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Cognitive and psychological resilience of students facing fire risk: implications for mental health and educational wellbeing

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Aim: In contemporary society, exposure to natural and technological hazards, such as fires, poses significant challenges for mental health and for the effective functioning of educational and organisational institutions. The literature highlights that risk perception is a central determinant of adaptation processes, being closely linked to multiple dimensions of resilience.
Objectives/hypotheses: This study aimed to analyse the relationship between fire risk perception and individual resilience, integrating psychological, cognitive, adaptive, and institutional dimensions. Four hypotheses were formulated: H1 – risk perception predicts resilience levels; H2 – cognitive resilience mediates the relationship between risk perception and psychological resilience; H3 – knowledge of intervention procedures mediates the relationship with adaptive resilience; H4 – institutional resilience moderates the relationship between risk perception and overall resilience.
Methodology: The sample consisted of 86 participants, primarily residents of Constanța County. Data were collected using the "Natural Disaster Resilience" questionnaire and analysed with SPSS 28, applying multiple regressions, mediation models (PROCESS Model 4), and moderation analyses (PROCESS Model 1).
Results: Analyses revealed that risk perception significantly predicted all resilience dimensions (η_p^2 = 0.972). The relationship between risk perception and psychological resilience was inversely mediated by cognitive resilience. Knowledge of intervention procedures mediated the relationship between adaptive resilience and expertise, while institutional resilience significantly moderated the link between risk perception and overall individual resilience.
Conclusion: The study confirms an integrative model of resilience, in which risk perceptions, cognitive and emotional resources, operational preparedness, and institutional support interact to foster mental health and effective adaptation in the face of critical situations.

KEYWORDS

adaptive resilience, cognitive resilience, fires, institutional resilience, psychological resilience, risk perception

1 Introduction

In contemporary society, exposure to natural and technological hazards such as fires poses complex challenges to psychological wellbeing and to the functioning of educational and organisational systems. Individuals' responses to such threats depend largely on how they appraise and interpret risk, a process that shapes both emotional regulation and cognitive strategies for managing uncertainty (Paton, 2019).

In the present study, the notion of risk of fire is conceptualised through the lens of cognitive and psychological appraisal theories (Paton, 2019; Slovic, 2016). Objective risk refers to the quantifiable probability of a fire event occurring, as derived from environmental, structural, or meteorological indicators. In contrast, perceived fire risk represents the individual's subjective assessment of the likelihood and potential impact of a fire, shaped by previous experience, knowledge, emotional responses, and trust in institutions.

Consistent with the psychometric paradigm of risk (Slovic, 2016; Paton, 2019), perceived risk is not a direct reflection of objective danger but a psychological construct that integrates cognitive evaluations (e.g., probability estimation, controllability) and affective reactions (e.g., worry, perceived vulnerability). Therefore, in this study, fire-risk perception is operationally defined as "the individual's cognitive and emotional evaluation regarding exposure to and control over fire-related hazards," measured through 11 items on a five-point Likert scale (1 = never; 5 = always).

This conceptual distinction is fundamental to understanding resilience processes, since objective exposure alone does not predict adaptive responses—rather, it is the perceived threat that activates cognitive appraisal, emotional regulation, and preparedness behaviours (Paton, 2019; Chen and Bonanno, 2020).

Within this conceptual framework, resilience is viewed as a multidimensional construct that encompasses psychological, cognitive, adaptive, and institutional components. These dimensions interact dynamically - cognitive mechanisms influence emotional stability, while organisational support structures may buffer or amplify individual coping capacities (Duchek, 2019; Yanbei et al., 2023).

Research on psychological resilience indicates that maintaining emotional balance and self-efficacy during crises depends on the individual's ability to evaluate danger accurately and to manage stress adaptively. During the COVID-19 pandemic, cognitive strategies such as reappraisal and planning proved central to emotional regulation (Chen and Bonanno, 2020), suggesting that cognitive processes often serve as mediators between subjective risk appraisal and emotional adjustment. Similarly, Badía et al. (2024) found that resilience and the satisfaction of psychological needs mediated the association between perceived threat and wellbeing among emergency medical personnel, confirming that cognitive and affective mechanisms jointly transform subjective appraisals into adaptive responses.

