

Scoping Review: Analysis of Occupational Stress Levels and Their Associated Factors Among Firefighters

Febyona Jolest Puteri^{1*}, Dadan Erwandi²

¹Magister program in Occupational Health and Safety, Faculty of Public Health, University of Indonesia

²Departemen of Occupational Health and Safety, Faculty of Public Health, University of Indonesia

*E-mail : febyona.jolest@ui.ac.id

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Abstract

Firefighting is a high-stress occupation due to exposure to situations involving extinguishing fires, saving lives, and protecting the property of people affected by fire incidents. The aim of this study was to identify stress-related factors and association in firefighters. A systematic review following the PRISMA 2020 V1 statement was carried out in the Science Direct and Google Scholar databases. The literature search was conducted in April 2025. A total of 12 studies were included in this review. Based on the result and discussion, burnout in firefighters happens because of a mix of different factors such as mental pressure, personal background, behavior, and workplace conditions. When firefighters face heavy workloads, frequent emergencies, poor sleep, and lack healthy ways to handle stress, it can lead to serious mental health problems. A bad work environment only makes things worse. These issues not only affect their personal well-being but also reduce their job performance and put safety at risk. Therefore, it is recommended that fire departments and related institutions implement comprehensive strategies to address these risks. In addition, interventions such as stress management training, regular health screenings, and improvements in the work environment should be prioritized to reduce burnout and enhance the quality of life and performance among firefighters.

INTRODUCTION

Firefighting is a profession that demands both physical and mental readiness to handle high-risk emergency situations. Their duties include extinguishing fires, rescuing victims, providing first aid, and conducting fire prevention and education. The unpredictable and intense nature of their work can lead to significant occupational stress. Therefore, this study aims to analyze the levels of work-related stress among firefighters and identify its contributing factors. The findings are expected to serve as a foundation for improving psychological well-being and workplace safety through appropriate policies and support programs.

Firefighters are required to be on duty 24 hours a day. Although a shift work system has been implemented, in emergency situations such as fires, off-duty personnel must still be ready to be called in at any time. The increased occurrence and severity of worldwide disasters, exacerbated by the impact of

climate change, pose significant challenges to emergency management, calling for novel and more effective Disaster Risk Reduction (DRR) approaches. Despite the phenomenological differences of diverse hazards and the heterogeneity of local policies and governance structures, effective communication systems are needed to better manage the available resources in all phases of the emergency management cycle, especially in the case of cross-border events (Urbanelli et al., 2024). Fire and rescue personnel play a very important role in society. They carry out various emergency tasks that must be performed swiftly. Fire and rescue officers hold roles and responsibilities that make theirs one of the high-risk professions. They are directly involved in fire suppression activities, saving human and animal lives, and minimizing material or property losses for communities affected by fires or those in need of assistance (Azanella & Hardiyanto, 2022).

Publication titled, "Workplace Stress: a collective challenge" notes that work-related stress

occurs when the demands of the job do not match or exceed the capabilities, resources, or needs of the worker, or when the knowledge or abilities of an individual worker or group to cope are not matched with the expectations of the culture of an enterprise. Stress can manifest itself in numerous ways - from feeling ill in the morning to much more serious health-related impairments, such as cardiovascular disease, burnout, depression and anxiety and suicide (ILO, 2016). According to the global estimates published by the International Labour Organization (ILO), 2.78 million workers lose their lives each year in work-related accidents and diseases, of which 2.4 million due to work-related diseases alone, a number that far exceeds the number of fatal occupational accidents. These estimates also show that more than 160 million workers become ill each year due to risks at work (ILO, 2024).

Firefighting is a high-stress occupation due to exposure to situations involving extinguishing fires, saving lives, and protecting the property of people affected by fire incidents. Therefore, firefighters are required to perform their duties effectively (Nurrahmi, 2018). Firefighters bear significant duties and responsibilities in extinguishing fires, saving lives, and protecting property. They are also required to remain constantly alert while performing their tasks, given that fire incidents are often unpredictable and that they are also involved in emergency rescue efforts beyond firefighting. Research findings indicate that 39.1% of firefighters experience a high level of work-related stress (Olivia et al., 2022).

