






Review

Predictive stressors for the burnout syndrome in firefighters. A systematic review

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ABSTRACT

Firefighters are exposed to situations where decision making is constant and affects not only the lives of those they serve, but also their own. The aim of this study was to identify stress-related factors that may predispose to the development of burnout in firefighters. A systematic review following the PRISMA 2020 statement was carried out in the Web of Science, Science Direct, Scopus, and Pubmed databases. The literature search was conducted in August 2024. The methodological quality was assessed using the critical appraisal tools for studies of the Joanna Briggs Institute. A total of 34 studies were included in this review. 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. These stressors have the potential to impact the worker, resulting in occupational illnesses and injuries, poor compliance with safety measures, and the onset of sleep disorders. Such consequences may have serious implications for the worker's physical and mental health, as well as the health and integrity of third parties.

1. Introduction

Experiencing traumatic events is a common occurrence in the lives of almost 70 % of people today (Benjet et al., 2016). For firefighters in particular, data are even more alarming. Their work often involves them in dangerous rescues that are far more intense and dangerous than those faced by the average individual (Huang et al., 2019; Igboanugo et al., 2021). This profession requires not only physical endurance, but also resilience in the face of relentless psychological stressors (Barger et al., 2009). Consequently, firefighters confront a career path marked by unique challenges that pose constant strain on their limits.

Work-related stress is a pervasive issue in public service jobs, with firefighters standing out as particularly vulnerable (Klimley et al., 2018; Rassolian et al., 2017). Every day, they confront unpredictable environmental hazards and traumatic events (Fullerton et al., 2004). Their duties expose them to a variety of dangers—from structural hazards and toxic chemicals to diesel exhaust fumes, unstable fire-damaged floors, and the inherent stress of emergency responses (National Institute for Occupational Safety and Health, 2023). Amidst these challenges, firefighters must remain alert, making critical decisions while under the constant strain of psychological and occupational stressors. This relentless pressure leaves them at risk for numerous health issues,

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including depression (Regehr et al., 2000; Wagner et al., 1998), substance abuse (Haddock et al., 2015; Meyer et al., 2012), psychological stress leading to suicide (Stanley et al., 2015), sleep disorders (Smith et al., 2019a; Straud et al., 2018), and burnout (Smith et al., 2019a). In addition, because of firefighters' specific duties, stress arising from job performance may be positively related to musculoskeletal disorders derived from emotional exhaustion, low personal accomplishment, depersonalisation, and depression in general (Khoshakhlagh et al., 2024b).

Chronic exposure to these stressors can inevitably drive firefighters toward burnout, a complex syndrome marked by emotional exhaustion, depersonalisation, and a diminished sense of accomplishment that lingers even after time off work (Maslach and Leiter, 2016). When burnout occurs, it triggers a cascade of negative effects—a profound sense of psychological loss, waning job satisfaction, and declining performance. If left unchecked, this can spiral into a vicious cycle of escalating work-related stress (Youn, 2009).

Numerous studies have delved into the connection between work environments and burnout, consistently finding that negative aspects of a job and its organisational structure are closely linked to work-related burnout (Montano et al., 2017; Rattrie et al., 2019). However, not all workers exposed to the same environment or working conditions experience burnout (Pérez-Fuentes et al., 2019). A meta-analysis further highlights that prolonged exposure to burnout can trigger a range of physical and psychological issues, including chronic fatigue, headaches, depressive symptoms (Salvagioni et al., 2017), anxiety, lethargy, and post-traumatic stress disorder (PTSD) (Benedek et al., 2007). According to the Job Demand-Resources (JD-R) model, these risk factors are categorised as job demands, while protective factors are identified as job resources (Bakker et al., 2014). The JD-R model is a widely recognised framework for understanding the dynamics of workplace stress and motivation. It argues that job demands, such as high workload and emotional strain, can negatively affect health and decrease motivation, while job resources, such as support and autonomy, can improve motivation and well-being (Tummers and Bakker, 2021). Risk factors, including chronic stress and lack of support, exacerbate the negative impacts of job demands, potentially leading to the burnout syndrome—a state of emotional, physical, and mental exhaustion caused by prolonged stress (Salvagioni et al., 2017). Conversely, protective factors, such as strong social support and effective coping strategies, can mitigate these risks and promote resilience (Shahwan et al., 2024). Understanding these protective factors is crucial for mitigating the severe psychological and clinical impacts of burnout (Shin et al., 2014).

When stress becomes a constant companion, burnout begins to manifest in various ways. These symptoms, deeply intertwined with stress, anxiety, and depression, are key indicators of declining psychological health (Bianchi et al., 2013; Rössler et al., 2015). As firefighters succumb to exhaustion, their ability to communicate and raise safety concerns diminishes. They become less likely to use personal protective equipment correctly and more prone to bypass standard operating procedures, heightening the risk of injury on the job (Smith et al., 2019b). Working in such a high-pressure, emergency-driven environment often exposes them to the potential injury or death of colleagues or victims. These harrowing experiences are part of the job and, in some cases, can lead to the development of PTSD (Shin et al., 2014).

This study is grounded in the JD-R model, which provides a framework for understanding how job demands—factors requiring substantial physical, emotional, or mental effort, such as extended shifts, constant public interaction, and the risk of infection—impact workers' health and well-being. The model also emphasises the role of job resources—elements that help mitigate the effects of demands, such as social support, health protection measures, and adequate training—which can buffer the negative impact of these demands on perceived stress. Within this framework, the study explores how the specific demands and resources of firefighters work during the pandemic influenced the psychological well-being of officers, drawing on previous

research on the effects of occupational stress in emergency scenarios.

Given these challenges, this study set out with three primary objectives: first, to identify the risk factors that contribute to burnout within firefighting teams and brigades; second, to uncover the protective factors that can serve as defence mechanisms against the development of this stress-induced condition; and third, to explore how burnout manifests in team members after they have been exposed to various stressful events.

2. Methods

2.1. Study design

A systematic review was conducted following the guidelines of the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement. The protocol followed is listed in the Prospective International Register of Systematic Reviews (PROSPERO) with code CRD42024579264.

2.2. Databases and search strategy

The search was carried out in the Web of Science, Science Direct, Scopus, and Pubmed databases on the basis of the keywords that the research question yielded following the PEO strategy to determine the association between particular exposures/risk factors and outcomes (Munn et al., 2018) (Table 1).

As a search strategy for this review, the following key terms were used. Then, the Medical Subject Headings (MeSH) thesaurus was consulted, yielding the descriptors *firefighter*, *psychological burnout* and *occupational stress*.

To improve the retrieval of published studies in line with the subject of this review, synonymous terms were used in order to complete the search strategy based on the MeSH descriptors (Table 2). The Boolean operators of intersection (AND) and addition (OR) were used.

Table 3 shows the search strategy carried out on 12 August 2024 for each of the above-mentioned databases during the search process.

2.3. Selection criteria

The following inclusion criteria were adopted in the selection of articles: i) participants: articles whose main sample is composed by firefighters; ii) scientific-technical articles of intermediate/high quality; iii) context: original articles published in the last ten years (2014–2024) and; iv) articles assessing any of the following values and/or effects: level of burnout and related factors. Similarly, the exclusion criteria were: i) participants: rescue workers, emergency physicians, nurses, pharmacists, police, pilots, pre-school educators, teachers, and firefighters who do not perform rescue tasks; ii) articles of low scientific-technical quality after applying the quality assessment tool; iii) typology: qualitative studies where the prevalence of burnout cannot be determined and; iv) articles not answering the research question and not related to the objective of the review.

2.4. Data collection and extraction

Citations from each search in the 4 databases were downloaded into Mendeley and the identified duplicates were removed. Three authors

Table 1
PEO format: keywords.

Population	Firefighters
Exposure	Work-related stressful situations
Outcome	Predictive risk factors for the onset of burnout
Research question	What stress-related factors predispose to the development of the burnout syndrome in firefighters?

Table 2
Search terms used.

MeSH terms	Meaning	Terms
Firefighters	Professional or volunteer members of a fire department who are trained to suppress fire and respond to related emergency.	Fire fighter* OR Firefighter*
Professional Burnout	An excessive stress reaction to one's occupational or professional environment. It may be characterised by feelings of emotional and physical exhaustion, coupled with a sense of frustration and failure.	Burnout OR Psychological Burnout OR Professional Burnout OR Burnout Syndrome
Occupational Stress	Adverse psychological and behavioural reactions caused by the pressures and demands of employers or clients or other factors, such as the physical environment of the workplace, workplace violence, or workplace bullying.	Stress* OR Distress OR Psychological Stress OR Psychological Distress OR Occupational Stress

† MeSH: Medical Subject Headings.

Table 3
Search strategy used for each database.