Cognitive resilience refers to the ability to process relevant information, make rapid and flexible decisions, and sustain mental adaptability in unpredictable contexts. Zhang et al. (2024) demonstrated that cognitive functioning and post-traumatic symptomatology mediate the relationship between personality traits and resilience in oncology patients, illustrating how mental flexibility supports psychological stability under pressure. By contrast, adaptive resilience reflects the behavioural translation of awareness and learning into concrete response capacities. Mishra and Suar (2011) showed that emergency preparedness training and familiarity with operational procedures enhance individuals' readiness and reduce perceived vulnerability. Recent findings by Elkady et al. (2024) further suggest that previous experience and informal problem-solving strategies strengthen adaptive flexibility and improve future-oriented coping.

The institutional dimension of resilience highlights the role of organisational environments in sustaining recovery and adaptation. Perceived institutional support and trust can buffer the impact of stressors, reinforcing both personal and collective resilience. Yanbei et al. (2023) demonstrated that organisational support mitigates the relationship between occupational stress and burnout, while Duchek (2019) conceptualised organisational resilience as a collective resource that enhances confidence, cohesion, and efficiency in crisis situations.

Although the literature provides consistent evidence for the importance of resilience across its various domains, few studies have examined how these dimensions operate simultaneously within a unified empirical model. The present study seeks to address this gap by analysing how fire-related risk appraisal interacts with psychological, cognitive, adaptive, and institutional mechanisms to foster or hinder individual resilience. Specifically, it explores how cognitive processes and procedural knowledge mediate resilience outcomes, and how institutional support moderates these relationships.

The overall aim of the study is to analyse the relationship between fire risk perception and individual resilience by integrating its psychological, cognitive, adaptive, and institutional dimensions, and to highlight the cognitive, operational, and organisational mechanisms that mediate or moderate this relationship. Building on this general aim—to understand the relationship between fire risk perception and individual resilience across multiple dimensions—a set of specific objectives was formulated. First, we sought to investigate the extent to which risk perception predicts individual resilience, as reflected in its psychological, cognitive, adaptive, and institutional components. Second, we aimed to examine whether cognitive resilience functions as a mediating mechanism between risk perception and psychological resilience, thereby explaining how cognitive evaluations influence emotional balance. In addition, a central objective was to explore the role of knowledge of intervention procedures as a mediator in the relationship between risk perception and adaptive resilience, to assess the extent to which operational preparedness facilitates the transformation of risk perceptions into concrete action capacities. Finally, we aimed to examine how institutional resilience operates as a moderating factor, strengthening or attenuating the effect of risk perception on overall individual resilience.

Although both psychological and cognitive resilience describe mechanisms of adaptation under stress, they operate at distinct functional levels (Duchek, 2019; Chen and Bonanno, 2020). Psychological resilience primarily reflects emotional stability, self-efficacy, and the capacity to regulate affect in response to stressors, enabling individuals to maintain wellbeing and motivation when confronted with adversity. In contrast, cognitive resilience represents the ability to process information efficiently, maintain mental flexibility, and adapt reasoning strategies in unpredictable contexts (Zhang et al., 2024).

Empirical research suggests that cognitive and psychological resilience are dynamically interdependent but not identical. Cognitive mechanisms such as planning, reappraisal, and

problem-solving provide the foundation for psychological regulation, yet excessive cognitive activation can deplete emotional resources and lead to fatigue or anxiety—a phenomenon consistent with the cognitive load theory (Sweller, 1988) and the dual-process model of stress adaptation (Lazarus and Folkman, 1984). This duality explains the paradoxical finding of the current study, whereby cognitive resilience positively predicts analytical control but inversely relates to emotional balance.

Therefore, their differentiation in the present model is theoretically and empirically grounded: while cognitive resilience captures the analytical and information-processing side of adaptation, psychological resilience reflects the affective and motivational components that sustain wellbeing. Treating these constructs separately allows for a more precise understanding of how mental effort and emotional regulation interact—sometimes synergistically, other times competitively—under conditions of perceived risk.

Based on these objectives, we formulated the corresponding research hypotheses, which investigate both the direct and the mediated or moderated effects among the analysed variables:

> *H1*: The perception of risk associated with fires significantly predicts the level of individual resilience (psychological, cognitive, adaptive, and institutional).
>
> *H2*: The relationship between risk perception and psychological resilience is mediated by cognitive resilience, suggesting that cognitive mechanisms are the way in which subjective risk assessments influence individual emotional resources.
>
> *H3*: Knowledge of intervention procedures mediates the relationship between risk perception and adaptive resilience, indicating that the level of operational readiness transforms subjective risk assessments into concrete action capacities.
>
> *H4*: Institutional resilience moderates the relationship between risk perception and individual resilience, so employees perceive a higher level of personal resilience when institutional support is strong.