Occupational stress is defined as stress arising from exposure to various risk factors in the workplace, whether physical or psychological in nature. It can be identified once symptoms manifest, and there are several approaches to detect stress. One widely used method is through interviews with workers or by administering standardized questionnaires such as the Depression Anxiety Stress Scale (DASS-42), which is well-known and commonly employed (Kurniawidjaja & Ramdan, 2019). Stress levels can be assessed using either standardized or customized questionnaires, depending on the objectives and needs of the study. In the study conducted by (Izza & Martiana, 2023), the Job Stress Scale (JSS) was used to measure occupational stress, the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, and the Industrial Fatigue Research Committee (IFRC) questionnaire to evaluate work fatigue among firefighters. Mental workload and stress levels were measured using the National Aeronautics

and Space Administration Task Load Index (NASA-TLX) (Basumerda et al., 2024), which includes two stages: paired comparison and event scoring (Pradhana & Suliantoro, 2018). Other tools such as reaction timers (to assess fatigue) and pulse meters (to measure oxygen saturation) were also used in analyzing fatigue among firefighters (Dengo et al., 2023). Occupational stress risk factors among firefighters have also been assessed using the DASS-21, NASA-TLX for mental workload, and the National Institute for Occupational Safety and Health (NIOSH) questionnaire to evaluate interpersonal relationships in the workplace (Sianturi et al., 2021). Additionally, standardized instruments such as the Perceived Stress Scale (PSS) have been utilized to measure occupational stress (Najmi et al., 2024).

In this context, protecting firefighters from work-related stress in the workplace also known as Occupational Safety and Health (OSH) is essential. The Regulation of the Minister of Manpower of the Republic of Indonesia Number 5 of 2018 concerning Occupational Safety and Health (OSH) in the Work Environment regulates work-related stress as part of psychological factors in OSH. This regulation emphasizes the importance of addressing workplace stress and includes various factors that may contribute to stress, such as workload, interpersonal relationships, and lack of participation in decision-making.

The ILO Occupational Safety and Health Convention (No. 155) and Recommendation (No. 164) provides legal frameworks to protect the health and safety of workers. However, the WHO Mental Health Atlas found that only 35% of countries reported having national programmes for work-related mental health promotion and prevention (WHO, 2022). The study of *Analysis of Occupational Stress Levels and Their Associated Factors Among Firefighters* is crucial because firefighting is a high-risk profession with significant psychological pressure. Firefighters are frequently exposed to emergency situations, physical hazards, and a heavy responsibility for others' safety, all of which can impact their mental health and job performance. Understanding the levels of occupational stress and its contributing factors can provide a foundation for developing intervention strategies and policies that support firefighters' psychological well-being and work productivity.

METHOD

Study Design

This scoping review was conducted following the guidelines of the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) 2020 V1 statement.

Databases and Search Strategy

The scoping review framework was developed using the PEO approach (Population, Exposure, and Outcome).

Table 1. PEO: Keywords

Population	Firefighters
Exposure	Work-related stressful situations
Outcome	Risk factors and stress levels
Research question	<i>What are the factors associated with work stress in firefighters?</i>

Shows the search strategy carried out on 23 April 2025 for each of the above-mentioned databases during the search process.

Table 2. Search Strategy Used for each Database

Database	Keyword and Query	Result
Science Direct	Analysis OR association AND work stressors AND firefighter	2,890
Google Scholar	Analisis ATAU hubungan DAN stres kerja DAN petugas pemadam kebakaran	1,640
Date of search: 23/04/2025	Total	4,530

Selection Criteria

The search was carried out in the Science Direct and Google Scholar. Search on the Science Direct database, during the initial screening using a filter by providing a checklist in the categories "Last 5 years", "Article", and "Publication title". Whereas in the Google Scholar database, the screening stage is carried out by providing a checklist on the categories "Since 2021", "Sort by relevance", "All types", and "Include patents". The time period for the literature search was carried out from 23 April 2025 to 29 April 2025.