Database	Search strategy	Results
Pubmed	((Firefighters[MeSH Terms]) OR (Fire fighter* [Title/Abstract] OR Firefighter*[Title/Abstract])) AND ((Professional Burnout[MeSH Terms]) OR (Burnout[Title/Abstract])) AND ((Occupational stress[MeSH Terms]) OR (Stress*[Title/Abstract] OR Distress[Title/Abstract])) Filters: from 2014 – 2024	74
Scopus	(TITLE-ABS-KEY ("fire fighter*" OR firefighter*) AND TITLE-ABS-KEY (burnout) AND TITLE-ABS-KEY (stress* OR distress)) AND PUBYEAR > 2013 AND PUBYEAR < 2025	103
Web Of Science	Fire fighter* OR Firefighter* (Topic) AND Burnout (Topic) AND Stress* OR Distress (Topic) and 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 (Publication Years)	200
Science Direct	(Fire fighters OR Firefighters) AND (Burnout) AND (Stress OR Distress). Filters: from 2014 – 2024	316
Date of search: 12/08/2024	Total	693

were involved (JJGI, AMBR, and JGS). Two authors (JJGI and AMBR) screened by title to determine whether the articles met the eligibility criteria for potential inclusion (please, see *Selection criteria*) or could be excluded at this stage. Following this, authors JJGI and AMBR performed a full-text screening, extracting specific information (authors, design, objective, context, method, and results); there was a reason for exclusion in the rejected studies. Eligible studies were then discussed with another author (JJGI vs AMBR) to check and confirm their eligibility (if there was disagreement: authors JJGI and AMBR). Discrepancies were resolved by author JGS. Authors JJGI and AMBR extracted the relevant data from these articles and author JGS checked the data extraction for included studies to ensure that data had been extracted correctly. Finally, author JGS applied the JBI's critical appraisal tools to assist in assessing the reliability, relevance, and results of the published articles.

2.5. Methodological quality assessment

The Joanna Briggs Institute (JBI) tools were used to assess the quality of the selected articles (Pearson and Jordan, 2010). These tools allow for

the assessment of the methodological quality of a study and the extent to which a study has excluded or minimised the possibility of bias in its design, conduct, and/or analysis.

The checklists for analytical cross-sectional studies and for case-control studies were used (Supplementary Material).

3. Results

The initial search strategies identified a total of 693 references, which were then screened according to the topic of this review. A total of 34 studies were finally selected (Fig. 1), 33 of which were analytical cross-sectional studies and 1 case-control.

Of the 34 studies, 7 had been carried out China (Chen et al., 2022a; Chen et al., 2022b; Cui et al., 2022; Huang et al., 2022; Jin et al., 2024; Lv et al., 2024; Wu et al., 2024), 6 in the United States (Dyal et al., 2022; Smith et al., 2019a; Smith et al., 2020, 2017; Stout et al., 2021; Wolkow et al., 2019), 4 in France (Crombez-Bequet et al., 2024; Crombez-Bequet and Legrand, 2024; Michinov, 2022; Vaulerin et al., 2016), 3 in Poland (Krok, 2016; Makara-Studzińska et al., 2019; Stefanowski et al., 2023), 3 in Portugal (Ángelo and Chambel, 2015; Dias et al., 2022; Llorens et al., 2022), 3 in Korea (Jeung et al., 2021; Jo et al., 2018; Kim et al., 2020), 2 in Greece (Chatzea et al., 2018; Katsavouni et al., 2016), 1 in Romania (Roşca et al., 2021), 1 in Iran (Khoshakhlagh et al., 2024a), 1 in Russia (Pyatibrat et al., 2024), 1 in Brazil (De Carvalho et al., 2021), 1 in Turkey (Bastug et al., 2019), and 1 in Kazakhstan (Vinnikov et al., 2019).

Among the risk factors identified at the individual level were years of service, low levels of self-compassion, language barriers, alcohol consumption, age, proactive and negative coping styles, work stress and perceived stress, compassion fatigue, past medical history, family responsibilities, satisfaction with standard of living, feelings of loneliness, and sleep disorders. At the organisational level, role ambiguity, role conflict, work-family conflict, organisational demands, lack of challenge, type of job, rotating shift work, and work uniform were observed. Subsequently, a number of protective factors were identified such as social support, perceived social support, physical activity, sense of self-efficacy, self-concept awareness, peer support, role performance in an external environment, proactive coping, and meaningfulness of work. Finally, a number of effects emerged from burnout, such as unsafe behaviours, injuries, musculoskeletal disorders, occupational diseases, reduced performance, and mental health impairment (PTSD, sleep disorders, etc.). The characteristics of the studies finally selected are detailed in Table 4.

4. Discussion

The aim of this review was to identify stress-related factors that may predispose to the development of burnout in firefighters.

One of the identified risk factors for the development of burnout was previous clinical conditions, such as having previous mental disorders or a sleep disorder (Wolkow et al., 2019). In fact, chronic fatigue resulting in depleted energy reserves due to high levels of bodily stress can lead to burnout and difficulties in falling asleep and maintaining sleep, as has been observed in other studies (Stewart and Arora, 2019; Wolkow et al., 2019).

In terms of work experience, Makara-Studzińska et al. (2020) found that the number of years of service was positively and significantly correlated with all three dimensions of burnout, as well as with the level of perceived stress, especially in firefighters with 5 or more years of experience as determined by Pyatibrat et al. (2024) or 11–15 years of service according to Stout et al. (2021). This may be explained by the fact that over the years, promotion opportunities arise that imply greater responsibility (Braveman and Gottlieb, 2014; Vinnikov et al., 2019) and increase the likelihood that there will be a greater number of dependent family members (Dias et al., 2022). In this respect, firefighters with fewer dependents also experienced less burnout and lower levels of

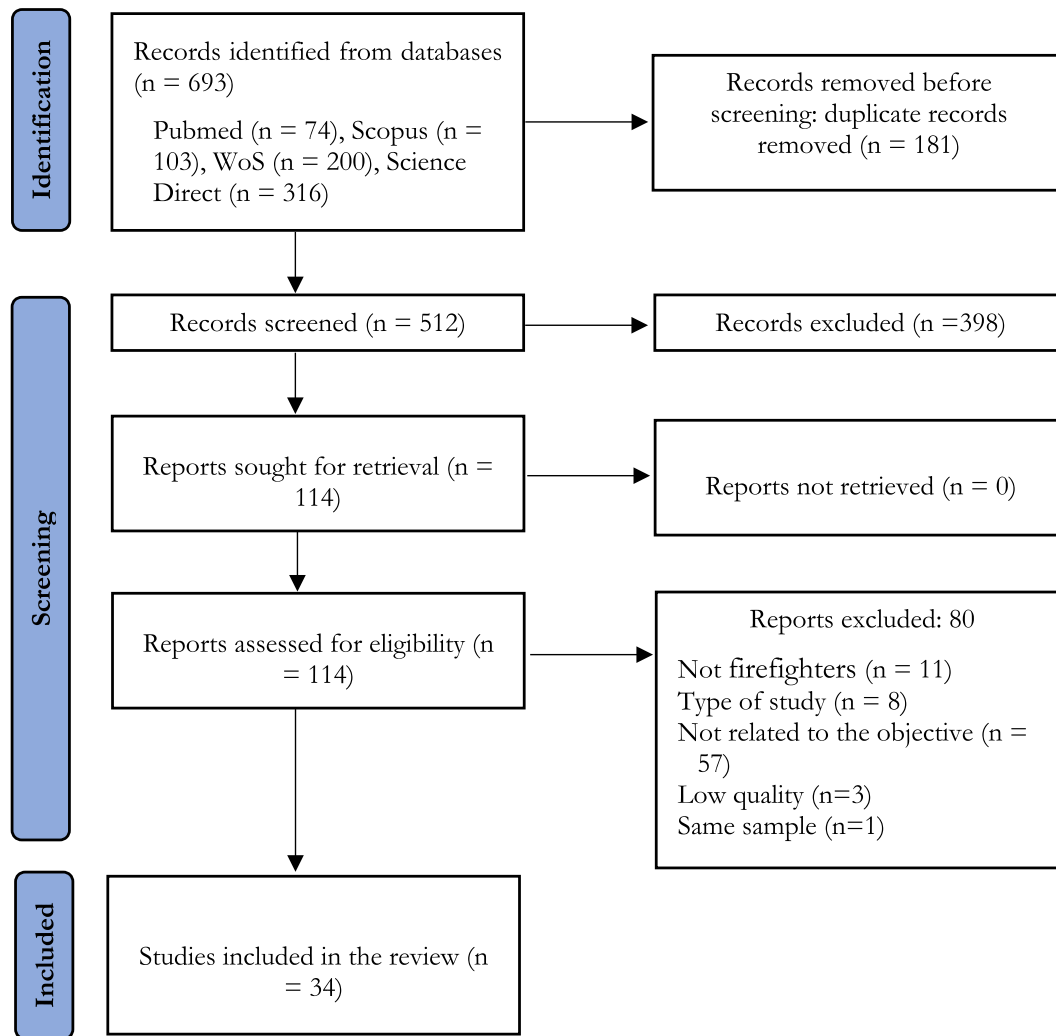


Fig. 1. Identification of studies via databases (PRISMA flowchart) (Page et al., 2021).

disconnection than their peers with more dependent family members (Dias et al., 2022). These results would be in line with the JD-R theory, highlighting that firefighters may experience work overload and find a lack of resources and organisational measures to support the work-family balance (Tummers and Bakker, 2021).

