Do Resources Buffer Job Demands? Evidence From Firefighters' Burnout and Well-Being

¿Los recursos amortiguan las demandas laborales? Evidencia a partir del agotamiento y el bienestar en bomberos

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Abstract

This cross-sectional study, grounded in the Conservation of Resources Theory, examined the role of personal (PsyCap) and organizational resources (learning opportunities) in relation to job demands and their association with occupational health among Brazilian military firefighters. The study involved a sample of 1,327 participants, 92.46% operational firefighters and 7.54% officers, recruited from 19 Brazilian states via an electronic survey. Two alternative theoretical models were tested: one examining a linear relationship and the other testing moderate effects between resources and demands. The findings were more consistent with the linear model, indicating that PsyCap was negatively associated with burnout and positively associated with well-being, while learning opportunities were associated with lower burnout levels. However, moderated effects were not statistically significant, suggesting that resources were directly related to occupational health outcomes rather than buffering the relationship between demands and outcomes. The results highlight the relevance of PsyCap as a personal resource associated with occupational health. The study also underscores the role of organizational context and work design in shaping the effectiveness of learning opportunities. These findings suggest that interventions aimed at strengthening personal and organizational resources may improve occupational health indicators among high-risk professionals. The research emphasizes the need for context-sensitive approaches given the unique challenges faced by firefighters. By advancing the understanding of resource-based processes, this study contributes to the broader literature on burnout and well-being in high-risk occupations.

Keywords

Psychological capital; job demands; learning opportunities; burnout; well-being.

Resumen

Este estudio transversal, basado en la Teoría de la Conservación de Recursos, analizó el papel de los recursos personales (PsyCap) y organizacionales (oportunidades de aprendizaje) en relación con las demandas laborales, así como su asociación con la salud ocupacional de bomberos militares brasileños. La muestra incluyó a 1327 participantes, de los cuales 92,46 % fueron bomberos operativos y 7,54 % oficiales, provenientes de 19 estados brasileños, mediante una encuesta electrónica. Se probaron dos modelos competidores: uno que evaluaba relaciones lineales y otro que consideraba efectos moderados entre recursos y demandas. Los resultados fueron más consistentes con el modelo lineal, puesto que mostraron que el PsyCap se asoció negativamente con el agotamiento y positivamente con el bienestar, mientras que las oportunidades de aprendizaje se asociaron con niveles más bajos de agotamiento. Los efectos moderados no fueron estadísticamente significativos, lo que sugiere que los recursos se relacionan directamente con los resultados de salud ocupacional y no evidencian un efecto amortiguador sobre la relación entre las demandas y dichos resultados. Los hallazgos resaltan la relevancia del PsyCap como recurso personal vinculado a la salud ocupacional. Además, subrayan cómo el contexto organizacional y el diseño del trabajo influyen en la efectividad de las oportunidades de aprendizaje. Este estudio sugiere que las intervenciones orientadas al fortalecimiento de los recursos personales y organizacionales pueden contribuir a mejorar los indicadores de salud ocupacional en profesiones de alto riesgo. Asimismo, destaca la importancia de enfoques sensibles al contexto que consideren los desafíos específicos que enfrentan los bomberos. Al ampliar la comprensión de los procesos basados en recursos, este trabajo contribuye al debate sobre el agotamiento y el bienestar en ocupaciones de alto riesgo.

Palabras clave

Capital psicológico; demandas laborales; oportunidades de aprendizaje; agotamiento; bienestar.

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Introduction

Stress represents a significant threat to both mental and physical health, particularly in high-demand occupations such as public safety, emergency services, and military roles (Chirico *et al.*, 2020; Hirschle *et al.*, 2019; Rodrigues-Silveira *et al.*, 2023). In these contexts, repeated exposure to stressful events may contribute to psychological disorders, including depression and anxiety, and, in more severe cases, may develop into burnout syndrome or post-traumatic stress disorder (PTSD), ultimately affecting work performance and generating feelings of dissatisfaction and insecurity (Bartlett *et al.*, 2019; Chirico, 2017; De Clercq *et al.*, 2019). The intensification of job demands in many contemporary work settings further amplifies these risks, reinforcing the importance of investigating psychosocial factors that may attenuate these effects (Sandoval-Reyes *et al.*, 2020).

At the same time, research in occupational health has increasingly emphasized well-being as a key indicator of workers' mental health. Well-being refers to the capacity to deal with life and work demands in a healthy and satisfying way (Scaria *et al.*, 2020). Within the framework of Positive Psychology, well-being encompasses five interrelated dimensions—positive emotions, engagement, positive relationships, meaning, and accomplishment—known as the PERMA model (Seligman, 2011). Personal and contextual resources, such as social support, virtues and character strengths, and proactive coping strategies, play an important role in fostering well-being and are associated with lower levels of stress and better occupational health indicators (Ângelo & Chambel, 2014; De Clercq *et al.*, 2019; Tisu *et al.*, 2022).

Given the protective role of resources, scholars have increasingly examined how these factors contribute to both stress prevention and the promotion of well-being in demanding work environments (De Clercq *et al.*, 2019; Rodrigues-Silveira *et al.*, 2023; Tisu *et al.*, 2022). One of the most influential perspectives in this field is the Conservation of Resources Theory (COR), which proposes that stress and well-being result from the balance between job demands and the resources available to cope with them (Hobfoll *et al.*, 2016; Hobfoll *et al.*, 2018). Nevertheless, important gaps remain in understanding how these resources operate in professions characterized by frequent exposure to high demands and limited control over work conditions (Tisu *et al.*, 2022). In particular, the mechanisms by which job demands and resources influence occupational health outcomes—whether through additive (linear) effects or interactive (moderating or buffering) processes, as proposed by COR theory—still require further empirical clarification, especially in high-risk occupations. Within COR theory, flourishing, as operationalized through the PERMA model, can be interpreted as an indicator of resource gain and preservation, reflecting the maintenance and development of valued psychological, social, and personal resources.