Table 3. Categories for Screening Articles

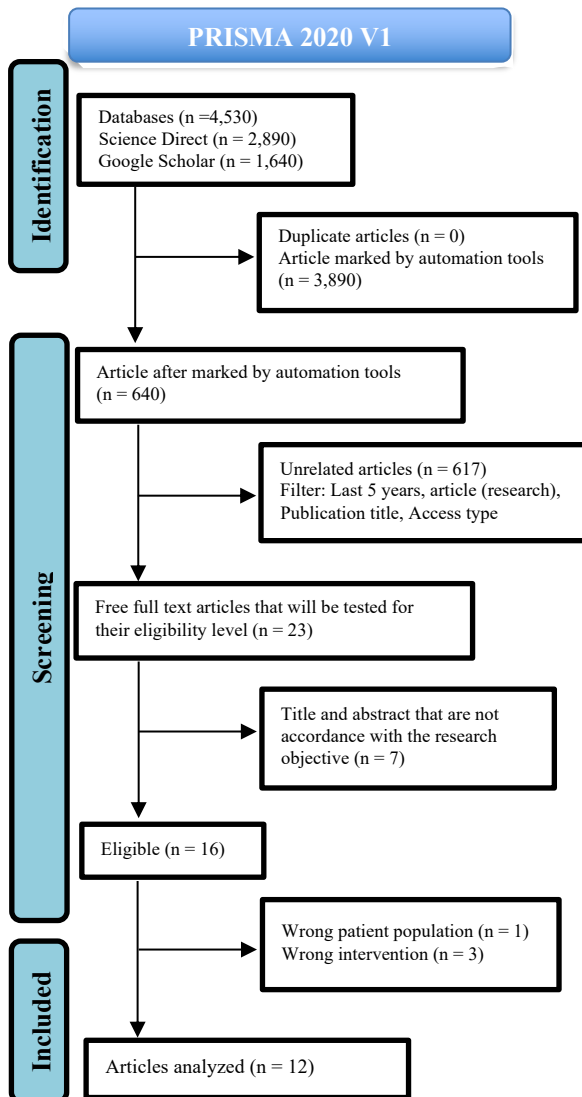
Criteria	Inklusi	Ekklusi
Population	Firefighter	Non-firefighter
Exposure	Work stress	Not a stress from work
Year	2021-2025	Before 2021
Article Type	Research articles, review articles	Encyclopedia, book chapters
Language	English, Indonesian	Apart from Indonesian and English
Type text	Free full text	Abstract, full text
Publication type	Safety Science, Safety and Health at Work, Fire Safety Journal, Journal of Safety Research	Other than occupational safety and health journals
Access Type	Open access & Open archive	Close Access

RESULTS AND DISCUSSION

Results

The initial search strategies identified a total of 4,530 references, which were then screened according to the topic of this review. A total of 12 studies were finally selected. All selected articles that met the inclusion and exclusion criteria were then read and analyzed by the author. In particular, the title and abstract are discussed for confirmation its feasibility under review for the intended purpose. All studies considered and included in the analysis, either qualitative or quantitative methods were used in the articles. Electronic database searches were conducted from April 23 to April 29, 2025. Initially, the first author searched each database using keywords that had been formulated. Then, the authors read the research title and abstract based on the search results obtained from writing keywords. The research title and abstract that matched the inclusion criteria (Lestari & Modjo, 2022).

Identification of studies via databases (PRISMA flowcart) (Grimshaw et al., 2021).



Discussion

This discussion explores the relationship between the identified data and the broader theoretical context surrounding occupational stress and burnout, particularly in high-risk professions such as firefighting.

Factor Affecting Work Stress in Firefighter

Among the risk factors identified as being associated with burnout were years of service, low levels of self-compassion, language barriers, alcohol consumption, age, proactive and negative coping styles, work stress, perceived stress, compassion fatigue, previous mental health history, performance in an external environment, family responsibilities, satisfaction with standard of living, feelings of loneliness, sleep disturbance, and work uniform. In this

population, protective factors against the development of burnout included proactive coping, physical activity, perceived social support, self-concept clarity, and resilience. A number of risk and protective factors have been identified as predisposing the emergence of the burnout syndrome (García-Iglesias et al., 2025).

Moreover, results indicate that job demand factors are likely to trigger employees' health-impairing mental/physical conditions that can constitute a precursor of unsafe behavior. Results imply as well the existence of a link between work-induced psychosocial states (typically in a form of stress or exhaustion) and safety (Derdowski & Mathisen, 2023).

These findings provide a comprehensive understanding of the complex interplay between personal, psychological, and occupational factors contributing to burnout and deteriorating mental well-being. These factors highlight why stress-related symptoms appear—long exposure to emergency situations, physical exhaustion, and emotional fatigue can accumulate, especially without adequate coping mechanisms. The identification of years of service, poor self-compassion, sleep disturbances, and high job demands as significant contributors underscores the need for a multidimensional approach to mental health intervention in the workplace. Consequently, evidence-based and holistic strategies are imperative to safeguard and enhance the mental health of workers, particularly in high-risk professions such as firefighting.

Associating Work Stress and Firefighter

Occupational stress has been identified as a major concern among firefighters due to the unique demands and pressures associated with their profession. Firefighters are routinely exposed to life-threatening situations, physical danger, high workloads, and irregular working hours, all of which contribute to elevated stress levels. The nature of their duties requires constant vigilance, emotional resilience, and physical endurance, making them particularly vulnerable to chronic stress. Studies have shown that prolonged exposure to such stressors can lead to adverse outcomes including emotional exhaustion, burnout, sleep disturbances, decreased job performance, and even long-term psychological disorders. Understanding the correlation between occupational stress and its impact on firefighters is essential for developing effective interventions aimed at protecting their mental and physical well-being.

