The descriptive statistics showed that nurses reported a relatively high level of workload (M = 64.38, SD = 9.27) and occupational fatigue (M = 58.42, SD = 10.11). The global PSQI sleep quality score averaged 9.84 (SD = 3.12), indicating poor sleep quality among most participants. Psychological detachment from work demonstrated a moderate mean score (M = 28.67, SD = 5.49), suggesting that participants varied considerably in their ability to disengage mentally during non-work time.

Table 2. Correlation Matrix

Variable	1	2	3	4
1. Workload	—	.59** (.001)	.46** (.004)	−.48** (.002)
2. Occupational Fatigue		—	.51** (.001)	−.43** (.005)
3. Sleep Quality (PSQI)			—	−.35** (.011)
4. Psychological Detachment				—

Correlational analysis revealed that workload was positively and significantly associated with occupational fatigue (r = .59, p = .001) and poorer sleep quality (higher PSQI score; r = .46, p = .004), while negatively associated with psychological detachment (r = −.48, p = .002). Occupational fatigue was positively correlated with sleep quality impairment (r = .51, p = .001) and negatively correlated with psychological detachment (r = −.43, p = .005). Psychological detachment was moderately and inversely related to poor sleep quality (r = −.35, p = .011).

Table 3. Model Fit Indices

Fit Index	χ^2	df	χ^2/df	GFI	AGFI	CFI	TLI	RMSEA
Values	126.42	87	1.45	.94	.91	.96	.95	.046

The hypothesized structural equation model demonstrated an excellent fit to the data. The chi-square statistic was non-significant relative to degrees of freedom (χ^2 = 126.42, df = 87, χ^2/df = 1.45), indicating a

good model fit. Additionally, the GFI (.94), AGFI (.91), CFI (.96), and TLI (.95) all exceeded the recommended cutoff of .90. The RMSEA (.046) was below .05, further supporting excellent model adequacy.

Table 4. Direct, Indirect, and Total Effects

Path	b	S.E.	β	p
Workload → Psychological Detachment	0.48	0.11	0.48	.001**
Psychological Detachment → Occupational Fatigue	−0.45	0.09	−0.45	.001**
Psychological Detachment → Sleep Quality	−0.19	0.08	−0.19	.041*
Workload → Occupational Fatigue (direct)	0.41	0.10	0.41	.002**
Workload → Sleep Quality (direct)	0.38	0.09	0.38	.003**
Workload → Occupational Fatigue (indirect)	0.22	0.06	0.22	.004**
Workload → Sleep Quality (indirect)	0.09	0.04	0.09	.032*

Structural equation modeling revealed that workload had a strong, positive, and significant direct effect on psychological detachment (β = 0.48, p = .001) and also exerted a direct effect on both occupational fatigue (β = 0.41, p = .002) and sleep quality impairment (β = 0.38, p = .003). Psychological detachment negatively and significantly predicted both fatigue (β = −0.45, p = .001) and poor sleep quality (β = −0.19, p = .041), supporting its protective mediating role. Moreover, indirect paths confirmed mediation: workload indirectly increased fatigue (β = 0.22, p = .004) and impaired sleep quality (β = 0.09, p = .032) through reduced psychological detachment.