In this context, this study investigates the relationship between job demands, job resources, and workers' mental health indicators (well-being and burnout). To this end, two theoretically distinct models of occupational mental health are tested: (1) an additive (linear) model examining the direct effects of job demands and resources and (2) an interaction model testing the moderating role of resources in the relationship between job demands and mental health outcomes, consistent with the buffering mechanism proposed by COR.

According to COR theory, resources may influence occupational health through different mechanisms. One possibility is an additive process, in which job resources and personal resources exert direct effects on well-being and burnout. Another possibility is a buffering process in which resources interact with job demands, attenuating their negative impact. These mechanisms represent theoretically distinct explanations of how resources operate within COR theory, which proposes that resources may either directly affect well-being and burnout or buffer the negative impact of demands. Therefore, the moderating model is not merely a statistical extension of the additive model but represents a theoretically distinct mechanism proposed by COR theory, in which personal resources may change the strength of the relationship between demands and outcomes.

If the linear model is supported, both job demands and resources will exert direct effects on workers' health, indicating that both should be targets of organizational improvements and interventions. Conversely, if

interaction effects are supported, interventions may prioritize the strengthening of personal and contextual resources that help individuals cope with stressful demands. These strategies may be associated with higher levels of well-being and lower levels of burnout even in occupations where control over job demands is limited. Thus, the findings may help inform organizational investments in well-being initiatives for the studied population.

The Additive (Linear) Relationship Between Resources and Job Demands

Professionals working in high-risk occupations, such as military firefighters, face intense operational and organizational demands that are associated with negative mental health outcomes and an increased risk of burnout (Ângelo & Chambel, 2014; Costa *et al.*, 2022; Lambert *et al.*, 2012; Oliveira & Moraes, 2021). For these professionals, psychological and emotional risks arise not only from rescue and firefighting missions but also from the organizational structure of their work (Ângelo & Chambel, 2015). Understanding how these demanding work conditions affect occupational health requires a theoretical framework that explains the relationship between job demands and personal and contextual resources.

COR theory provides a framework by explaining the relationship between job demands and resources. According to this perspective, two main processes may occur: first, sustained exposure to high demands can deplete individual resources and lead to health impairment, such as burnout; second, the availability of sufficient resources can foster adaptive responses and promote positive outcomes, including well-being (Ângelo & Chambel, 2013, 2015; Hobfoll, 1989). From this perspective, stress emerges when workers perceive a threat of resource loss or experience an actual loss due to demanding work conditions, which may be associated with poorer mental health outcomes (Ângelo & Chambel, 2013, 2015; Duran *et al.*, 2019; Sianoja *et al.*, 2018).

Although many operational demands are unpredictable, organizational demands can be modified to improve occupational well-being (Ângelo & Chambel, 2015). Empirical evidence indicates that high job demands are negatively associated with well-being (Ndengu & Leka, 2022). This suggests that demands are associated not only with burnout but also with well-being dimensions described in the PERMA model, which can be understood as positive outcomes resulting from the availability of personal and contextual resources (Seligman, 2011).

The following hypotheses were proposed regarding the relationship between firefighters' job demands and mental health outcomes:

(a) H1a: Job demands are positively related to military firefighters' burnout.

(b) H1b: Job demands are negatively related to military firefighters' well-being.

According to COR, individuals are motivated to acquire resources and therefore invest their available resources to expand their reserves. This process helps protect them from future losses and improve their life prospects and achievements, that is, their overall well-being (Hobfoll, 1989).

The first resource examined in this study is Psychological Capital (PsyCap). PsyCap is defined as a positive psychological state characterized by: (1) self-efficacy—confidence to exert the effort needed to succeed in challenging tasks; (2) optimism—making positive attributions about present and future success; (3) hope—persevering toward goals and redirecting paths when necessary; and (4) resilience—the capacity to recover and continue striving when facing adversity (Luthans *et al.*, 2006).

Empirical studies show a negative association between PsyCap and burnout, particularly the emotional exhaustion dimension (Kotze & Massyn, 2019). Similar findings have been reported in emergency service personnel (Krzeminska *et al.*, 2018), healthcare professionals working in specialized autism services (Manzano-García & Ayala, 2017), and teachers (Moyer *et al.*, 2017).

Studies have also identified the components of PsyCap as important resources for promoting well-being (Kotze & Massyn, 2019; Luthans & Youssef, 2004; van Erp *et al.*, 2018; Vazquez *et al.*, 2018). In organizational contexts, higher levels of PsyCap are associated with positive human resource practices that foster

engagement and reduce cynical, stressful, and anxious behaviors (Kim *et al.*, 2020; Lowery & Cassidy, 2022; Singhal & Rastogi, 2018). Thus, the following hypotheses are proposed:

(c) H2a: PsyCap is negatively related to military firefighters' burnout.

(d) H2b: PsyCap is positively related to military firefighters' well-being.

In addition to personal resources, the model also includes learning opportunities as a contextual resource. Training and skill development can help workers cope with job demands, although their relationship with occupational health remains relatively underexplored (Panari *et al.*, 2010; Watson *et al.*, 2018). Adequate training may help emergency professionals deal with pressure and reduce the risk of PTSD (Nikolova *et al.*, 2014). In stressful contexts, training may prepare professionals to face uncertainty, make decisions, regulate emotions, and maintain occupational health (Karasek, 1979; Karasek & Theorell, 1992). Perceived opportunities for formal or informal learning from colleagues, supervisors, or other sources may therefore help individuals manage demands and emotions, influencing occupational health outcomes (Panari *et al.*, 2010).

Opportunities to use and develop skills have also been identified as predictors of workplace motivation and may positively influence well-being and quality of work life (Silva & Ferreira, 2013). In organizational contexts characterized by chronic stressors, prior training and experience in simulated environments are highly valued before responding to real incidents (van Erp *et al.*, 2018; Young *et al.*, 2014). Experiential learning and training may help firefighters develop the technical and emotional resources needed to handle high-stress situations (Paterson *et al.*, 2014; Regehr, 2009; Scott & Myers, 2005; van den Broeck *et al.*, 2011; van Erp *et al.*, 2018).