Following the JD-R theory, in the studies by Angelo and Chambel (2015), Roşca et al. (2021) and Llorens et al. (2022) it was observed that firefighters with high levels of burnout perceived higher job demands, either as a result of a negatively biased perception or as a result of real changes in the work environment. One of the characteristics of firefighters is that they work rotating shifts and this is a risk factor for developing burnout (Dias et al., 2022). In this sense, getting too little sleep during a night shift may increase the risk of sleep disorders and increased exhaustion (Wolkow et al., 2019). Insufficient sleep during night shifts disrupts the body's natural circadian rhythm, which regulates sleep-wake cycles, leading to poor sleep quality and difficulty achieving restorative rest. Over time, this can result in chronic sleep deprivation, increasing the risk of sleep disorders and intensifying physical and mental exhaustion (Potter et al., 2016).

As well as being a source of work pressure and stress, work can also lead to work-family conflict (Smith et al., 2019a). In this case, employees may experience high work demands on a chronic basis, and available resources may be mobilised to the maximum of their capacity, leaving little room to meet family demands (Tammaing et al., 2023). The statement underlines that work can not only be a source of pressure and

stress, but also a trigger for work-family conflicts. This occurs when the demands of the job are chronic, i.e. persistent and very intense, and force employees to allocate most of their resources –both physical and emotional– to meeting the job requirements. As a result, available resources such as time, energy, and attention are either overstretched or completely depleted, leaving little to no capacity to cope with family demands. This imbalance can negatively impact the work-life relationship, creating tensions that affect both individual well-being and family dynamics (Cooklin et al., 2016).

To counteract these situations, some authors have identified a number of protective factors, such as those described in the study by Lv et al. (2024), who found that workers with low levels of self-compassion tended to experience higher levels of job burnout, the study of Kim et al. (2020), where compassion fatigue was found to have a moderating effect on the environmental risk factors associated with the work of firefighters, and in the study by Stefanowski et al. (2023), where loneliness was found to act as a mediator between burnout and work ability. Perceived social support had also been examined and it appears that the greater the perceived social support, the greater the reduction in experiences of burnout (Chen et al., 2022a; Chen et al., 2022b; Huang et al., 2022; Kyron et al., 2021), as is the case in other professions (Garmendia et al., 2023). Additionally, another factor that may affect the level of burnout is self-efficacy, under both low and high perceived stress conditions (Makara-Studzińska et al., 2020, 2019). This phenomenon can be explained through the Resource Conservation Theory (Hobfoll, 1989),

Table 4
Characteristics of the studies included in the systematic review.

AUTHORS	DESIGN	OBJETIVE	CONTEXT	METHOD	RESULTS
(Crombez-Bequet and Legrand, 2024)	Case-control	To evaluate the effects of a 7-week long complex intervention (high-intensity interval training which focused on several fitness parameters and made use of firefighting equipment and materials) among French firefighters with moderate or elevated levels of BO.	France N = 40	- BAT - RSE - POMS - WCC	Results revealed that participants in the physical activity group reported significantly reduced BO scores immediately following the training program ($p < 0.001$). These benefits were still present 1 month after the end of intervention. The physical activity program had no significant effect on any of the secondary outcomes.
(Crombez-Bequet et al., 2024)	Quantitative cross-sectional	To assess the prevalence of occupational BO in a large and representative sample of French firefighters.	France N = 3038	- BAT	Findings revealed that while 2455 respondents (80.8 %) did not meet the criteria for BO, 345 (11.4 %) reported mild/moderate symptoms of BO, and 238 (7.8 %) could be deemed to have severe BO symptoms.
(Khoshakhlagh et al., 2024a)	Quantitative cross-sectional	To investigate the effects of occupational stress on work-related musculoskeletal disorders (WRMSD) in firefighters. In addition, the mediating effects of depression and job BO on proposed relationships were examined.	Iran N = 2339	- BDI - CES-D - MBI - PCL - Musculoskeletal Questionnaire	Work related stress is positively related to WRMSDs in firefighters and can lead to musculoskeletal symptoms through four paths, being emotional exhaustion, personal accomplishment, CES-D total score, and depersonalisation. Through depersonalisation, job stress had the most significant impact on musculoskeletal symptoms (coefficient = 0.053). Furthermore, the results showed that PTSD can affect musculoskeletal symptoms through ten paths, again through depersonalisation, PTSD had the most significant impact on musculoskeletal symptoms (coefficient = 0.141).
(Jin et al., 2024)	Quantitative cross-sectional	To examine what, if any, patterns and changes in these patterns over time of job BO among firefighters and their relationships with internal protective factors (i.e., dispositional mindfulness and reappraisal).	China N = 334	- MBI - MAAS - Emotional Regulation Questionnaire	24.25 % firefighters remained in the high job BO group, and 56.89 % remained in the low job BO group. Firefighters were more likely to be classified in the LJB and to move from the HJB to the LJB with the improvement of dispositional mindfulness and reappraisal levels.
(Pyatibrat et al., 2024)	Quantitative cross-sectional	To identify the indicators of professional psychological maturity among employees of the State Fire Service of the Ministry of Emergency Situations of Russia.	Russia N = 182	- BDHI - WHOQOL-26 - MBI	Extreme work characteristics (heavy physical exertion and mental stress) in firefighters can be accompanied by the development of negative personality traits, such as aggressiveness, suspiciousness, hostility, psychological components of professional BO (emotional exhaustion, depersonalisation and reduction of professional relationships) and decreased satisfaction with the quality of life. It turned out that in firefighters with 5 years of work experience or more, they manifest themselves much more often and faster than in specialists of other professional groups.
(Chen et al., 2022b)	Quantitative cross-sectional	To explore the effects of avoidant coping on PTSS and job BO among firefighters, and to examine the mediating role of perceived social support on the relationship between avoidant coping and PTSS and job BO.	China N = 431	- PCL-5 - MBI - Coping Style Inventory. - PSSS	Avoidant coping was positively related to PTSS and job BO among firefighters and avoidant coping was positively related to PTSS and job BO through the mediating effect of perceived social support.
(Chen et al., 2022a)	Quantitative cross-sectional	To investigate the ways in which dispositional mindfulness is related to PTSD symptoms and job BO among firefighters by considering the role of perceived social support.	China N = 409	- PTSD Checklist. - MBI - PSSS - Mindful Attention Awareness Scale.	Perceived social support partially mediated the relationship between dispositional mindfulness, PTSD, and job BO.
(De Carvalho et al., 2021)	Quantitative cross-sectional	To investigate the association between occupational stressors and BO dimensions among Brazilian firefighters	Brazil N = 237	- Job Stress Scale. - MBI	High strain was associated to emotional exhaustion and depersonalisation. Low social support was associated to emotional exhaustion (OR = 2.86; 95 % CI: 1.24 to 6.60) and low personal accomplishment (OR = 2.59; 95 % CI: 1.36 to 4.93). High operational exposure did not increase the odds of emotional exhaustion and depersonalisation and decreased the odds of low personal accomplishment (OR = 0.31; 95 % CI: 0.10 to 0.94).

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Table 4 (continued)

AUTHORS	DESIGN	OBJETIVE	CONTEXT	METHOD	RESULTS
(Jeung et al., 2021)	Quantitative cross-sectional	To examine the association of emotional labour and organisational climate with BO and elucidated the moderating effect of organisational climate on the relationship between emotional labour and BO among 18,936 Korean firefighters	Korea N = 18936	- Emotional Labor Scale. - MBI - Organisational Climate.	BO was associated with gender ($p < 0.001$), age ($p < 0.001$), education ($p < 0.001$), shift work ($p < 0.001$), main duty ($p < 0.001$), and working period
(Stout et al., 2021)	Quantitative cross-sectional	Assessing the likelihood of experiencing BO, compassion fatigue, and vicarious trauma.	United States N = 186	- MBI - Vicarious Trauma Scale. - Compassion Fatigue Self-Test.	the firefighters experienced emotional exhaustion, moderate depersonalisation, low reduced personal accomplishment ($\mu = 29.29$), extremely high compassion fatigue, and moderate vicarious trauma. There were no significant differences between wildfire responders and non-wildfire responders. However, firefighters who were midcareer (11–15 years of service) and those who were between the ages of 35 and 55 were statistically more likely to experience emotional exhaustion and depersonalisation than their younger and older peers.
(Bastug et al., 2019)	Quantitative cross-sectional	To investigate the rate of PTSD as well as the relationship between PTSD and depressive symptoms, BO, and life satisfaction in Turkish firefighters.	Turkey N = 100	- SCID-I - PTSS Scale. - MBI - SWLS - BDI - SF-8 - FSS - HRQoL - MBI	firefighters had a high rate (40 %) of PTSD according to DSM-IV criteria. Firefighters with PTSD also had higher BO in terms of emotional exhaustion, higher depression, and poor life satisfaction. Managers had higher levels of BO. Managing position in firefighting is assumed to have higher job demands compared to firefighters, therefore, managers are more likely to be emotionally exhausted. In general, BO was low in this sample. alcohol use, self-reported health-related quality of life and language barrier predicted higher cynicism, while high BO was associated with male sex and lower educational level.
(Vinnikov et al., 2019)	Quantitative cross-sectional	To ascertain the prevalence of BO with regard to position and to identify predictors of faster BO.	Kazakhstan N = 604	- DeJoy Scale. - Carlson Scale. - Malach-Pines Scale. - Security Practices.	both work stress and work-family conflict predicted BO and BO negatively influenced personal protective equipment compliance. Firefighter BO, as a stress-related disease, significantly impacts firefighter safety performance.
(Smith et al., 2017)	Quantitative cross-sectional	to delineate the relationships between work stress, work-family conflict, BO and firefighter safety behaviour outcomes.	United States N = 208	- MBI - Screening for sleep disorders. - OSA - SWD - EpworthSleepiness Scale.	Firefighters screening positive for a sleep disorder, particularly insomnia, had increased risk of emotional exhaustion. Firefighters self-reporting a current mental health condition were at greater risk of emotional exhaustion. Sleep during overnight work mediated the impact of having a sleep disorder and mental health condition on high BO. Sleepiness and sleep deficit (difference between required and actual sleep), even in firefighters without sleep disorder risk, were associated with depersonalisation.
(Wolkow et al., 2019)	Quantitative cross-sectional	To investigate whether sleep disorder risk and mental health outcomes in firefighters were associated with BO, particularly emotional exhaustion. To examine the mediating role of sleep at work in these relationships. To investigate associations between habitual sleep characteristics and BO.	United States N = 6307	- OLBI - Proactive Coping Scale. - Standard of living subscale.	variations in the role played by age, family responsibilities, proactive coping and satisfaction with standard of living on BO were found. Working in rotative shifts constituted a risk factor for career firefighters' BO. Both younger volunteer and career firefighters present higher BO levels than older volunteer and career firefighters. Proactive coping acts as a protective factor against BO in both volunteer and career firefighters, playing a more important role among volunteers. Satisfaction with the standard of living influence BO and disconnection. A high number of dependent family members was shown to put career firefighters at risk of developing BO.
(Dias et al., 2022)	Quantitative cross-sectional	To investigate the explaining role of personal and work-related factors on volunteer and career firefighters' BO.	Portugal N = 250	- Work pressure Scale. - DeJoy Scale. - Work-Family Conflict Scale.	Perceived work stress and work-family conflict emerged as the significant predictors of BO. The most significant model supports prior research that work
(Smith et al., 2019b)	Quantitative cross-sectional	To examine relationships between work pressure, work stress, and work-family conflict.	United States N = 208		