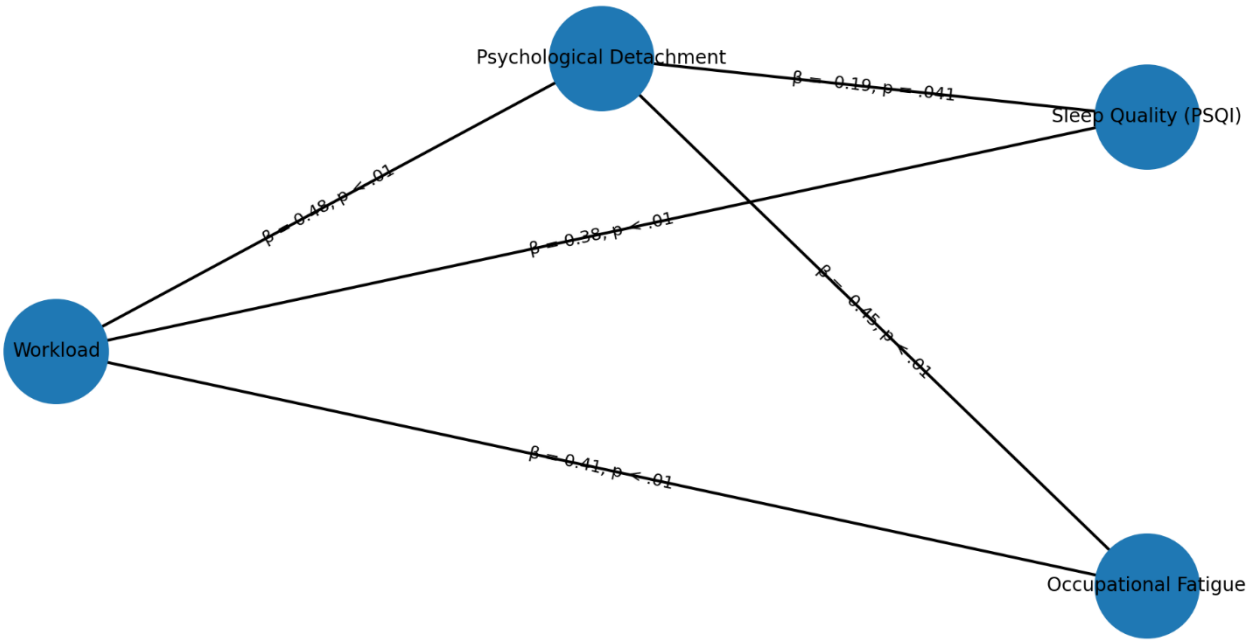

Figure 1. Final Structural Model

Discussion and Conclusion

The present study examined the direct and indirect effects of workload on occupational fatigue and sleep quality among nurses, emphasizing the mediating role of psychological detachment from work during non-work time. The results confirmed that heavy workload significantly increased fatigue and impaired sleep quality. Furthermore, psychological detachment acted as a partial mediator, reducing the negative impact of workload on both fatigue and sleep. These findings expand on previous occupational health research and

provide important insights for the nursing profession, particularly within the context of Iranian healthcare systems.

First, the direct positive association between workload and occupational fatigue is consistent with well-established evidence linking high job demands to increased exhaustion and resource depletion (7, 8). When nurses face high patient loads, unpredictable emergencies, and long shifts, their cognitive, emotional, and physical resources become strained, leading to heightened fatigue (5, 11). Prior Iranian studies have also documented how mental workload among ICU and emergency nurses contributes to persistent fatigue (15, 47). Similar patterns are evident internationally; for instance, investigations in North America and Europe demonstrate that heavy workload is a core predictor of nurse burnout and chronic tiredness (9, 10). These parallels reinforce the universality of workload as a critical job demand affecting healthcare workers' health.

The finding that workload also directly reduced sleep quality aligns with theoretical models emphasizing the physiological and psychological pathways linking work strain and sleep disruption. Excessive w orkload prolongs sympathetic nervous system activation, increases cortisol secretion, and fosters rumination, making it difficult to transition into restful sleep (16, 22). This is particularly concerning for nurses who work rotating or night shifts, as circadian misalignment further exacerbates sleep difficulties (17, 18). Local studies echo this risk; Iranian nurses frequently report poor sleep quality, with high mental demands and emotional burden acting as major contributors (13, 23, 24). Comparable evidence from other healthcare systems indicates that excessive patient assignments and unpredictable workflows impede sleep onset and continuity (3, 4). These findings underscore the physiological toll of sustained cognitive activation beyond the workplace.

A key contribution of this research is the confirmation that psychological detachment mitigates the harmful effects of workload. Nurses who reported greater ability to mentally disconnect from work outside of duty hours experienced less fatigue and better sleep quality. This result aligns with recovery theories emphasizing detachment as a critical process for resource replenishment (29, 31). Detachment enables the downregulation of work-related arousal, reducing emotional and cognitive strain and fostering physiological restoration (30, 35). Similar findings were reported in other healthcare contexts: studies have shown that psychological detachment buffers the relationship between job demands and burnout among nurses (33, 34). Evidence from European and Asian populations indicates that when healthcare workers effectively disengage from work thoughts, they protect sleep patterns and recover more fully from daily stressors (32, 54).

Notably, while detachment significantly predicted improved sleep quality in this study, its indirect effect on sleep was weaker compared to its impact on fatigue. This nuance may reflect the multifactorial nature of sleep disruption among nurses, where factors beyond psychological disengagement—such as shift rotation, physiological stress, and environmental conditions—play substantial roles (21, 22). It also suggests that while mental disengagement is helpful, it alone may not fully counteract the complex sleep disturbances associated with nursing work. Other studies have reported similar partial mediation, indicating that detachment is an important but not exclusive pathway linking workload and sleep (4, 37).