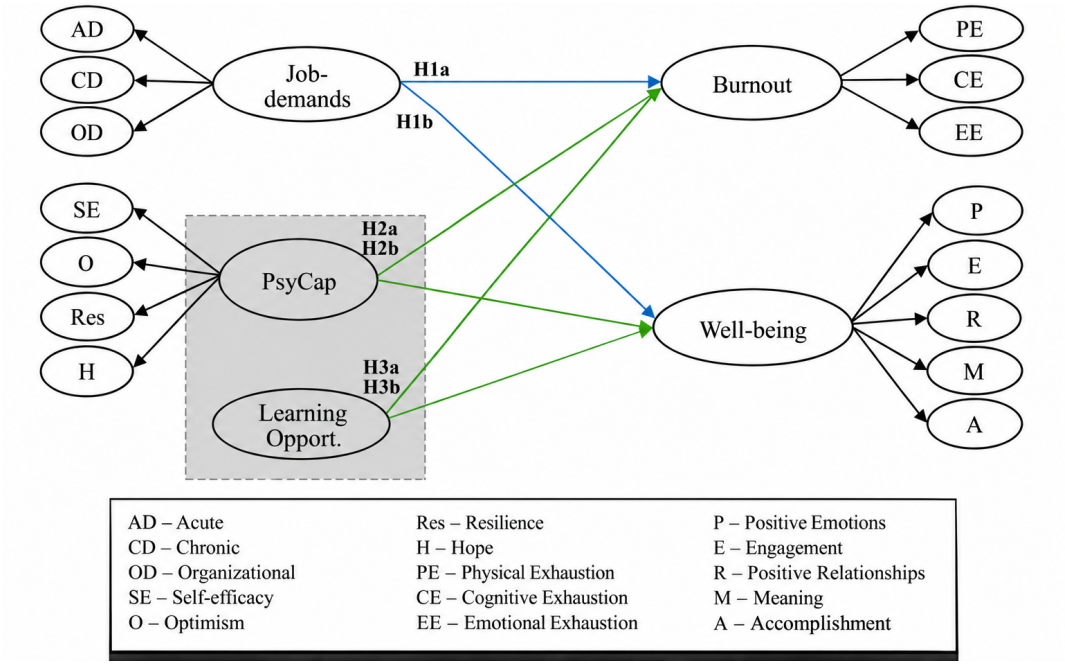
Thus, the following hypotheses are proposed:

(e) H3a: Learning opportunities are negatively related to military firefighters' burnout.

(f) H3b: Learning opportunities are positively related to military firefighters' well-being.

Based on the hypothesized relationships, Model 1 is presented in Figure 1.

Figure 1. Diagram of the Linear Model Showing Job Demands and Resources Relationship



The Interactive Relationship Between Job Demands and Resources

According to COR, individuals invest resources to protect themselves against potential losses from demands and to recover depleted resources (Hobfoll, 1989). The resources available to workers influence their ability to cope with demands and are associated with occupational mental health outcomes (Hobfoll & Ford, 2007; Westman *et al.*, 2004). In stressful situations, resources are therefore considered essential for protecting workers from negative outcomes (van Erp *et al.*, 2018; Xanthopoulou *et al.*, 2007). This buffering mechanism represents a process different from the additive effects of resources, as it assumes that the impact of job demands on health outcomes depends on the level of resources available to the individual (Hobfoll, 1989; Hobfoll *et al.*, 2018).

Personal resources, such as PsyCap and its dimensions, may play a moderating role in demanding situations, such as those faced by military firefighters (Duran *et al.*, 2018; Lowery & Cassidy, 2022; Moyer *et al.*, 2017; Souza *et al.*, 2015). Characteristics such as self-efficacy, resilience, and optimism are associated with lower perceived stress and burnout (Chitra & Karunanidhi, 2018; Clauss *et al.*, 2018; Duran *et al.*, 2018; Matthews & Ritter, 2019; Sanford *et al.*, 2017; Souza *et al.*, 2015). Evidence from Chinese police officers shows that individuals with higher PsyCap can recover resources in stressful situations and are less prone to stress symptoms and work withdrawal (Siu *et al.*, 2015). In addition, PsyCap has been shown to buffer the effects of stressors on well-being (Darvishmotevali & Ali, 2020). These findings are consistent with the COR assumption that personal resources may reduce the negative impact of demands by altering the relationship between stressors and health outcomes, rather than only exerting direct effects.

Learning opportunities may also serve as contextual resources that influence workers' health. Training may prepare firefighters to deal with emotionally demanding situations and regulate negative emotions (Regehr, 2009). Learning at work may also enable individuals to better cope with stressors and unexpected events (Zhang *et al.*, 2018). The availability of learning opportunities may reduce the impact of stressors on well-being (van den Broeck *et al.*, 2011), while workplace and informal learning may help workers cope with stressful events (Van Hootegem *et al.*, 2019). Furthermore, a learning orientation can moderate the relationship between stressors and job performance, promoting innovation (Peng *et al.*, 2019). From the perspective of COR, contextual resources may serve as protective factors that moderate the relationship between job demands and occupational health indicators, supporting the buffering hypothesis.

Given theoretical and empirical evidence that resources may buffer the effects of stressful demands, representing a mechanism distinct from the additive effects proposed in the previous model, the following hypotheses are proposed:

(g) H4a: PsyCap moderates the relationship between perceived stressful job demands and burnout (i.e., the higher the PsyCap, the weaker the positive relationship between stressful demands and burnout).