Furthermore, the association between sleep quality and work fatigue ($p=0.027$), as reported by (Izza & Martiana, 2023), confirms the physiological toll of irregular work schedules on firefighters. This is supported by (Olivia et al., 2022), who found a strong relationship between workload and work stress ($p=0.000$), reinforcing the notion that the nature and intensity of job demands directly affect mental and physical health. The presence of mental workload ($p=0.004$) and its correlation with stress levels (Sianturi et al., 2021), along with the significant influence of factors such as age, work conflict, and workload (Najmi et al., 2024), further demonstrate how demographic and interpersonal elements contribute to the stress-burnout cycle. The findings also emphasize the role of environmental and organizational conditions, such as work discipline, occupational health and safety (Pausia et al., 2025), and the high demands during rescue operations (Basumerda et al., 2024), in shaping firefighters' experiences of stress.

These results collectively explain why burnout is prevalent among firefighters and support the theoretical model that psychosocial stressors can impair health and safety behavior, ultimately influencing job performance and long-term well-being. The demonstrated association between sleep disturbances and work fatigue, as well as the strong link between workload and stress, underscore the need for more humane work scheduling and adequate psychosocial support within the workplace. Moreover, the influence of factors such as age, work conflict, and organizational conditions highlights the necessity of a holistic approach to mental health interventions for firefighters, balancing individual, social, and structural dimensions.

CONCLUSION

Work-related stress is a significant issue that often goes unrecognized, as its symptoms are not always physically visible like other occupational diseases. This also applies to the profession of firefighters, who are required to remain on constant alert 24 hours a day. Findings from various studies discussed in this paper indicate that the effects of occupational stress on firefighters may influence demographic and interpersonal factors, sleep quality, physiological responses, physical fatigue, and the accumulation of emotional exhaustion.

About 95 % of the global population is covered by mobile networks, and the percentage of people subscribed to mobile services is expected to be at 70 %

in 2025 (GSMA – Global System for Mobile Communications Association, 2022). The novelty of this work lies in the proposed tool itself, which borrows some ideas from previous works related to mobile applications and chatbots for DRR. This design, develop, and validate this user-friendly conversational interaction following the user-centred approach, considering realistic scenarios defined from high-impact historic emergency events and involving several emergency practitioners, volunteering organisations, and citizens. Name the solution is ERMES Chatbot, where ERMES is an acronym derived from "Enhancing Resiliency to Manage Emergency Situations" and alludes to the ancient Greek deity Hermes, who was the messenger of the gods. The ERMES Chatbot can be effectively used by different stakeholders, including emergency management practitioners such as first responders and citizens. This work primarily focuses on the citizen dimension (requirements, functions, experience, and improvements). The detailed description and validation of the functionalities for professionals are left as future work (Urbanelli et al., 2024).

Based on the result and discussion, it can be concluded that occupational burnout among firefighters is strongly associated with a complex interaction of psychosocial, demographic, behavioral, and organizational factors. High job demands, prolonged exposure to emergency situations, inadequate coping mechanisms, sleep disturbances, and poor work environments significantly contribute to increased levels of work stress and mental health issues. These factors not only impair individual well-being but also reduce overall work performance and safety.

Therefore, it is recommended that fire departments and related institutions implement comprehensive strategies to address these risks. This includes promoting mental health programs, ensuring adequate rest periods, strengthening organizational support, and fostering a culture of safety and compassion. In addition, interventions such as stress management training, regular health screenings, and improvements in the work environment should be prioritized to reduce burnout and enhance the quality of life and performance among firefighters.

REFERENCES

- Azanella, L. A., & Hardiyanto, S. (2022). Terkesan Serba Bisa, Apa Saja Tugas Dan Fungsi Petugas Damkar? *Kompas.Com*.

