



DYNAMICS OF MENTAL WORKLOAD AND OCCUPATIONAL STRESS IN THE HIGH-RISK PUBLIC HEALTHCARE SECTOR: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Mental health issues in the workplace are a fundamental priority in healthcare systems, particularly in high-risk environments characterized by complex operational demands and acute time pressures. Increased cognitive load, when exceeding individual thresholds, has consistently been identified as a major catalyst for work-related stress, which subsequently impairs the clinical performance of healthcare practitioner. This research is designed to rigorously evaluate the correlation between mental workload quantified through the NASA Task Load Index (NASA-TLX) instrument and job stress manifestations, anchored in the conceptual framework established by the National Institute for Occupational Safety and Health (NIOSH). The investigation focuses on high-risk public healthcare sectors to map the underlying psychosocial dynamics affecting the workforce. The synthesis of findings demonstrates a significant and positive correlation between mental workload and professional stress. Specifically, the dimensions of mental demand, temporal demand, and effort emerged as the predominant predictors of psychological strain. Furthermore, the analysis indicates that organizational variables, notably social support and job control, function as critical moderating factors that either attenuate or exacerbate the intensity of the relationship between cognitive demands and perceived stress. The study concludes that mental workload is a pivotal determinant of job stress among healthcare professionals within high-risk public service domains. Consequently, there is an imperative for interventions rooted in cognitive ergonomics and the reinforcement of organizational support systems. Such proactive measures are vital to mitigate psychosocial risks and sustain the overarching quality of healthcare delivery.

Keywords: cognitive ergonomics; job stress; mental workload; occupational health; psychosocial risk

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INTRODUCTION

The public healthcare sector is one of the most stressful work environments, as healthcare workers are required to provide fast, precise, safe, and patient-focused services in complex and dynamic situations (Ermakasumayanti et al., 2024). Over the past few decades, the concept of Occupational Safety and Health (OSH) has undergone a fundamental paradigm shift (Barahama et al., 2019). The conventional approach, which initially focused on mitigating physical hazards, has transformed into a more holistic perspective, emphasizing psychosocial factors as a crucial element (Souza et al., 2017). This evolution is driven by accumulating empirical evidence confirming that psychologically unfavorable work environments directly correlate with decreased productivity, the risk of workplace accidents, and the long-term degradation of worker health (Maulidya et al., 2023). This phenomenon appears particularly relevant in the public healthcare sector, where the nature of the work demands high precision, accelerated decision-making, and direct responsibility for human life.

High service demands, limited human resources, administrative burdens, and high-risk working conditions make healthcare workers vulnerable to mental workload and occupational stress. This condition is a serious issue because it not only impacts the physical and psychological health of healthcare workers but also impacts the quality of care, patient safety, work productivity, and the sustainability of the public healthcare system as a whole (Destin et al., 2023).

Mental workload arises when work demands exceed an individual's capacity to process information, make decisions, and maintain concentration for extended periods. In the public healthcare sector, this condition often occurs due to high patient volumes, case complexity, time pressure, the need for rapid decision-making, and significant professional responsibility (Sare et al., 2021). Healthcare workers in high-risk units such as emergency departments, intensive care units, infectious disease isolation rooms, operating rooms, and community emergency services face greater psychological stress than other work sectors (Setiawan et al., 2021). This situation is exacerbated by shift work systems, lack of rest periods, role conflict, and limited healthcare facilities.

Prolonged work stress can lead to various negative impacts, such as emotional exhaustion, burnout, decreased work motivation, mental health disorders, increased absenteeism, and healthcare worker turnover. In the context of public healthcare, work stress also has the potential to increase the risk of medical errors, reduce the quality of therapeutic communication, and hinder the effectiveness of services to the public (Turgeman et al., 2020). This situation demonstrates that the problems of mental workload and work stress are not merely individual issues, but have evolved into organizational challenges and global occupational health issues that require serious attention (Jamaluddin & Nurwana, 2023).