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Table 4 (continued)

AUTHORS	DESIGN	OBJETIVE	CONTEXT	METHOD	RESULTS
				- Malach-Pines Scale.	stress and work-family conflict are associated with BO.
(Krok, 2016)	Quantitative cross-sectional	To examine the relationships between different dimensions of meaning in life (personal meaning, presence of meaning, search for meaning) and BO among firefighters.	Poland N = 189	- Personal Meaning Profile. - Meaning in Life Questionnaire. - MBI	Firefighters with higher levels of personal meaning and presence of meaning reported less emotional exhaustion and depersonalisation, and more personal accomplishment. Most of the personal meaning dimensions also had significant associations with the BO indicators. Individuals in detached style had higher levels of emotional exhaustion and depersonalisation than individuals in presence style and presence and search style. Meaning structures are an important salutary factor that enables firefighters to effectively comprehend and interpret their work-related experiences, and thus reduces the likelihood of distress and weariness.
(Wu et al., 2024)	Quantitative cross-sectional	To examine the potential of self-concept clarity as a resource and to extend the JD-R model.	China N = 2156	- SCCS - RS-14 - MBI - UWES-9	Self-concept clarity had a direct effect on job BO and work engagement, and an indirect effect by improving the firefighters' resilience. Self-concept clarity is negatively correlated with job BO and positively with work engagement. A positive correlation between self-concept clarity and resilience was found. Self-concept clarity can not only directly affect their working state, but can also reduce job BO and improve work engagement by promoting resilience.
(Roşca et al., 2021)	Quantitative cross-sectional	To assess the buffering role of work meaning in the health-impairment process of the JD-R model, targeting the relationship between job demands and related emotional exhaustion.	Romania N = 1096	- WAMI - MBI - JD-RQ	Both challenging demands and hindering demands positively predicted exhaustion. Higher perceived intensity of job demands predicted higher emotional exhaustion levels in firefighters. In addition, work meaning had a significant negative relationship with exhaustion, indicating that the more meaning one finds in work, the lower the risk of negative strain.
(Llorens et al., 2022)	Quantitative cross-sectional	To examine how demands and resources may relate to psychological well-being in a multilevel analytical context (individual and organisation).	Portugal N = 1601	- JD-RQ - Proactive Coping Inventory. - Job Content Questionnaire. - MBI - UWES-9	Proactive coping was related to lower BO and higher work engagement, whereas acute demands were related to higher BO and lower work engagement (for vigour only). Proactive coping moderated the relationship between acute demands and vigour and, unexpectedly, social support from colleagues was not related to firefighters' well-being, whereas organisation-level demands were related to higher BO and lower work engagement.
(Vaulerin et al., 2016)	Quantitative cross-sectional	To quantify and characterize the musculoskeletal injuries specific to French firefighters and to examine the contribution of physical exercise, BO and coping strategies in explaining these injuries.	France N = 220	- Department of Public Safety Questionnaire. - SMBM - WCC	Weekly hours of physical exercise were significantly related to injuries. Regular physical exercise could be considered as a risk factor for musculoskeletal injury in this population of firefighters. Cognitive weariness was positively related to injuries. Emotional exhaustion was negatively related to the total number of injuries. Problem-focused coping was a protective factor for firefighter injuries, which is consistent with previous findings.
(Chatzea et al., 2018)	Quantitative cross-sectional	To assess the prevalence and the factors associated with self-assessed PTSD, perceived well-being and BO among rescue workers operating at Lesvos during the European refugees crisis.	Greece N = 217	- PCL-C - MBI - WHO-5	The prevalence of self-assessed PTSD and perceived BO syndrome was 17.1 % and 57 % respectively, while 72.8 % of the rescuers reported low levels of perceived well-being. Self-assessed PTSD was positively correlated with perceived BO and inversely correlated with perceived well-being. Perceived BO was also inversely correlated with perceived well-being. A number of significant predictors were identified for self-assessed PTSD, perceived BO and well-being, including: family status, age, duration of shifts,

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Table 4 (continued)

AUTHORS	DESIGN	OBJETIVE	CONTEXT	METHOD	RESULTS
(Jo et al., 2018)	Quantitative cross-sectional	To examine the role of calling, or vocation, in the association between BO and PTSD symptoms.	Korea N = 109	- MBI - Sense of Calling Subscale of the Professionalism Scale. - IES-Revised	collection of dead adults or dead children bodies. BO was a significant predictor of PTSD symptoms. Furthermore, the interaction term between BO and calling accounted for a significant variance in PTSD symptoms. Higher BO was associated with severe PTSD symptoms, but this relationship differed by the level of calling. The increase in PTSD symptoms due to increased BO in the high calling group was relatively higher than in the low and average calling groups.
(Makara-Studzińska et al., 2019)	Quantitative cross-sectional	To analyse the importance of individual resources in firefighting.	Poland N = 580	- PSS - LBQ - GSES	Self-efficacy is a significant moderator that changes the direction and strength of the relationships between perceived stress and psychophysical exhaustion, sense of professional inefficacy, and disillusion. self-efficacy in firefighters is a crucial personal resource that buffers the impact of perceived stress on most BO symptoms.
(Stefanowski et al., 2023)	Quantitative cross-sectional	To explore the mediating effects of insomnia, depressive symptoms, loneliness and alcohol misuse in the relationship between two dimensions of BO (i.e., exhaustion and disengagement) and work ability among firefighters.	Poland N = 460	- OLBI - WAI - AIS - CESD-R - DJGLS - CAGE questionnaire.	The proposed model explained 44 % of variance in work ability. Higher levels of both exhaustion and disengagement predicted worsened work ability. When mediators were controlled for, these effects remained statistically significant. Depressive symptoms and feelings of loneliness were found to be partial mediators of the association between exhaustion and work ability, and between disengagement and work ability. The mediating effects of insomnia and alcohol misuse were non-significant.
(Lv et al., 2024)	Quantitative cross-sectional	To inspect the impact of protective factors and risk elements on firefighters' job BO.	China N = 488	- PSS - Self-compassion Scale. - Simplified Coping Style Questionnaire. - MBI	Firefighters' perceived stress explicitly predicts job BO and implicitly influences job BO via self-compassion and negative coping style. Positive coping style moderated the link involving perceived stress and job BO and the link encompassing perceived stress and negative coping style.
(R. Kim et al., 2020)	Quantitative cross-sectional	To examine risk factors in working environment affecting firefighters' BO and to verify the moderating effect of compassion fatigue in the relationship between risk factors and BO.	Korea N = 341	- Working Environment Inventory. - MBI - Compassion Fatigue Self-test for Helpers Scale.	High correlation between risk factors, BO, and compassion fatigue. The sub-factors affecting BO were the lack of challenge, the role ambiguity, the role conflict, and overwork. Firefighters' compassion fatigue was found to significantly control the effects of risk factors on BO. As the level of compassion fatigue increased, the influence of risk factors in working environment on BO increased.
(Cui et al., 2022)	Quantitative cross-sectional	To investigate the association between job BO and depressive symptoms among Chinese firefighters, assuming collegueship to play a moderating role in the aforementioned relationship.	China N = 1328	- CESD-R - MBI - Collegueship Scale.	All dimensions of job BO were associated with worse depressive symptoms. Cynicism had the strongest association with depressive symptoms, followed by emotional exhaustion and inefficacy. Moreover, firefighters with better affective collegueship and better obligatory collegueship were less likely to have depressive symptoms when confronted with job BOs.
(Katsavouni et al., 2016)	Quantitative cross-sectional	To examine the correlation between work-related injuries WRIs, BO, PTSD symptoms in firefighters.	Greece N = 3289	- WRI questionnaire. - MBI - IES-Revised, Greek version.	There was a significant association between WRIs, BO syndrome, PTSD symptoms and age, work experience and physical condition. Relationships were found between PTSD symptoms, the MBI-emotional exhaustion dimension and WRIs and between MBI-depersonalisation dimension and PTSD symptoms.
(Smith et al., 2020)	Quantitative cross-sectional	To examine a hypothesised model that linked stress and BO to diminished safety compliance behaviour, personal protective equipment behaviour, safe work practices, and safety citizenship behaviour.	United States N = 742	- DeJoy Scale. - Malach-Pines Scale. - Personal Protective Equipment Behaviour Scale.	BO, as a stress-related process, negatively impacts firefighter safety behaviour outcomes, which have been linked to occupational injury and illness outcomes. BO not only impacts compliance-oriented behaviours such as following standard operating procedures and properly using