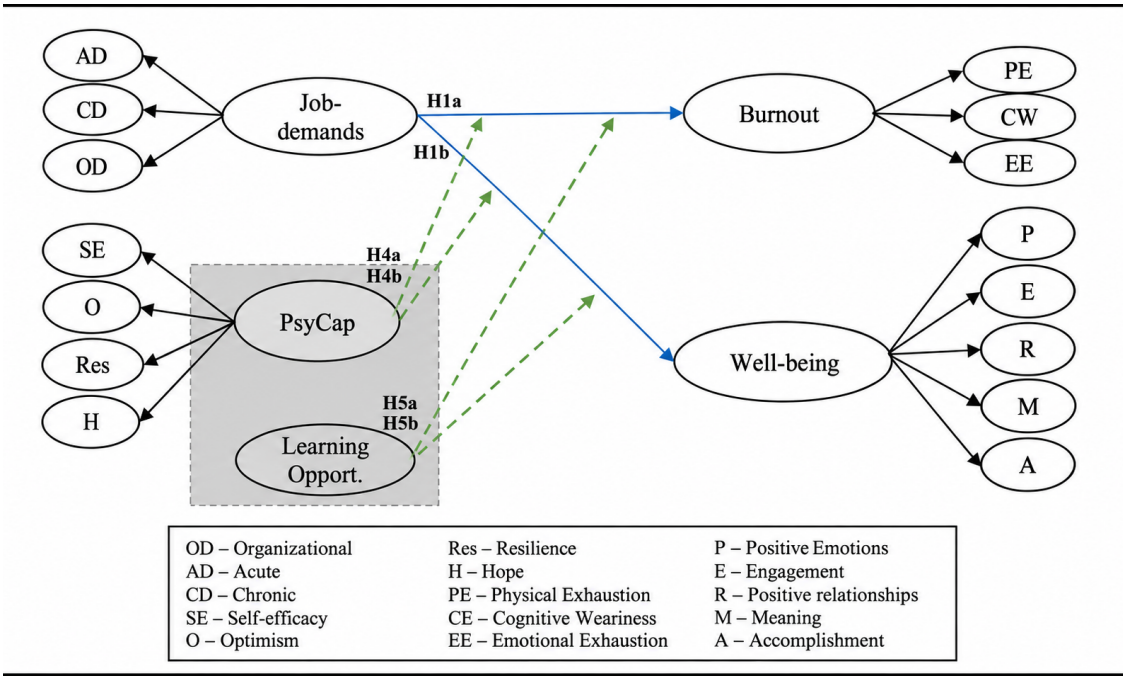
(h) H4b: PsyCap moderates the relationship between perceived job demands as stressful and well-being (i.e., the higher the PsyCap, the weaker the negative relationship between stressful demands and well-being).

(i) H5a: Perceived learning opportunities moderate the relationship between perceived job demands as stressful and burnout (i.e., the higher the perceived learning opportunities, the weaker the positive relationship between stressful demands and burnout).

(j) H5b: Perceived learning opportunities moderate the relationship between perceived stressful job demands and well-being (i.e., the higher the perceived learning opportunities, the weaker the negative relationship between stressful demands and well-being).

Based on hypothesized relationships, Model 2 is presented in Figure 2, representing an alternative theoretical explanation in which resources moderate the relationship between job demands and occupational health outcomes.

Figure 2. Moderated Model Depicting the Interaction Between Job Demands and Resources



By identifying and testing alternative models representing different structural relationships, theoretical contributions can be advanced (Hair *et al.*, 2010). Accordingly, this study extends the research of Ângelo and Chambel (2014, 2015) by examining the role of PsyCap and learning opportunities within the framework of COR theory. Specifically, the study tests whether job demands and resources are related to occupational health through direct effects or through interaction processes, as suggested in previous theoretical formulations. The two models presented above were tested, and their results were compared to address the proposed objectives.

Target Population

Frontline workers—nurses, doctors, and firefighters—are often the first responders in emergencies and frequently perform tasks that involve close physical contact and require emotional regulation (Oliveira *et al.*, 2023; Sinden *et al.*, 2020). As work pressure increases in these occupations, greater attention to well-being and mental health has become increasingly important (Sinden *et al.*, 2020; Unadkat & Farquhar, 2020).

Research on effective approaches to address mental health disorders among firefighters, including PTSD, remains limited, and the available evidence on interventions aimed at improving their mental health is still scarce (Sinden *et al.*, 2020). At the same time, previous studies suggest that firefighters do not always exhibit long-term declines in well-being (Ângelo & Chambel, 2014; Scott & Myers, 2005). According to COR theory, this pattern may be associated with the dynamic relationship between job demands and available resources and their link to occupational health indicators (Ângelo & Chambel, 2013, 2014, 2015).

Recent empirical studies on firefighters' occupational health have mainly examined the relationship between job demands and resources using indicators of illness or dysfunctional outcomes and have only indirectly inferred implications for promoting well-being (Duran *et al.*, 2019). Because emergency response contexts offer limited opportunity for prior intervention, preparation becomes particularly relevant. Learning opportunities as contextual resources and PsyCap as a personal resource may therefore be associated with higher well-being and lower burnout in demanding occupational contexts.

Method

Study Type and Design

This is a cross-sectional study based on the COR Theory. The research applied a quantitative approach, employing validated psychometric instruments to collect data from a sample of 1,327 Brazilian military firefighters. The study aligns with the criteria for a cross-sectional observational design, focusing on identifying relationships between job demands, personal and organizational resources, and occupational health outcomes, specifically burnout and well-being. Given the cross-sectional design, the study examines associations between variables and does not allow causal inferences.

The methodology follows the guidelines of Hair *et al.* (2010), ensuring methodological rigor in data collection and analysis, and emphasizes cultural and linguistic adaptation procedures for all instruments used to effectively address the Brazilian context.

Participants and Procedures

All military firefighting corps from the 26 Brazilian states and the Federal District were invited to participate and to disseminate the survey within their units. All variables were collected through an electronic self-report questionnaire administered at a single time point (Hair *et al.*, 2010).