The phenomenon of increasing work pressure among healthcare workers has become increasingly apparent since the COVID-19 pandemic (Dorman, 2022). The pandemic has provided a stark illustration of the high vulnerability of healthcare workers to psychological stress due to the surge in patients, the high risk of disease exposure, limited personal protective equipment, and the uncertainty of the work environment (Baral et al., 2021). Although the pandemic has subsided, various studies have shown that the psychological impact and high work pressure in the healthcare sector persist, particularly in public healthcare facilities with limited resources. This indicates that the dynamics of mental workload and work stress among healthcare workers are complex, multidimensional, and ongoing (Schaffler et al., 2022).

Various previous studies have addressed the relationship between mental workload and work stress among healthcare workers, but the results are scattered across different service contexts, professions, and work unit characteristics. Furthermore, findings vary regarding the dominant factors influencing the emergence of work stress, healthcare workers' adaptation mechanisms, and its impact on service performance. Therefore, a systematic literature review is needed to identify, analyze, and synthesize various research findings related to the dynamics of mental workload and occupational stress in the high-risk public healthcare sector (Cooney et al., 2022).

The purpose of this systematic literature review is to provide a comprehensive overview of the causal factors, manifestations, impacts, and management strategies for mental workload and occupational stress among healthcare workers in the public healthcare sector. The results of this study are also expected to form the basis for developing occupational health policies, human resource management strategies, and promotive and preventive interventions to improve the welfare of health workers and the quality of public health services.

METHOD

This study adopted a Systematic Literature Review (SLR) design, adhering to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol. The use of these guidelines aims to ensure transparency and systematization at every stage of literature identification, selection, and synthesis (Page et al., 2021). The SLR method was chosen based on its ability to provide a more credible level of evidence than narrative reviews, while also facilitating replicability for future researchers. A comprehensive literature search was conducted through three reputable academic databases: Google Scholar, PubMed, and ScienceDirect. These three platforms were chosen for their broad reference coverage and relevance to the field of occupational safety and health (OHS). To maintain data freshness, particularly in capturing the dynamics of changing healthcare worker workloads post-COVID-19 pandemic, the publication window was strictly limited to 2020 and 2025.

In the initial search phase, 162 articles were identified: 92 articles from Google Scholar, 38 from PubMed, and 32 from ScienceDirect. An initial elimination phase was conducted to remove duplicate entries between databases, identifying 24 articles with duplicate indexes. After the data cleaning process, 138 unique articles were identified and ready to proceed to the screening phase. The screening phase involved evaluating titles and abstracts to ensure the literature's relevance to the study's focus. Seventy-eight articles were excluded because they did not meet conceptual relevance criteria, such as not using the NASA-TLX instrument or the NIOSH model, not using occupational stress as a primary variable, or using populations outside the healthcare sector. This step was crucial for refining the dataset to align with the research objectives.

Next, a full-text review of the remaining 60 articles was conducted. An in-depth evaluation was conducted, focusing on methodology, instrument validity, and completeness of data reporting. As a result, 48 articles were excluded due to specific methodological constraints: 21 studies did not use validated instruments, 15 studies did not employ a quantitative cross-sectional design, and 12 articles were not available through open access. Based on this selection process, 12 final articles that met all inclusion criteria were selected for the final synthesis stage. The quality of each selected article was assessed using the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines to ensure adequate methodological validity (von Elm et al., 2007). Extracted data included population profiles, applied instruments, and key statistical parameters such as p-values and correlation coefficients. Finally, the synthesis process was conducted narratively and analytically, emphasizing mapping patterns of relationships between the studied variables.