- Basumerda, C., Santoso, D. W., Faruq, A. U. Al, & Alfaizi, R. M. (2024). Analisis Beban Kerja Mental Dan Tingkat Stres Pada Staf Pemadam Kebakaran. *Prosiding Seminar Nasional Hasil Penelitian Dan Pengabdian Masyarakat*, 11–23. <https://dspace.uui.ac.id/handle/123456789/53428>
- Dengo, Moh. R., Arda, Zul A., Anggraini, P., & Darise, D. S. (2023). Analisis Kelelahan Kerja Pada Petugas Damkar Di Bpbd Kabupaten Gorontalo. *Jurnal Promotif Preventif*, 6(2), 230–236. <https://doi.org/10.47650/jpp.v6i2.744>
- Derdowski, L. A., & Mathisen, G. E. (2023). Psychosocial Factors And Safety In High-Risk Industries: A Systematic Literature Review. *Safety Science*, 15(7), 105–948. <https://doi.org/10.1016/J.Ssci.2022.105948>
- García-Iglesias, J. J., Bermejo-Ramírez, A. M., Goniewicz, K., Fernández-Carrasco, F. J., Gómez-Salgado, C., Camacho-Vega, J. C., & Gómez-Salgado, J. (2025). Predictive Stressors For The Burnout Syndrome In Firefighters. A Systematic Review. *Safety Science*, 186, 106831. <https://doi.org/10.1016/J.Ssci.2025.106831>
- Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McGuinness, L., McDonald, S., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., Moher, D., Glanville, J., Chou, R., Brennan, S. E., Boutron, I., Akl, E., ... Tetzlaff, J. M. (2021). Pravila Prisma 2020. *Medicina Fluminensis*, 57(4), 444–465. https://doi.org/10.21860/Medflum2021_264903
- Gsma – Global System For Mobile Communications Association. (2022). *The Mobile Economy. London*.
- ILO. (2016, April 28). *Workplace Stress: A Collective Challenge*. Ilo Nesw.
- ILO. (2024, August 21). *The Prevention Of Work Related Occupational Diseases*. International Labour Organization.
- Izza, A. N., & Martiana, T. (2023). The Relationship Between Sleep Quality And Work Stress With Work Fatigue Of Firefighters. *Media Gizi Kemas*, 12(1), 134–141. <https://doi.org/10.20473/mgk.v12i1.2023.134-141>
- Olivia, I. S., Firdani, F., & Putri, N. W. (2022). Hubungan Beban Kerja Dan Karakteristik Individu Dengan Stres Kerja Pada Petugas Pemadam Kebakaran Kabupaten Tanah Datar. *Jurnal Keselamatan, Kesehatan Kerja Dan Lingkungan (Jk3l)*, 03(1). <https://doi.org/10.25077/jk3l.3.1.1-9.2022>
- Lestari, F., & Modjo, R. (2022). Scoping Review: Risk Factors For Tuberculosis Exposure In Hospital Workers. *Aisch 2022 The 3rd Al Insyirah International Scientific Conference On Health*. 3 (1), 1–8. <https://jurnal.ikta.ac.id/aish/article/view/2341>
- Nurrahmi, M. (2018). *Faktor Yang Berhubungan Dengan Stres Kerja Pada Petugas Pemadam Kebakaran Di Dinas Pemadam Kebakaran Kota Padang Tahun 2018*. Universitas Andalas.
- Najmi, M., Septiani, R., & Ariscasari, P. (2024). Hubungan Stres Kerja Dengan Kejadian Hipertensi Pada Petugas Pemadam Kebakaran Di Dpkp Kota Banda Aceh Tahun 2023. *Jurnal Kesehatan Tambusai*, 5(1), 1372–1381. <https://doi.org/10.31004/jkt.v5i1.25591>
- Pausia, N., Mar'i, A., Paskalis, Y., Erwina, & Mursida. (2025). Pengaruh Disiplin Kerja, Lingkungan Kerja, Dan K3 Terhadap Kinerja Pegawai Dinas Pemadam Kebakaran Dan Penyelamatan Kabupaten Luwu. *Yume : Journal Of Management*, 8(1), 1631–1640. <https://doi.org/10.37531/yum.v8i1.8354>
- Pradhana, C. A., & Suliantoro, H. (2018). Analisis Beban Kerja Mental Menggunakan Metode Nasa-Tlx Pada Bagian Shipping Perlengkapan Di Pt. Triangle Motorindo. *Industrial Engineering Online Journal*, 7 (3), <https://doi.org/10.35308/jopt.v7i2.4352>
- Sianturi, K., Handayani, R., Handayani, P., & Keumala Muda, C. A. (2021). Risk Factors Of Work Stress On Firefighters. *Journal Of Vocational Health Studies*, 5(2), 112. <https://doi.org/10.20473/Jvhs.V5.I2.2021.112-118>
- Urbanelli, A., Frisiello, A., Bruno, L., & Rossi, C. (2024). The Ermes Chatbot: A Conversational Communication Tool For Improved Emergency Management And Disaster Risk Reduction. *International Journal Of Disaster Risk Reduction*, 112, 104792. <https://doi.org/10.1016/J.Ijdr.2024.104792>
- WHO. (2022, September 28). *Who And Ilo Call For New Measures To Tackle Mental Health Issues At Work*. Joint News Release Geneva, Switzerland.