A total of 1,668 valid responses were obtained. Based on the study objectives and inclusion criteria, firefighters who reported working exclusively in administrative roles were excluded, as the study focused on professionals exposed to operational demands. The final sample consisted of 1,327 participants from 19 Brazilian states. Of these, 1,227 were operational firefighters (92.46%), and 100 were officers (7.54%). In addition, 49% worked in cities with fewer than 100,000 residents, 80% were between 26 and 45 years old, and less than 1% were women.

Instruments

Five instruments were used for data collection. All instruments were subjected to Exploratory and Confirmatory Factor Analysis (CFA). The criteria adopted for scale retention were: reliability assessed by Cronbach's alpha (α) and McDonald's hierarchical omega (ωH), with expected values above .70; KMO above .80; and factor loadings above .50 (Hair *et al.*, 2010).

Burnout was assessed using the Shirom–Melamed Burnout Measure (SMBM), which conceptualizes burnout through three dimensions: Physical Fatigue (PF), defined as a reduction in physical energy; Emotional Exhaustion (EE), referring to emotional fatigue in interpersonal relationships; and Cognitive Fatigue (CF), defined as reduced thinking and concentration ability (Shirom & Melamed, 2006). The instrument was translated into European Portuguese by Gomes (2012).[1] The scale contains 14 items measured on a seven-point Likert scale (1 = *never*; 7 = *always*). Reliability indices were satisfactory (ωH = .86; KMO = .95). Internal consistency for each dimension was: PF α = .94 (e.g., "*I feel tired*"), CF α = .97 (e.g., "*I have difficulty concentrating*"), and EE α = .88 (e.g., "*I feel I am unable to be sensitive to the needs of coworkers and recipients*").

Well-being was measured using the Brazilian version of the PERMA-Profiler Flourishing Scale (Butler & Kern, 2016; Carvalho, 2020). The instrument includes five dimensions, each measured by three items, for a total of 15 items. Responses were recorded on a seven-point Likert scale (1 = *never*; 7 = *always*). The scale showed good reliability (ωH = .83; KMO = .93). Internal consistency for each dimension was: Positive Emotions (α = .94; e.g., "*How often do you generally feel happy?*"), Engagement (α = .74; e.g., "*How often do you get deeply involved in what you're doing?*"), Positive Relationships (α = .83; e.g., "*How much help and support do you get from others when you need it?*"), Meaning (α = .92; e.g., "*How meaningful and purposful is your life in general?*"), and

1 The translation into Brazilian Portuguese followed the methodology proposed by Beaton et al. (2000), which involved an initial translation by two bilingual translators, synthesis of the translations, back-translation of the consensual version into the original language, and evaluation by two experts. Subsequently, the complete instrument was sent for pre-testing, with no adjustments required. After this, the official data collection process was conducted.

Accomplishment (α = .83; e.g., "*How often do you feel you're progressing towards your goals?*"). The instrument maintained its original five-factor structure.

Demands were determined using the Brazilian Military Firefighters' Professional Demands Scale (PDS-MF-BR), originally developed by Ângelo and Chambel (2014) and adapted and validated for this study (Costa *et al.*, 2022). The instrument operationalizes organizational, acute, and chronic demands experienced by firefighters. The scale includes 11 items distributed across three dimensions: organizational (4 items; α = .77; e.g., "*Do you feel your life is in danger while carrying out your duties as a firefighter?*"), acute (3 items; α = .73; e.g., "*Incident with a dead child*"), and chronic (4 items; α = .79; e.g., "*Perceiving or suffering abuse of authority from a hierarchical superior*"). Responses were given on a seven-point Likert scale (1 = *very rarely*; 7 = *very frequently*). Overall reliability indices were satisfactory (ωH = .73; KMO = .81), with factor loadings above .50.

PsyCap was measured using the Psychological Capital Questionnaire (PCQ) (Luthans *et al.*, 2007). The shortened version (PCQ-12), validated for the Brazilian population by Kamei *et al.* (2018), was used. The second-order construct comprises four dimensions: Self-efficacy (3 items; α = .87; e.g., "*I feel confident when seeking a solution to a long-term problem*"), Hope (4 items; α = .89; e.g., "*I can think of many ways to reach my goals at work*"), Resilience (3 items; α = .81; e.g., "A*t work, if necessary, I am capable of taking risks*"), and Optimism (2 items; α = .83; e.g., "*At work, I am optimistic about what will happen in the future*"). Responses were recorded on a seven-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*). During factor analysis, the item "*If I were in a difficult situation at work, I could think of many ways to get out of it*" was excluded due to factor loadings below .50, indicating insufficient contribution to the latent construct in the present sample, according to recommended criteria for SEM (Hair *et al.*, 2010). The exclusion did not alter the theoretical structure of the construct, and the final model, with four factors and 11 items, showed adequate reliability and validity indices (ωH = .87; KMO = .91).

Learning Opportunities were assessed using the Learning and Development Opportunities Scale (Panari *et al.*, 2010), translated and adapted for this study.[2] The scale includes five items that measure the extent to which the work context is perceived as stimulating learning, skill use, and competency development. The instrument showed good reliability (α = .89; KMO = .83) and factor loadings above .50, maintaining its original unifactorial structure. Although some fit indices in the initial confirmatory model were slightly below optimal thresholds, the scale was retained due to acceptable factor loadings, internal consistency, and theoretical coherence with the original instrument. Responses were recorded on a seven-point Likert scale (1 = *never*; 7 = *very often*), for example: "*At work, I have good opportunities to use my skills and competencies.*"

Data Analysis Strategy

After assessing unidimensionality/multidimensionality and reliability, the measurement model was evaluated using CFA. Because all variables were obtained through self-report measures collected at a single time point, special attention was given to the adequacy of the measurement model in order to reduce potential bias associated with cross-sectional designs. The fit indices and reference values are presented in Table 1.

2 The translation into Brazilian Portuguese followed the methodology proposed by Beaton et al. (2000), which involved an initial translation by two bilingual translators, synthesis of the translations, back-translation of the consensual version into the original language, and evaluation by two experts. Subsequently, the complete instrument was sent for pre-testing, with no adjustments required. After this, the official data collection process was conducted.