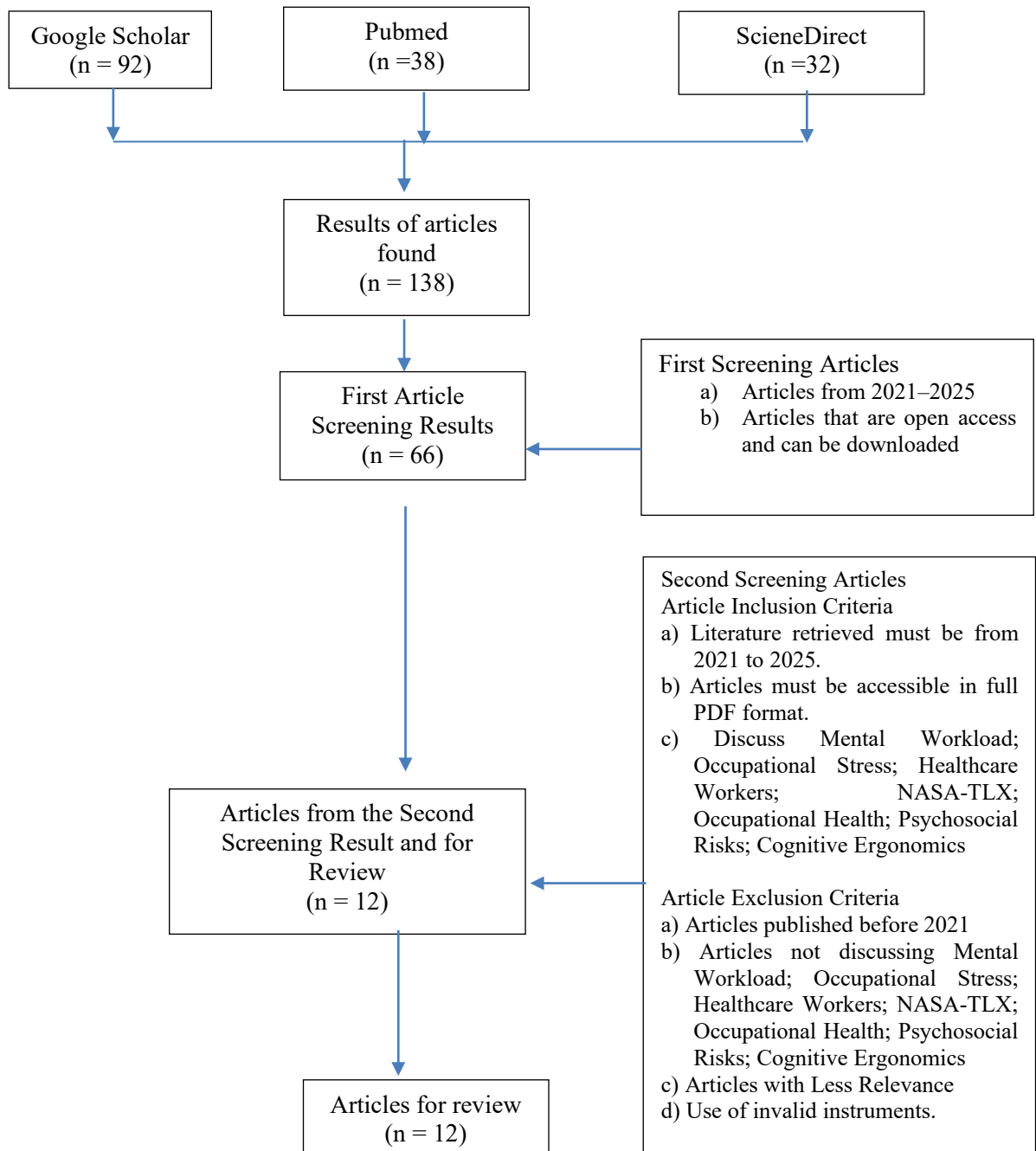


Figure 1. PRISMA

RESULT

This study conducted an in-depth analysis of 12 studies that met the inclusion criteria, all of which consistently adopted a cross-sectional research design. The population profile in these studies was dominated by healthcare professionals, including nurses, doctors, and civil servants (ASN) working in public service units. In operationalizing the research variables, the majority of studies relied on the NASA-TLX instrument to measure workload, while the NIOSH theoretical framework was applied to identify various stressors in the workplace. The data synthesis revealed a linear finding, with all studies reporting a significant correlation between workload and job stress levels ($p < 0.05$). This finding reflects the consistent relationship between these variables, regardless of differences in geographic context and population characteristics. Furthermore, several studies recorded correlation coefficients ranging from moderate to strong. This confirms the role of workload as a substantial predictor of job stress in healthcare workers (Ahmed et al., 2021; Rahman et al., 2023).

Table 1.
Characteristics of Analysis Results

No.	Author	Population	Instrument	Design	Statistic Result	Implication
1	Alhasan et al. (2021)	ICU nurse	NASA-TLX	Cross-sectional	p=0.001	The high mental workload in the ICU demands cognitive ergonomics-based interventions, particularly in managing critical taskloads and reducing high-risk multitasking.
2	Ahmed et al. (2021)	Nurse	NASA-TLX	Cross-sectional	r=0.58	Moderate correlations indicate the need for task-based workload management to prevent the accumulation of chronic stress.
3	Zhang et al. (2022)	Doctor	NIOSH	Cross-sectional	p<0.01	Occupational stress is influenced by an imbalance of demands and control, therefore, increasing job control is a primary mitigation strategy.
4	Lee et al. (2022)	Medical personnel	NIOSH	Cross-sectional	p=0.02	Organizational support has been shown to act as a protective factor, so strengthening leadership and supervision is essential.
5	Hassan et al. (2022)	Nurse	NASA-TLX	Cross-sectional	p=0.004	High temporal demands necessitate optimization of shift systems and rest periods to reduce time pressure.
6	Rahman et al. (2023)	Hospital Staff	NASA-TLX	Cross-sectional	r=0.66	The strong correlation suggests the need for structural interventions, such as job redesign, to reduce cognitive load..