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Table 4 (continued)

AUTHORS	DESIGN	OBJETIVE	CONTEXT	METHOD	RESULTS
(Dyal et al., 2022)	Quantitative cross-sectional	To discover the relationship between occupational stress and perceived sleep health, and the role of BO as a mediator.	United States N = 161	- DeJoy Scale. - Malach-Pines Scale.	personal protective equipment, but also negatively influences safety citizenship behaviours. BO fully mediated the relationship between occupational stress and sleep health. Occupational stress fully mediated the relationship between sleep duration and BO during two of the three sleep duration reference groups. When it comes to firefighters, subjective characteristics of sleep health were affected by occupational stressors and were also dynamically involved in the response to occupational stressors. A moderate correlation between sleep duration and sleep health was identified.
(Michinov, 2022)	Quantitative cross-sectional	To investigate the relationships between conflict management style, emotional intelligence and BO in a sample of firefighters.	France N = 240	- MBI - Rahim Organisational Conflict Inventory-II. - WEIP-S	The integrating conflict style reduced BO. They also revealed the effects of emotion regulation on BO, whereby the awareness and management of one's own emotions reduced BO. Moreover, awareness of one's own emotions moderated the relationship between integrating conflict resolution style and BO.
(Huang et al., 2022)	Quantitative cross-sectional	To examine the role of perceived social support as negatively predicting job BO, and the mediating role of coping strategies in the relationship between perceived social support and job BO.	China N = 340	- MBI - PSSS - CSI	Perceived social support acts through positive coping strategies to reduce job BO in Chinese firefighters. Perceived social support was significantly and negatively correlated with job BO. The effect of perceived social support on alleviating job BO among firefighters was stable over the long-term. Coping strategies mediated between perceived social support and job BO, with coping strategies, including problem-solving, support seeking, and avoidance coping, acting as mediators.
(Ângelo and Chambel, 2015)	Quantitative cross-sectional	To provide longitudinal evidence for the JD-R model; to simultaneously take into account both positive (engagement) and negative (BO) dimensions of well-being among firefighters.	Portugal N = 651	- Organisational demands scale. - Job Content Questionnaire. - MBI - UWES-9	Organisational demands had a positive cross-lagged effect on BO. Supervisory support had a positive cross-lagged effect on work engagement. BO had a positive cross-lagged effect on organisational demands. Work engagement did not have a positive cross-lagged effect on supervisory support. There was evidence of regular, reversed and reciprocal relationships between work characteristics and mental health. Although BO and engagement are traditionally seen as an outcome, this two-wave longitudinal study also suggests that they can be considered as both consequences and causes in the JD-R model.

AIS: Athens Insomnia Scale; BAT: Schaufeli burnout assessment tool; BDHI: Bass–Darky technique; BDI: Beck Depression Inventory; BO: Burnout; CESD-R: Centre for Epidemiological Studies Depression Scale, Revised; CSI: Coping Strategy Indicator; HRQoL: Health-related quality of life; DJGLS: De Jong Gierveld Loneliness Scale; WEIP-S: Workgroup Emotional Intelligence Profile-Short; FSS: Fatigue Severity Scale; GSES: ‘General Self-Efficacy’ Scale; IES: Impact of Event Scale; JD-R: Job Demands-Resources; JD-RQ: Job Demands-Resources Questionnaire; LBQ: ‘Link Burnout’ Questionnaire; MAAS: Mindfulness Attention Awareness Scale; MBI: Maslach Burnout Inventory; OSA: Obstructive Sleep Apnea; OLB: Oldenburg Burnout Inventory; PCL-C: PTSD Checklist-Civilian Version; POMS: Profile of Mood States; PSS: Perceived Stress Scale; PSSS: Perceived Social Support Scale; PTSS: Posttraumatic Stress Symptoms; RSE: Rosenberg Self-Esteem Scale; RS-14: 14-item Resilience Scale; SCCS: Self-concept Clarity Scale; SCID-I: Structured Clinical Interview for DSM-IV Axis I Disorders, PTSD section; SF-8: Short-Form-8 Health Survey; SMBM: Shirom Melamed Burnout Measure; SWD: Satisfaction with Decision; SWLS: Satisfaction With Life Scale; PTSD: post-traumatic stress disorder; UWES-9: Utrecht Work Engagement Scale-9; WAI: Work Ability Index; WAMI: Work and Meaning Inventory; WCC: Ways of Coping Checklist; WHO-5: Five Well Being Index; WHOQOL-26: Quality of Life Scale; WRI: Work-Related Injuries; WRMSD: Work-Related Musculoskeletal Disorders.

explaining that employees with fewer personal resources experience a loss of resources and that this can negatively influence the employee’s psychological well-being.

Self-concept clarity was negatively correlated with firefighters’ burnout, cynicism, and reduced professional efficacy, and positively correlated with firefighters’ resilience and work engagement (Wu et al., 2024). In this sense, greater resilience helps people to successfully adapt to stressful work environments, which reduces job burnout (Shatté et al., 2017). Additionally, collegueship may be a moderating factor for burnout as it reduces the likelihood of developing depressive symptoms

(Cui et al., 2022), as is the case with other professions exposed to high levels of stress, such as those in the healthcare sector (Ranasinghe et al., 2021).

Concerning coping styles, there are discrepancies across the included studies. For Llorens et al. (2022), a proactive coping style is associated with lower levels of burnout, and for Dias et al. (2022) proactive coping style is a personal determinant that can lead to burnout. These differing results could be explained by the different demands that the two samples may be facing. A similar situation applies to age. While for Dias et al. (2022) younger firefighters reported lower levels of burnout than older

firefighters, these results were at odds with previous studies such as the one by Aranda et al. (2019), Maslach et al. (2001) or Stout et al. (2021). The latter finds that firefighters in the middle age bracket (35 and 55 years) are the most likely to develop burnout. A possible explanation for this finding is that, as younger firefighters are usually subordinate to a higher chain of command, they may assume less responsibility for decision making and enjoy more time interacting with their peers and receiving emotional support. Less decision-making responsibility and social support may mitigate the vulnerability of younger firefighters to emotional exhaustion (Dangermond et al., 2022).

This review found that burnout negatively impacts firefighters' health, safety, performance, and quality of practice, resulting in increased occupational injuries and illnesses. Therefore, preventive activities concerning work organisation are needed so as to minimise risk factors and enhance protective factors. Organisations should design interventions and policies to prevent and manage work-related stress, as is the case in other professions (Catapano et al., 2023; International Labour Office, 2012). Activities such as promoting physical activity, providing psychological resources, increasing work ratios, and balancing work and family life can be measures to reduce stressors and thus the development of the burnout syndrome (Mincarone et al., 2024; Naczenski et al., 2017). In the future, research needs to address these factors and search for other related variables. In this context, future studies should explore the long-term effects of burnout prevention strategies and assess their effectiveness in different contexts and countries. In addition, research should focus on identifying new risk and protective factors that may emerge due to changing work demands, technological advances, and changing work environments. A further possible line of research could focus on the use of artificial intelligence to monitor stress in order to establish and articulate early intervention. In addition, comparative studies in different countries and firefighting systems can provide valuable information on best practices to mitigate burnout, so a multi-centre study may allow an assessment of areas where there is less stress and what strategies are being followed.

There are a number of limitations that have been identified in this paper. One limitation lies in the context, as the review does not focus on a particular country, but rather looks at outcomes in a variety of countries around the world. Secondly, as most of the studies included are mainly cross-sectional observational studies, risk factors in a population can be examined at a defined time and place, but no inferences of causality can be made, in addition to the non-representativeness of the samples. Thirdly, not all authors employed the same measurement instruments, so the results may not be homogeneous. Certain aspects were found to be controversial, either because they constitute both a risk factor and a protective factor, or because the results found in the studies under review contradict previous research.