Table 1. CFA Fit Indices

Indices	Reference values
Minimum Discrepancy (X^2)/Degrees of Freedom (*df*)	< 5*
Standardized Root Mean Square Residual (SRMR)	< .05
Root Mean Square Error of Approximation (RMSEA)	< .07
Comparative Fit Index (CFI)	> .90
Tucker-Lewis Index (TLI)	> .90
Log-likelihood (to verify the model with interactions)	p < .005

* X^2 with values greater than 5 are considered relevant only if the other fit indices are discrepant.

Source: Based on Kline (2016), Peugh and Feldon (2020), and Wang and Wang (2020).

The Latent Moderated Structural Equation Modeling (LMS) approach was used to analyze the alternative structural models proposed in this study and test the hypothesized relationships. Specifically, the Single-Indicator LMS technique corrected for reliability (RCSLMS) was applied, enabling the estimation of latent interaction effects while accounting for measurement error without imposing restrictions or requiring complex nonlinear multiplications, such as creating product indicators (Cheung *et al.*, 2021; Cheung & Lau, 2017). The LMS approach allows the comparison of alternative models representing different theoretical assumptions using the distributed chi-square difference test based on the log-likelihood ratio (TRd). This test compares the relative fit of Model 0 (null model, in which the interaction is fixed at zero) and Model 1 (alternative model, in which the interaction is freely estimated). Thus, it evaluates whether including the interaction term significantly improves model fit, indicating that the relationship between demands and health outcomes varies with resource levels (Cheung *et al.*, 2021). The analysis procedures and results are presented in the next section. Analyses were conducted using Mplus software (version 8.1), following recommended procedures for structural equation modeling with latent interactions.

Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Universidade de Caxias do Sul and by the National Council of Health of the Ministry of Health - Brazil (CAAE: 43224121.1.0000.5341, 05/05/2021). Informed consent was obtained from all subjects involved in the study.

Results

The assumption of normality was met. Therefore, the individual measures and the overall measurement model were examined using confirmatory procedures to verify the adequacy of the measurement structure. Table 2 presents the results of the individual validation of the constructs, including validity, reliability, and fit indices.

Table 2. Individual Construct Validation

Model/Scale	Unidimensionality and reliability		CFA				
	KMO ≥ .5	ωH ≥ .7	X^2/df < 5	SRMR < .05	RMSEA < .06	CFI > .90	TLI > .90
Burnout	.95	.864	6.475**	.024	.064	.981	.976
Well-being	.93	.826	6.006**	.036	.061	.974	.966
Demands	.81	.73	6.517**	.048	.064	.955	.938
PsyCap	.91	.872	6.281**	.031	.063	.978	.969
Learning Opportunities	.83	.89***	29.172**	.028	.146	.972	.931

* $p \leq .05$; ** $p \leq .01$, in both cases, the null hypothesis is rejected, and the model is supported; *** Reliability is indicated by α once it is a unidimensional scale.

Source: Prepared by the authors based on the results.

All measures were individually validated, showing acceptable reliability and factor loadings consistent with recommended criteria for SEM. The structural model consists of one second-order independent construct, Demands (3 factors; 11 items); two second-order dependent constructs, Burnout (3 factors; 14 items) and Well-being (5 factors; 15 items); and two additional constructs that operate as independent variables in the linear model or as moderators in the moderated model: PsyCap, a second-order construct (4 factors; 11 items), and Learning Opportunities (5 items).

The complete measurement model showed adequate indices (KMO = .961; ωH = .70). Three of the sixty communalities were below .50. However, considering the satisfactory global fit, the theoretical relevance of the items, and the results of the individual construct validation, these items were retained, following recommended guidelines for scale evaluation in SEM (Hair *et al.*, 2010). The use of self-report measures collected at a single time point may also increase the risk of common method variance. This potential influence was assessed using Harman's single-factor test, in which 11 factors had eigenvalues greater than 1 and jointly explained 70.58% of the variance, suggesting that common method variance is unlikely to pose a serious threat (Podsakoff *et al.*, 2003). Additionally, the model was compared with alternative specifications in which the second-order constructs were grouped differently. The original measurement model showed superior fit compared to the alternative specifications and was therefore retained.

Testing of Alternative Structural Models

The structural models presented in Figures 1 and 2 were tested using the four-step procedure proposed by Cheung *et al.* (2021) for the RCSLMS method.

(a) STEP 1. Measurement model validation. The first step consisted of validating the measurement model by examining model fit indices using the maximum likelihood estimator with robust standard errors (MLR).

(b) STEP 2. Linear structural model (M0). The second step estimated the structural model, including only linear relationships, referred to as the null model (M0), also using the MLR estimator. In latent interaction models, Mplus does not provide conventional fit indices because they are not sensitive to missing interaction effects. Therefore, model comparison was conducted using the distributed chi-square difference test based on log-likelihood values (TRd), accounting for the number of free parameters and correction factors. Regression

coefficients and confidence intervals used for hypothesis testing were also estimated. At this stage, the model represents the additive relationships between demands, resources, and occupational health indicators. In the present study, M0 corresponds to the linear model shown in Figure 1.

(c) ***STEP 3. Moderated structural model (M1).*** In the third step, latent interaction terms were introduced to estimate the moderated structural model (M1). This step assumes an acceptable fit of the linear model (M0), which serves as the baseline for testing interaction effects. In Mplus, latent interactions were estimated using the TYPE = RANDOM option with ALGORITHM = INTEGRATION, applying numerical integration procedures (Cheung et al., 2021). M1 corresponds to the moderated model shown in Figure 2.

(d) ***STEP 4. Probing significant interactions.*** The fourth step was conducted only when significant interactions were identified. In these cases, simple slope analyses were performed to examine the nature of the interactions. Bootstrapping with 2,000 resamples was applied to estimate bias-corrected confidence intervals and assess model stability. Only statistically significant latent interactions identified in the previous step were included in this analysis.