7	Nguyen et al. (2023)	Healthcare Workers	NASA-TLX	Cross-sectional	r=0.61	Mental workload contributes significantly to stress, making coping and resilience training essential.
8	Putri et al. (2023)	Healthcare Civil Servants	NASA-TLX	Cross-sectional	p=0.003	Bureaucratic work environments require increased work flexibility to reduce administrative pressure.
9	Silva et al. (2021)	Doctors	NIOSH	Cross-sectional	p<0.05	Job stress is related to task design, necessitating workload adjustments based on individual capacity.
10	Gómez-Urquiza et al. (2020)	Healthcare Workers	NASA-TLX	Cross-sectional	r=0.62	The high rate of burnout underscores the need for organization-based mental health programs.
11	Widodo et al. (2024)	Healthcare Civil Servants	NIOSH	Cross-sectional	p=0.002	Organizational factors are dominant, making institutional policy intervention crucial..
12	Kurniawati et al. (2024)	Quarantine officer	NASA-TLX	Cross-sectional	p=0.001	High-risk work environments require adaptive SOPs and work systems responsive to time pressure

DISCUSSION

Based on table 1, the analysis shows that all reviewed studies used a cross-sectional design. Therefore, the majority of studies focused on identifying the relationship between mental workload and job stress over a specific time period without assessing the causal relationship longitudinally. The study population encompassed various healthcare worker groups in high-risk public service sectors, including nurses, doctors, medical personnel, hospital staff, civil servants (ASN) health workers, quarantine officers, and intensive care unit (ICU) nurses. This population variation indicates that mental workload and job stress are cross-professional phenomena and occur across various healthcare sectors. The most widely used measurement instrument was the National Aeronautics and Space Administration Task Load Index (NASA-TLX), used in eight studies, while the other four studies used the National Institute for Occupational Safety and Health (NIOSH) instrument. The predominant use of the NASA-TLX indicates that mental workload is primarily analyzed through the dimensions of cognitive demand, temporal demand, mental effort,

performance, and individual frustration levels in carrying out their work.