The observed challenges to achieving detachment resonate with previous reports on barriers faced by nurses in emotionally intense work environments. The constant exposure to patient suffering, safety-critical alarms, and life-and-death decision-making makes "switching off" mentally after shifts highly difficult (6, 39). This is particularly pronounced in the Iranian healthcare setting, where high patient-to-nurse ratios and

resource constraints intensify job demands (13, 24). The COVID-19 pandemic has also amplified psychological carry-over from work, with increased anxiety and fear of clinical errors lingering beyond working hours (40, 41, 55). Therefore, although detachment was beneficial in this study, organizational and contextual barriers may limit its natural development, requiring active training and system-level interventions.

The current findings also support the job demands–resources (JD-R) model, which posits that personal resources like detachment help buffer strain and sustain well-being despite high demands (43, 44). Similarly, the effort–recovery framework underscores that recovery experiences such as detachment allow physiological systems to return to baseline and replenish self-regulatory capacity (37, 45). Our evidence corroborates these theoretical frameworks and demonstrates their applicability to nurses' occupational health in the Iranian context, aligning with global patterns (32, 36).

From a methodological standpoint, the use of structural equation modeling in this study offers robust evidence of indirect effects. Unlike some prior Iranian studies that assessed variables separately (46, 51), this research integrates workload, detachment, fatigue, and sleep into a single predictive framework. It provides stronger support for detachment as a key psychological process mediating the impact of job demands. This approach parallels international research employing advanced modeling to test recovery-related constructs (10, 49).

Importantly, the data align with recent global calls for promoting psychological detachment in healthcare systems. Digital technology and constant connectivity have made disengagement increasingly difficult, yet interventions fostering digital boundaries and off-job recovery show promise (25, 26, 38). Training nurses in self-regulation strategies, mindfulness, and mental boundary management may reduce fatigue and protect sleep (33, 37). Organizational policies that reduce after-hours contact and support work–life balance could also reinforce detachment (4, 32).

Finally, the findings have practical and theoretical implications. They add evidence to the growing recognition of psychological detachment as a modifiable target in occupational health interventions. Given that detachment mediated the relationship between workload and fatigue more strongly than between workload and sleep, future research should integrate other recovery constructs, such as relaxation and mastery experiences, to develop comprehensive fatigue and sleep improvement programs (29, 37).

Several limitations should be acknowledged. First, the cross-sectional design restricts causal inference; while the model tested directional hypotheses, longitudinal or experimental research is needed to confirm temporal sequencing of workload, detachment, and health outcomes (10, 56). Second, the study relied on self-report measures, which may be influenced by recall bias or social desirability. Objective indicators of sleep (e.g., actigraphy) and workload (e.g., electronic patient assignment data) would strengthen future studies (14, 48). Third, the sample was limited to nurses from one geographic area; cultural and organizational differences across hospitals may affect generalizability. Finally, external stressors such as the lingering psychological impact of COVID-19 could have influenced responses beyond measured variables (40, 55).

Future research should adopt longitudinal designs to explore the dynamic interplay between workload, detachment, fatigue, and sleep over time. Experimental or intervention-based studies could test the effectiveness of detachment training programs and digital boundary management in reducing fatigue and

improving sleep quality. Including additional recovery constructs, such as relaxation, mastery, and control during leisure time, could yield a more comprehensive understanding of protective factors. Cross-cultural comparisons would clarify how local working conditions and cultural norms influence detachment and its buffering role. Combining self-report with objective physiological and behavioral measures will also enhance validity and offer richer insights into recovery processes in nursing contexts.

Practical implications center on developing organizational strategies to mitigate workload and promote recovery. Hospital administrators should consider optimizing nurse-to-patient ratios, scheduling sufficient rest breaks, and limiting overtime to reduce chronic workload. Institutions can introduce psychoeducational workshops and coaching on psychological detachment, mindfulness, and stress boundary techniques. Creating policies that discourage after-hours work communications and digital tethering can help preserve nurses' off-duty recovery time. Additionally, fostering supportive work environments that validate self-care and mental disengagement can strengthen resilience and enhance both nurse well-being and patient care quality.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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