Latent interactions were estimated following the recommendations of Cheung *et al*. (2021). Table 3 presents the fit indices obtained for the first three steps.

Table 3. Fit Indices for the Test of Alternative Models

Model/Scale	Adjustment Ratios						
	Log-likelihood		X^2 (*df*)	RMSEA	SRMR	CFI	TLI
Burnout	H0	-112669.64	3.23	.041	.06	.931	.927
Well-being	H1	-109839.58					
Demands	H0	-39599.67	7.79	.072	.052	.908	.890
PsyCap	H1	-38801.14					

	Log-likelihood		Correction factor for MLR	Free parameters
Null Model (M0) - Step 2	H0	-39599.67	1.3377	70
Model with Interactions (M1) - Step 3	H0	-39597.89	1.4340	74

The M0 model showed acceptable fit indices; therefore, the M1 model, including latent interactions, was estimated. The comparison of log-likelihood values between M0 and M1 resulted in TRd(df = 4) = 3.119 (p = .888), indicating that the inclusion of interaction effects did not significantly improve model fit. In other

words, the moderated model did not provide a better fit compared to the model including only direct relationships (Cheung *et al.*, 2021). Although the model including only direct relationships showed a more adequate fit, additional analyses were conducted to examine the hypotheses specified in both models.

Hypothesis Testing

The results showed significant support for the linear model hypotheses, whereas the moderation hypotheses were not statistically significant (see Tables 4 and 5).

Table 4. Hypothesis Testing of the Linear Relationships Model (M0)

Relationship		*b*	*P*-value	SE	CI (95%)		Result
					Lower 2.5%	Upper 2.5%	
***Burnout* ON**							
H1a	Demands	.37	.000	.03	.312	.428	Supported
H2a	PsyCap	-.419	.000	.043	-.502	-.335	Supported
H3a	Learning Opportunities	-.135	.002	.044	-.222	-.048	Supported
Well-being ON							
H1b	Demands	-.072	.005	.03	-.121	-.022	Supported
H2b	PsyCap	.794	.000	.033	.73	.858	Supported
H3b	Learning Opportunities	.019	.601	.037	-.053	.092	Refuted

Regression coefficients (*b*) for the linear hypotheses were statistically significant, except for H3b, and the confidence intervals were consistent with these results.

The results for the moderated model (regression coefficients, significance levels, and confidence intervals) are presented in Table 5. Because the interaction effects were not statistically significant, Step 4 of the LMS procedure (simple slope analysis) was not conducted.

Table 5. Hypothesis Testing of the Moderated Relationships Model (M1)

Relationship		*b*	*P*-value	SE	CI (95%)		Result
					Lower 2.5%	Upper 2.5%	
***Burno*ut ON**							
H1a	Demands	.4	.000	.036	.35	.49	Supported
H4a	Demands x PsyCap	-.04	.589	.074	-.186	.106	Refuted
H5a	Demands x Learning Opportunities	-.002	.976	.078	-.203	.15	Refuted

» Table 5. (continued)

» Table 5. (continued)

Relationship *Burnout* ON		*b*	*P*-value	SE	CI (95%)		Result
					Lower 2.5%	Upper 2.5%	
Well-being ON							
H1b	Demands	-.082	.016	.034	-.148	-.015	Supported
H4b	Demands x PsyCap	.04	.34	.118	-.191	.271	Refuted
H5b	Demands x Learning Opportunities	-.009	.073	.128	-.261	.242	Refuted

Source: Data from the Mplus software analysis.

Overall, the findings were consistent with the linear model, whereas the moderated model did not show significant interaction effects. The comparison between models indicated that including interaction terms did not significantly improve model fit, suggesting that the relationships between job demands, resources, and occupational health indicators were predominantly additive in the present sample. The theoretical and practical implications of these results are discussed in the following section.

Discussion

The comparison of alternative models indicated that the relationships were better represented by the linear model. In the studied population, job demands were positively associated with burnout and negatively associated with well-being among firefighters. Likewise, the relationships between resources and both outcomes were also significant. PsyCap was negatively associated with burnout and positively associated with well-being. Learning opportunities were negatively associated with burnout but not significantly associated with well-being. The inclusion of interaction effects did not significantly improve model fit compared with the model including only direct relationships, indicating that, for this population, the resources examined were directly associated with mental health outcomes rather than moderating the relationship between job demands and mental health. The absence of moderation does not invalidate COR theory, but suggests that, in this context, resources may operate through additive rather than buffering processes.

The results indicate a negative association between PsyCap and burnout among firefighters, supporting previous studies (Baron *et al.*, 2016; Kotze & Massyn, 2019; Manzano-García & Ayala, 2017; Moyer *et al.*, 2017). PsyCap has been described as a personal resource associated with lower physical, emotional, and cognitive exhaustion (Luthans & Youssef, 2004). Moreover, higher levels of PsyCap are associated with more positive work perceptions, consistent with COR theory, which posits that individuals use available resources to compensate for losses and tolerate stressors more effectively (Doane *et al.*, 2012; Hobfoll, 1989; Hobfoll *et al.*, 2016; Hobfoll *et al.*, 2018).

The COR principle of resource loss primacy suggests that resource losses have stronger effects than resource gains (Hobfoll *et al.*, 2018). However, in this study, PsyCap showed a stronger association with firefighters' well-being (b = .794) than the association between demands, resource loss, and burnout (b = .419). This

finding may suggest that, in contexts characterized by high resource loss, resource gains can play an important role in sustaining positive functioning. In such contexts, PsyCap may help compensate for losses, as the preservation and acquisition of resources motivate individuals to pursue goals and maintain functioning (Hobfoll, 2014).