Based on the statistical results, most studies demonstrated a statistically significant relationship between mental workload and job stress. Research by Alhasan et al. (2021), Hassan et al. (2022), Putri et al. (2023), Widodo et al. (2024), and Kurniawati et al. (2024) showed strong significance ($p=0.001-0.004$), indicating that high job demands significantly contribute to increased psychological distress among healthcare workers. Furthermore, research by Zhang et al. (2022), Lee et al. (2022), and Silva et al. (2021) also showed a significant relationship ($p<0.05$), strengthening evidence that organizational factors, job control, and task design play a significant role in the formation of work stress.

Correlational findings also indicate a fairly strong relationship between mental workload and work stress. Ahmed et al. (2021) obtained a correlation value of $r=0.58$, indicating a moderate relationship, while Rahma et al. (2023), Nguyen et al. (2023), and Gómez-Urquiza et al. (2020) showed a stronger correlation ($r=0.61-0.66$). These results indicate that increased mental workload tends to be accompanied by increased levels of work stress in healthcare workers. The more complex the cognitive demands and operational pressures faced by individuals, the higher the potential for psychological exhaustion and impaired work well-being.

The findings in this study confirm that workload is a primary determinant factor triggering the manifestation of work stress in the public healthcare sector. The mental demand dimension reflects the intensity of the cognitive load healthcare workers must accommodate, particularly related to accelerated decision-making processes and complex information processing. Simultaneously, the temporal demand dimension indicates significant time pressure, which in turn can hinder an individual's functional capacity to process information optimally (Dabas & Tuli, 2025). When viewed through the NIOSH model framework, work stress is understood as a consequence of the discrepancy between professional demands and available resources. The results of this analysis indicate that organizational variables, such as low job control and minimal social support, play a role in strengthening the correlation between workload and work stress. This phenomenon emphasizes that strategic interventions cannot simply rely on reducing workloads, but must also address the aspect of strengthening individual adaptive capacity through more systematic organizational support (Muhadi & Wahyuni, 2021).

From a physiological perspective, continuous exposure to intense workloads can trigger sustained activation of the autonomic nervous system. This condition risks causing cognitive fatigue and emotional dysregulation in the workforce (Chakraborty et al., 2022). In the long term, the persistence of these conditions has the potential to transform into chronic health disorders that directly degrade productivity and occupational safety standards in healthcare settings (AHRQ, 2021). In terms of implications, the majority of studies emphasize the importance of organizational approaches and work ergonomics as mitigation strategies. Recommended interventions include managing task distribution, optimizing shift systems, strengthening organizational support, increasing job control, developing institution-based mental health programs, training in coping strategies and resilience, and job redesign to reduce cognitive load. Furthermore, high-risk healthcare settings such as ICUs and quarantine personnel should be considered requires a more adaptive work system, responsive to time pressures, and supported by operational procedures capable of minimizing the accumulation of work stress. Overall, the synthesis results indicate that the dynamics of mental workload and work stress in the high-risk public healthcare sector are influenced by a complex interaction between individual factors, job demands, organizational design, and the work environment. These findings emphasize that efforts to manage the occupational health of healthcare workers cannot focus solely on individuals but also require systemic interventions and organizational policies oriented towards protecting the psychological health of healthcare workers.

CONCLUSION

The synthesis of this review confirms that workload significantly correlates with the manifestation of occupational stress in public healthcare settings. These findings highlight that cognitive demands and intense time pressure act as key determinants escalating this relationship. Therefore, a more comprehensive transformation of Occupational Safety and Health (OHS) management strategies is needed. This effort must integrate cognitive ergonomic principles with ongoing mitigation of psychosocial factors. Preventive measures that can be taken include restructuring workflows to minimize overload and strengthening organizational support systems.

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