5. Conclusions

This review identified a range of factors that influence the development of burnout among firefighters. On the risk side, elements such as years of service, low self-compassion, language barriers, alcohol use, age, various coping styles (both proactive and negative), work and perceived stress, compassion fatigue, a history of mental health issues, family responsibilities, dissatisfaction with living standards, loneliness, sleep disorders, and the burden of wearing a work uniform all contribute to the likelihood of burnout. Conversely, protective factors like proactive coping, strong social support, clear self-concept, and resilience play crucial roles in shielding firefighters from burnout.

Burnout does not occur in isolation—it deeply impacts firefighters' performance, endangering both their physical and mental well-being. The ripple effects extend beyond the individual, affecting their families and the broader community. Given the clear connection between burnout and its serious consequences, it's critical to explore further how variables such as age, race, and gender might influence the degree of burnout or contribute to its occurrence. Understanding these dynamics

will be key to developing targeted interventions that protect those who serve in such high-pressure roles.

6. Authorship statement

All authors listed meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors, and all authors agree with the manuscript.

CRediT authorship contribution statement

Juan Jesús García-Iglesias: Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ana María Bermejo-Ramírez:** Writing – original draft, Visualization, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Krzysztof Goniewicz:** Writing – review & editing, Supervision, Software, Resources, Project administration, Investigation, Formal analysis, Data curation. **Francisco Javier Fernández-Carrasco:** Writing – review & editing, Visualization, Validation, Resources, Methodology, Investigation, Formal analysis, Conceptualization. **Carlos Gómez-Salgado:** Writing – original draft, Visualization, Software, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Juan Carlos Camacho-Vega:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Juan Gómez-Salgado:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

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Declaration of competing interest

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

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssci.2025.106831>.

Data availability

Data are available online as supplemental material of the present article. Additional data and materials related to the systematic review are available from the corresponding author.

References

- Ángelo, R.P., Chambel, M.J., 2015. The reciprocal relationship between work characteristics and employee burnout and engagement: a longitudinal study of firefighters. *Stress. Health* 31, 106–114. <https://doi.org/10.1002/SMI.2532>.
- Aranda, M., Zappalà, S., Topa, G., 2019. Motivations for Volunteerism, Satisfaction, and Emotional Exhaustion: The Moderating Effect of Volunteers' Age. *Sustainability* 2019, Vol. 11, Page 4477 11, 4477. <https://doi.org/10.3390/SU11164477>.
- Bakker, A.B., Demerouti, E., Sanz-Vergel, A.I., 2014. Burnout and Work Engagement: The JD-R Approach. *Annu. Rev. Organ. Psychol. Organ. Behav* 1, 389–411. <https://doi.org/10.1146/annurev-orgpsych-031413-091235>.