The results suggest that the perception of having learned effective techniques for managing incidents may help reduce stress in rapid-response situations (Karasek, 1979; Panari *et al.*, 2010). However, the relationship between workplace learning and burnout remains relatively underexplored in the literature (Panari *et al.*, 2010; Watson *et al.*, 2018). Workplace learning is shaped by social interaction, organizational culture, and structural conditions (Silva & Larentis, 2022). In hierarchical and bureaucratic military contexts, learning is often oriented toward problem-solving and coping with operational demands, with less emphasis on emotional regulation and resource recovery.

The context, conception, and design of work may significantly influence the effect of learning opportunities on well-being—or even explain the absence of this effect, as observed in this study. Work environments that neglect individual needs, impose excessive pressure, or lack organizational support may lead workers to perceive learning demands as threatening (Watson *et al.*, 2018; White & Kern, 2018). Moreover, an excessive focus on performance may restrict autonomy and decision-making, thereby undermining motivation and well-being (Watson *et al.*, 2018). For this reason, learning opportunities should be structured to balance performance goals with the promotion of worker well-being.

The relatively low explanatory power of learning opportunities for health and work stress indicators is also consistent with the argument proposed by Hobfoll *et al.* (2016), who suggest that in high-risk contexts, multiple factors may hinder resource gains and limit the role of learning opportunities in preventing resource loss cycles. This may also help explain why the interaction effects were not significant, since in situations of frequent or prolonged exposure to demands, resources may contribute directly to well-being without necessarily buffering the impact of demands.

Overall, the findings are consistent with the idea that resource loss in the face of demands is associated with negative effects on workers' mental health, whereas resources are associated with more favorable outcomes even under stressful conditions. The strength of the association between PsyCap and well-being suggests that personal resources may play a particularly relevant role in high-risk occupations. This may help explain why firefighters, despite chronic exposure to risk, often exhibit better occupational health outcomes than other professionals working in similarly high-risk conditions (Ângelo & Chambel, 2014). Taken together, these findings reinforce the importance of both personal and contextual resources in sustaining firefighters' mental health in high-demand occupational environments.

Practical and Managerial Implications

The tested models provide a useful framework for understanding the relationships between job demands, resources, and occupational mental health indicators. These findings may offer guidance for developing programs and organizational practices to improve firefighters' health, well-being, and quality of life. In particular, the results highlight the importance of strengthening resources associated with well-being and lower burnout.

Although the studied resources did not moderate the relationship between demands and mental health outcomes, they were directly associated with these outcomes. Therefore, the continuous development of resources may help build a stronger resource base, which may help maintain well-being and reduce the likelihood of burnout over time.

From a managerial perspective, investments may involve both increasing access to resources and implementing organizational practices, policies, and innovations that strengthen them. The resources examined in this study, PsyCap and learning opportunities, are particularly relevant targets for organizational interventions and training initiatives.

PsyCap emerged as an important personal resource, associated with higher levels of well-being and lower levels of burnout. Its core dimensions have

been described as developable through training and development programs, which suggests potential for intervention. Although learning opportunities were not significantly associated with well-being, they were associated with lower levels of burnout. Providing opportunities for formal, informal, technical, or behavioral learning may therefore increase perceived preparedness and confidence when responding to incidents.

These initiatives may help strengthen psychological resources and improve firefighters' capacity to cope with high-demand occupational environments.

Limitations and Suggestions for Future Studies

The cross-sectional design of this study limits the ability to draw conclusions about temporal or causal relationships, particularly considering the momentum principle of the COR theory (Hobfoll *et al.*, 2016). Additionally, administering the questionnaire electronically may reduce control over response conditions. The absence of participants from the Northern region of Brazil may also limit the generalizability of the findings. Moreover, because the sample consisted exclusively of Brazilian military firefighters, the findings should be generalized with caution to civilian firefighters, firefighters from other countries, and professionals in other occupational contexts.

Given the relevance of PsyCap identified in this study, future research may examine additional personal resources, such as self-esteem and motivation, to expand the understanding of factors that promote occupational health. It is also recommended that the proposed model be tested in other high-risk occupational groups to determine whether similar resource dynamics are observed among professionals exposed to chronic risk.

The present research adopted a Positive Psychology perspective, focusing on the five dimensions of PERMA well-being (Seligman, 2011). Future studies may benefit from adopting a broader integrative approach by including other indicators of Positive Organizational Behavior, such as motivation, job satisfaction, and performance (Demerouti & Bakker, 2023). Finally, further research is needed to investigate workplace learning interventions and their potential impact on well-being, particularly considering cultural differences in the perception and management of stress (Hobfoll & Ford, 2007; Watson *et al.*, 2018). Despite these limitations, the study advances understanding of how job demands and resources relate to occupational mental health in high-risk professions.

Conclusion

The comparison between the competing models suggested that, in the studied population, the relationships between job demands, resources, and occupational mental health indicators were better represented by direct associations rather than by moderation effects. In this sense, the findings indicate that resources did not significantly change the strength of the relationship between job demands and burnout or well-being but were directly related to these outcomes.

The COR theory provides an important framework for understanding how work demands and available resources relate to occupational health, particularly in high-risk professions. The results suggest that personal resources, especially PsyCap, play a relevant role in well-being and burnout among firefighters.

PsyCap showed a negative association with burnout and a positive association with well-being,

indicating that strengthening personal psychological resources may represent a promising strategy for dealing with occupational stress. This may help explain why firefighters, despite chronic exposure to risk, often present relatively favorable occupational health outcomes compared to other high-risk professional groups, although further research is needed to better understand these dynamics (Hobfoll *et al.*, 2018).

In addition, learning opportunities were identified as a relevant organizational resource associated with lower levels of burnout. However, their association with well-being was not statistically significant, suggesting that the context and design of work may influence how learning opportunities contribute to occupational health.

Finally, the findings highlight the importance of considering cultural differences in stress perception and intervention effectiveness. Future initiatives should therefore adopt integrative approaches that incorporate multiple dimensions of well-being and indicators of Positive Organizational Behavior in order to better understand and promote occupational health in high-risk professions.

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