- Barger, L.K., Lockley, S.W., Rajaratnam, S.M.W., Landrigan, C.P., 2009. Neurobehavioral, health, and safety consequences associated with shift work in safety-sensitive professions. *Curr. Neurol. Neurosci. Rep.* 9, 155–164. <https://doi.org/10.1007/S11910-009-0024-7>.
- Bastug, G., Ergul-Topcu, A., Ozel-Kizil, E.T., Ergun, O.F., 2019. Secondary Traumatization and Related Psychological Outcomes in Firefighters. *J. Loss Trauma* 24, 143–158. <https://doi.org/10.1080/15325024.2018.1560898>.
- Benedek, D.M., Fullerton, C., Ursano, R.J., 2007. First responders: mental health consequences of natural and human-made disasters for public health and public safety workers. *Annu. Rev. Public Health* 28, 55–68. <https://doi.org/10.1146/ANNUREV.PUBLHEALTH.28.021406.144037>.
- Benjet, C., Bromet, E., Karam, E.G., Kessler, R.C., McLaughlin, K.A., Ruscio, A.M., Shahly, V., Stein, D.J., Petukhova, M., Hill, E., Alonso, J., Atwoli, L., Bunting, B., Bruffaerts, R., Caldas-De-Almeida, J.M., De Girolamo, G., Florescu, S., Gureje, O., Huang, Y., Lepine, J.P., Kawakami, N., Kovess-Masfety, V., Medina-Mora, M.E., Navarro-Mateu, F., Piazza, M., Posada-Villa, J., Scott, K.M., Shalev, A., Slade, T., Ten Have, M., Torres, Y., Viana, M.C., Zarkov, Z., Koenen, K.C., 2016. The epidemiology of traumatic event exposure worldwide: results from the World Mental Health Survey Consortium. *Psychol. Med.* 46, 327–343. <https://doi.org/10.1017/S0033291715001981>.
- Bianchi, R., Boffy, C., Hingray, C., Truchot, D., Laurent, E., 2013. Comparative symptomatology of burnout and depression. *J. Health Psychol.* 18, 782–787. <https://doi.org/10.1177/1359105313481079>.
- Braveman, P., Gottlieb, L., 2014. The Social Determinants of Health: It's Time to Consider the Causes of the Causes. *Public Health Rep.* 129, 19. <https://doi.org/10.1177/003335491412915206>.
- Catapano, P., Cipolla, S., Sampogna, G., Perris, F., Luciano, M., Catapano, F., Fiorillo, A., 2023. Organizational and Individual Interventions for Managing Work-Related Stress in Healthcare Professionals: A Systematic Review. *Medicina (lithuania)* 59, 1866. <https://doi.org/10.3390/MEDICINA59101866/S1>.
- Chatzea, V.E., Sifaki-Pistolla, D., Vlachaki, S.A., Melidoniotis, E., Pistolla, G., 2018. PTSD, burnout and well-being among rescue workers: Seeking to understand the impact of the European refugee crisis on rescuers. *Psychiatry Res.* 262, 446–451. <https://doi.org/10.1016/J.PSYCHRES.2017.09.022>.
- Chen, J., Li, W., An, Y., Zhang, Y., Du, J., Xu, W., 2022a. Perceived social support mediates the relationships of dispositional mindfulness to job burnout and posttraumatic stress disorder among chinese firefighters. *Psychol. Trauma* 14, 1117–1121. <https://doi.org/10.1037/TRA0000534>.
- Chen, Y., Li, X., Chen, C., An, Y., Shi, J., Huang, J., Zhao, Y., 2022b. Influence of Avoidant Coping on Posttraumatic Stress Symptoms and Job Burnout Among Firefighters: The Mediating Role of Perceived Social Support. *Disaster Med. Public Health Prep.* 16, 1476–1481. <https://doi.org/10.1017/DMP.2021.155>.
- Cooklin, A.R., Dinh, H., Strazdins, L., Westrupp, E., Leach, L.S., Nicholson, J.M., 2016. Change and stability in work-family conflict and mothers' and fathers' mental health: Longitudinal evidence from an Australian cohort. *Soc Sci Med* 155, 24–34. <https://doi.org/10.1016/J.SOCSCIMED.2016.02.036>.
- Crombez-Bequet, N., Legrand, F., 2024. Enhancing firefighters' mental health with exercise: Evaluating the effects of a 7-week long physical activity intervention on burnout and other well-being related constructs. *Ment. Health Phys. Act.* 27. <https://doi.org/10.1016/J.MHPA.2024.100617>.
- Crombez-Bequet, N., Schiffer, F., Legrand, F., 2024. Assessment of the condition of psychic health of French firefighters: Burnout. *Encephale* 50, 284–288. <https://doi.org/10.1016/J.ENCEP.2023.06.018>.
- Cui, L., Huang, N., Bai, Y., Fu, M., Zia, S., Guo, J., 2022. The Relationship Between Job Burnout and Depressive Symptoms Among Chinese Firefighters: Colleagueship as a Moderator. *J. Occup. Environ. Med.* 64, 659–664. <https://doi.org/10.1097/JOM.0000000000002555>.
- Dangermond, K., Weewer, R., Duynndam, J., Machielse, A., 2022. "The problem hasn't changed, but you're no longer left to deal with it on your own": The role of informal peer support in helping firefighters cope with critical incidents. *International Journal of Emergency Services* 11, 300–311. <https://doi.org/10.1108/IJES-02-2021-0007>.
- De Carvalho, T.G.S., Araújo, L.F., Lima, E.D.P., De Andrade, A.L.A., Bastos, M.L.A., Lacerda, E.M., Ferreira, M.J.M., 2021. Burden and protection. Heterogeneous Effects of Occupational and Operational Stressors on Burnout Dimensions Among Firefighters. *J. Occup. Environ. Med.* 63, E899–E904. <https://doi.org/10.1097/JOM.0000000000002398>.
- Dias, P.C., Oliveira, Í.M., Rodrigues, A., Peixoto, R., 2022. Burnout: personal and work factors in volunteer and career firefighters. *Int. J. Organ. Anal.* 31, 17–34. <https://doi.org/10.1108/IJOA-05-2022-3278>.
- Dyal, M.A.A., Smith, T.D., DeJoy, D.M., Moore, B.A., 2022. Occupational Stress and Burnout in the Fire Service: Examining the Complex Role and Impact of Sleep. *Health. Behav. Modif.* 46, 374–394. <https://doi.org/10.1177/01454455211040049>.
- Fullerton, C.S., Ursano, R.J., Wang, L., 2004. Acute stress disorder, posttraumatic stress disorder, and depression in disaster or rescue workers. *Am. J. Psychiatry* 161, 1370–1376. <https://doi.org/10.1176/APPI.AJP.161.8.1370>.
- Garmendia, P., Fernández-Salineró, S., Holgueras González, A.I., Topa, G., 2023. Social Support and Its Impact on Job Satisfaction and Emotional Exhaustion. *Eur J Investig Health Psychol Educ* 13, 2827. <https://doi.org/10.3390/EJHP13120195>.
- Haddock, C.K., Sue Day, R., Poston, W.S.C., Jahnke, S.A., Jitmarin, N., 2015. Alcohol use and caloric intake from alcohol in a national cohort of U.S. career firefighters. *J. Stud. Alcohol Drugs* 76, 360–366. <https://doi.org/10.15288/JSAD.2015.76.360>.
- Hobfoll, S.E., 1989. Conservation of resources. A new attempt at conceptualizing stress. *Am. Psychol.* 44, 513–524. <https://doi.org/10.1037//0003-066X.44.3.513>.
- Huang, J., Wang, X., Li, W., An, Y., 2019. The relationship between conscientiousness and posttraumatic stress disorder among young Chinese firefighters: The mediating effect of perceived social support. *Psychiatry Res.* 273, 450–455. <https://doi.org/10.1016/J.PSYCHRES.2019.01.053>.
- Huang, Q., An, Y., Li, X., 2022. Coping strategies as mediators in the relation between perceived social support and job burnout among Chinese firefighters. *J. Health Psychol.* 27, 363–373. <https://doi.org/10.1177/1359105320953475>.
- Igboanugo, S., Bigelow, P.L., Mielke, J.G., 2021. Health outcomes of psychosocial stress within firefighters: A systematic review of the research landscape. *J. Occup. Health* 63, 12219. <https://doi.org/10.1002/1348-9585.12219>.
- International Labour Office Stress prevention at work checkpoints 2012 Geneva.
- Jeung, D.-Y., Chang, Sei-Jin, Jeung, D.-Y., Chang, S.-J., 2021. Moderating Effects of Organizational Climate on the Relationship between Emotional Labor and Burnout among Korean Firefighters. *International Journal of Environmental Research and Public Health* 2021, Vol. 18, Page 914 18, 914. <https://doi.org/10.3390/IJERPH18030914>.
- Jin, J., Yuan, G.F., An, Y., 2024. Latent profiles and transition of job burnout and their relationship with dispositional mindfulness and reappraisal among firefighters in China. *Pers Individ Dif* 221. <https://doi.org/10.1016/j.paid.2024.112544>.
- Jo, I., Lee, S., Sung, G., Kim, M., Lee, S., Park, J., Lee, K., 2018. Relationship between burnout and PTSD symptoms in firefighters: the moderating effects of a sense of calling to firefighting. *Int Arch Occup Environ Health* 91, 117–123. <https://doi.org/10.1007/S00420-017-1263-6>.
- Katsavouni, F., Bebetos, E., Malliou, P., Beneka, A., 2016. The relationship between burnout, PTSD symptoms and injuries in firefighters. *Occup. Med. (Lond.)* 66, 32–37. <https://doi.org/10.1093/OCCMED/KQV144>.
- Khoshakhlagh, A.H., Al Sulaie, S., Mirzahosseinejad, M., Yazdanirad, S., Orr, R.M., Laal, F., Bamel, U., 2024a. Occupational stress and musculoskeletal disorders in firefighters: the mediating effect of depression and job burnout. *Sci. Rep.* 14, 4649. <https://doi.org/10.1038/S41598-024-55468-W>.
- Khoshakhlagh, A.H., Sulaie, S.A., Yazdanirad, S., Orr, R.M., Laal, F., 2024b. Relationships between job stress, post-traumatic stress and musculoskeletal symptoms in firefighters and the role of job burnout and depression mediators: a bayesian network model. *BMC Public Health* 24, 1–13. <https://doi.org/10.1186/S12889-024-17911-5/TABLES/5>.
- Kim, R., Ha, J.H., Jue, J., 2020. The moderating effect of compassion fatigue in the relationship between firefighters' burnout and risk factors in working environment. *J. Risk Res.* 23, 1491–1503. <https://doi.org/10.1080/13669872.2020.1738529>.
- Klimley, K.E., Van Hasselt, V.B., Stripling, A.M., 2018. Posttraumatic Stress Disorder in Police, Firefighters, and Emergency Dispatchers. *Aggress. Violent Behav.* 43, 33. <https://doi.org/10.1016/j.avb.2018.08.005>.
- Krok, D., 2016. Can meaning buffer work pressure? An exploratory study on styles of meaning in life and burnout in firefighters. *Arch. Psychiatry Psychother.* 18, 31–42. <https://doi.org/10.12740/APP/62154>.
- Kyron, M.J., Rees, C.S., Lawrence, D., Carleton, R.N., McEvoy, P.M., 2021. Prospective risk and protective factors for psychopathology and wellbeing in civilian emergency services personnel: a systematic review. *J. Affect. Disord.* 281, 517–532. <https://doi.org/10.1016/J.JAD.2020.12.021>.
- Llorens, S., Salanova, M., Chambel, M.J., Torrente, P., Ángel, R.P., 2022. Organizational Drivers of Burnout and Work Engagement: A Multilevel Study in Portuguese Firefighter Brigades. *Int. J. Environ. Res. Public Health* 19. <https://doi.org/10.3390/IJERPH19074053>.
- Lv, G., Li, J., Xu, Q., Zhang, H., Wu, W., Fan, X., Wang, Z., Liu, H., 2024. The influence of firefighters' perceived stress on job burnout: a moderated mediation model. *Curr. Psychol.* 43, 8874–8884. <https://doi.org/10.1007/s12144-023-05069-z>.
- Makara-Studzinska, M., Golonka, K., Izdorzcyk, B., 2019. Self-Efficacy as a Moderator between Stress and Professional Burnout in Firefighters. *Int. J. Environ. Res. Public Health* 16. <https://doi.org/10.3390/IJERPH16020183>.
- Makara-Studzinska, M., Wajda, Z., Lizinczyk, S., 2020. Years of service, self-efficacy, stress and burnout among Polish firefighters. *Int. J. Occup. Med. Environ. Health* 33, 283–297. <https://doi.org/10.13075/IJOMEH.1896.01483>.
- Maslach, C., Leiter, M.P., 2016. Understanding the burnout experience: Recent research and its implications for psychiatry. *World Psychiatry* 15, 103–111. <https://doi.org/10.1002/wps.20311>.
- Maslach, C., Schaufeli, W.B., Leiter, M.P., 2001. Job burnout. *Annu. Rev. Psychol.* 52, 397–422. <https://doi.org/10.1146/ANNUREV.PSYCH.52.1.397>.
- Meyer, E.C., Zimering, R., Daly, E., Knight, J., Kamholz, B.W., Gulliver, S.B., 2012. Predictors of posttraumatic stress disorder and other psychological symptoms in trauma-exposed firefighters. *Psychol. Serv.* 9, 1–15. <https://doi.org/10.1037/A0026414>.
- Michinov, E., 2022. The Moderating Role of Emotional Intelligence on the Relationship Between Conflict Management Styles and Burnout among Firefighters. *Saf. Health Work* 13, 448–455. <https://doi.org/10.1016/J.SHAH.2022.07.001>.
- Mincaroni, P., Bodini, A., Tumolo, M.R., Sabina, S., Colella, R., Mannini, L., Sabato, E., Leo, C.G., 2024. Association Between Physical Activity and the Risk of Burnout in Health Care Workers: Systematic Review. *JMIR Public Health Surveill.* 10, e49772. <https://doi.org/10.2196/49772>.
- Montano, D., Reeske, A., Franke, F., Hüffmeier, J., 2017. Leadership, followers' mental health and job performance in organizations: A comprehensive meta-analysis from an occupational health perspective. *J. Organ. Behav.* 38, 327–350. <https://doi.org/10.1002/JOB.2124>.
- Munn, Z., Stern, C., Aromataris, E., Lockwood, C., Jordan, Z., 2018. What kind of systematic review should I conduct? A proposed typology and guidance for systematic reviewers in the medical and health sciences. *BMC Med. Res. Method.* 18. <https://doi.org/10.1186/S12874-017-0468-4>.
- Naczenski, L.M., de Vries, J.D., van Hooft, M.L.M., Kompier, M.A.J., 2017. Systematic review of the association between physical activity and burnout. *J. Occup. Health* 59, 477. <https://doi.org/10.1539/JOH.17-0050-RA>.

- National Institute for Occupational Safety and Health, 2023. Firefighter Resources - Job Hazards [WWW Document]. National Institute for Occupational Safety and Health. URL <https://www.cdc.gov/niosh/firefighters/hazard.html> (accessed 7.8.24).
- Page, M.J., McKenzie, J.E., Bossuyt, P., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P., Moher, D., 2021. The prisma 2020 statement: An updated guideline for reporting systematic reviews. *Medicina Fluminensis*. https://doi.org/10.21860/medflum2021_264903.
- Pearson, A., Jordan, Z., 2010. Evidence-based healthcare in developing countries. *Int. J. Evid. Based Healthc.* 8, 97–100. <https://doi.org/10.1111/J.1744-1609.2010.00164.X>.
- del Pérez-Fuentes, M., C., Jurado, M. del M.M., Martínez, Á.M., Linares, J.J.G., 2019. Burnout and Engagement: Personality Profiles in Nursing Professionals. *J. Clin. Med.* 8. <https://doi.org/10.3390/JCM8030286>.
- Potter, G.D.M., Skene, D.J., Arendt, J., Cade, J.E., Grant, P.J., Hardie, L.J., 2016. Circadian Rhythm and Sleep Disruption: Causes, Metabolic Consequences, and Countermeasures. *Endocr. Rev.* 37, 584. <https://doi.org/10.1210/ER.2016-1083>.
- Pyatibrat, A.O., Sannikov, M.V., Tsikunova, N.S., 2024. Comparative analysis of the psychological status of the EMERCOM of Russia State Fire Service employees in correlation with work experience. *Medico-Biological and Socio-Psychological Issues of Safety in Emergency Situations* 65–71. <https://doi.org/10.25016/2541-7487-2024-0-1-65-71>.
- Ranasinghe, P.D., Owusu, J.T., Bertram, A., Michtalik, H., Yeh, H.C., Cofrancesco, J., Levine, D., Miller, E.R., Marinopoulos, S., 2021. Depressive Symptoms and Burnout Among Medical Students: A Prospective Study. *J. Gen. Intern. Med.* 37, 64. <https://doi.org/10.1007/S11606-021-06765-X>.
- Rassolian, M., Peterson, L.E., Fang, B., Knight, H.C., Peabody, M.R., Baxley, E.G., Mainous, A.G., 2017. Workplace Factors Associated With Burnout of Family Physicians. *JAMA Intern. Med.* 177, 1036. <https://doi.org/10.1001/JAMAINTERNMED.2017.1391>.
- Rattrie, L.T.B., Kittler, M.G., Paul, K.I., 2019. Culture, Burnout, and Engagement: A Meta-Analysis on National Cultural Values as Moderators in JD-R Theory. *Appl. Psychol.* 69, 176–220. <https://doi.org/10.1111/APPS.12209>.
- Regehr, C., Hill, J., Glancy, G.D., 2000. Individual predictors of traumatic reactions in firefighters. *J. Nerv. Ment. Dis.* 188, 333–339. <https://doi.org/10.1097/00005053-200006000-00003>.
- Roşca, A.C., Mateizer, A., Dan, C.I., Demerouti, E., 2021. Job Demands and Exhaustion in Firefighters: The Moderating Role of Work Meaning. *A Cross-Sectional Study*. *Int. J. Environ. Res. Public Health* 18. <https://doi.org/10.3390/IJERPH18189819>.
- Rössler, W., Hengartner, M.P., Ajdacic-Gross, V., Angst, J., 2015. Predictors of burnout: results from a prospective community study. *Eur. Arch. Psychiatry Clin. Neurosci.* 265, 19–25. <https://doi.org/10.1007/S00406-014-0512-X>.
- Salvagioni, D.A.J., Melanda, F.N., Mesas, A.E., González, A.D., Gabani, F.L., De Andrade, S.M., 2017. Physical, psychological and occupational consequences of job burnout: A systematic review of prospective studies. *PLoS One* 12. <https://doi.org/10.1371/JOURNAL.PONE.0185781>.
- Shahwan, S., Tay, E.H., Shafie, S., Tan, Y.B., Gunasekaran, S., Tan, R.H.S., Satghare, P., Zhang, Y., Wang, P., Tan, S.C., Subramaniam, M., 2024. The protective role of resilience and social support against burnout during the COVID-19 pandemic. *Front. Public Health* 12, 1374484. <https://doi.org/10.3389/FPUBH.2024.1374484/FULL>.
- Shatté, A., Perlman, A., Smith, B., Lynch, W.D., 2017. The Positive Effect of Resilience on Stress and Business Outcomes in Difficult Work Environments. *J. Occup. Environ. Med.* 59, 135. <https://doi.org/10.1097/JOM.0000000000000914>.
- Shin, H., Park, Y.M., Ying, J.Y., Kim, B., Noh, H., Lee, S.M., 2014. Relationships between coping strategies and burnout symptoms: A meta-analytic approach. *Prof Psychol Res Pr* 45, 44–56. <https://doi.org/10.1037/A0035220>.
- Smith, E., Velazquez-Pimentel, D., Trockels, A., 2019a. Posttraumatic Stress Disorder And Sleep Quality Among Urban Firefighters In Thailand – [Letter]. *Nat. Sci. Sleep* 11, 217. <https://doi.org/10.2147/NSS.S229181>.
- Smith, T.D., DeJoy, D.M., Dyal, M.A., (Aimee), Huang, G., 2019b. Impact of work pressure, work stress and work-family conflict on firefighter burnout. *Arch. Environ. Occup. Health* 74, 215–222. <https://doi.org/10.1080/19338244.2017.1395789>.
- Smith, T.D., Hughes, K., DeJoy, D.M., Dyal, M.-A., 2017. Assessment of relationships between work stress, work-family conflict, burnout and firefighter safety behavior outcomes. <https://doi.org/10.1016/j.ssci.2017.12.005>.
- Smith, T.D., Mullins-Jaime, C., Dyal, M.A., DeJoy, D.M., 2020. Stress, burnout and diminished safety behaviors: An argument for Total Worker Health® approaches in the fire service. *J. Saf. Res.* 75, 189. <https://doi.org/10.1016/J.JSR.2020.09.010>.
- Stanley, I.H., Hom, M.A., Hagan, C.R., Joiner, T.E., 2015. Career prevalence and correlates of suicidal thoughts and behaviors among firefighters. *J. Affect. Disord.* 187, 163–171. <https://doi.org/10.1016/J.JAD.2015.08.007>.
- Stefanowski, B., Mokros, L., Sienkiewicz-Jaros, H., Baka, L., Bugajska, J., Świtaj, P., 2023. The relationship between occupational burnout and work ability among firefighters: exploring the mediating effects of insomnia, depressive symptoms, loneliness and alcohol misuse. *Advances in Psychiatry and Neurology* 32, 1. <https://doi.org/10.5114/PPN.2023.127181>.
- Stewart, N.H., Arora, V.M., 2019. The Impact of Sleep and Circadian Disorders on Physician Burnout. *Chest* 156, 1022. <https://doi.org/10.1016/J.CHEST.2019.07.008>.
- Stout, R.A., Kostamo, S., West, S., 2021. Burnout, compassion fatigue, and vicarious trauma among wildfire responders. *J Emerg Manag* 19, 451–460. <https://doi.org/10.5055/JEM.0653>.
- Straud, C., Henderson, S.N., Vega, L., Black, R., Van Hasselt, V., 2018. Resiliency and posttraumatic stress symptoms in firefighter paramedics: The mediating role of depression, anxiety, and sleep. *Traumatology (tallahass Fla)* 24, 140–147. <https://doi.org/10.1037/TRM0000142>.
- Tamminga, S.J., Emal, L.M., Boschman, J.S., Levasseur, A., Thota, A., Ruotsalainen, J.H., Schelvis, R.M.C., Nieuwenhuijsen, K., van der Molen, H.F., 2023. Individual-level interventions for reducing occupational stress in healthcare workers. *Cochrane Database Syst. Rev.* 2023. <https://doi.org/10.1002/14651858.CD002892.PUB6>.
- Tummers, L.G., Bakker, A.B., 2021. Leadership and Job Demands-Resources Theory: A Systematic Review. *Front. Psychol.* 12, 722080. <https://doi.org/10.3389/FPSYG.2021.722080/BIBTEX>.
- Vaulerin, J., d'Arripe-Longueville, F., Emile, M., Colson, S.S., 2016. Physical exercise and burnout facets predict injuries in a population-based sample of French career firefighters. *Appl. Ergon.* 54, 131–135. <https://doi.org/10.1016/J.APERGO.2015.12.007>.
- Vinnikov, D., Tulekov, Z., Akylzhanov, A., Romanova, Z., Dushpanova, A., Kalmatayeva, Z., 2019. Age and work duration do not predict burnout in firefighters. *BMC Public Health* 19. <https://doi.org/10.1186/S12889-019-6643-2>.
- Wagner, D., Heinrichs, M., Ehler, U., 1998. Prevalence of symptoms of posttraumatic stress disorder in German professional firefighters. *Am. J. Psychiatry* 155, 1727–1732. <https://doi.org/10.1176/AJP.155.12.1727>.
- Wolkow, A.P., Barger, L.K., O'Brien, C.S., Sullivan, J.P., Qadri, S., Lockley, S.W., Czeisler, C.A., Rajaratnam, S.M.W., 2019. Associations between sleep disturbances, mental health outcomes and burnout in firefighters, and the mediating role of sleep during overnight work: A cross-sectional study. *J. Sleep Res.* 28. <https://doi.org/10.1111/JSR.12869>.
- Wu, P., Liu, T., Li, Q., Yu, X., Liu, Z., Tian, S., 2024. Maintaining the working state of firefighters by utilizing self-concept clarity as a resource. *BMC Public Health* 24. <https://doi.org/10.1186/S12889-024-17896-1>.
- Youn, E.J., 2009. An experiential analysis of burnout in counselors. *Korea J. Couns.* 10, 1855–1871.