2 Materials and methods

2.1 Research design and approach

The study follows a correlational and explanatory analytical framework, aiming to identify patterns of association and conditional relationships rather than to establish causal effects. Such an approach is considered appropriate when the research objective is to explore how subjective risk appraisal is associated with internal cognitive-emotional mechanisms and perceived external support resources, particularly in emerging or underexplored research areas (Hayes, 2022; Paton, 2019).

A cross-sectional design was deemed suitable given the exploratory nature of the proposed integrative resilience model and the practical constraints associated with longitudinal data collection in educational settings. Consistent with current methodological recommendations in psychological and disaster-risk research, the findings are interpreted as associational rather than causal, and causal language is avoided throughout the manuscript (Chen and Bonanno, 2020; Lazarus and Folkman, 1984).

The analytical strategy integrates multivariate regression, mediation, and moderation analyses to examine how perceived fire risk relates to distinct resilience dimensions and how cognitive mechanisms, procedural knowledge, and institutional support shape these relationships.

2.2 Samples

The selection of this sample was both theoretically and contextually justified. The Dobrogea region was chosen for its specific environmental and infrastructural characteristics and its recurrent exposure to natural and technological fire risks, particularly during the summer. The focus on university students was theoretically motivated by their developmental profile, characterised by high cognitive plasticity, adaptive learning capacity, and emerging social responsibility, which makes this group particularly relevant for examining psychological, mental, and adaptive mechanisms underlying disaster preparedness and resilience (Appleby-Arnold et al., 2020; Paton, 2019).

Participants were recruited through electronic dissemination of the study invitation within higher education institutions in the Dobrogea region. The invitation was distributed via official student communication platforms (Microsoft Teams) and included brief information regarding the study purpose, eligibility criteria, and access to the online questionnaire. Recruitment took place between 15 June and 31 July 2025, and participation was voluntary. Eligibility criteria required that respondents were enrolled as university students, resided in the Dobrogea region at the time of participation, and fell within the targeted age range. No material or academic incentives were offered for participation. To prevent multiple submissions by the same individual, the questionnaire was administered via Google Forms and configured to allow a single response per user account.

According to publicly available institutional statistics, the estimated population of university students residing in the Dobrogea region is approximately 15,000 individuals, based on enrolment data from higher education institutions located in Constanța County. This figure represents the empirical population eligible for participation in the present study and is reported to enhance transparency regarding the recruitment context, allowing readers to situate the obtained sample in relation to the broader population from which it was drawn, without implying population representativeness.

The study sample comprised 86 participants, all residents of the Dobrogea region, selected using a non-probabilistic convenience sampling strategy based on availability and voluntary participation. This sampling approach is frequently employed in exploratory psychological research conducted in educational settings, particularly when the research objective is to examine relational patterns and conditional processes among psychological constructs, rather than to estimate population-level parameters or prevalence rates (DeVellis and Thorpe, 2021; Hinkin, 1998). The achieved sample size ($N = 86$) was determined based on pragmatic considerations and participant availability within the institutional recruitment framework of Ovidius University of Constanța, where the study was implemented in the context of a specific academic project.

Participants' ages ranged from 19 to 22 years (M = 20.1, SD = 1.01), with a median of 20 and a mode of 19, reflecting a young, relatively homogeneous group characteristic of a student population. Regarding gender distribution, 54.7% of respondents identified as female and 45.3% as male, indicating a balanced composition with a slight predominance of female participants.

Approximately 32% of participants reported prior direct or indirect experience with fire-related events, such as household or neighbourhood incidents or assisting others during fire emergencies, while 68% reported no previous exposure. This variable was retained to capture variability in experiential background and to allow exploratory examination of whether prior exposure to fire hazards is associated with differences in perceived risk and resilience dimensions (Table 1).

2.3 Instruments

For the evaluation of the constructs included in the research hypotheses, the Natural Disaster Resilience Questionnaire was employed, from which the relevant dimensions were selected for analysing risk perception and individual resilience.

All constructs included in the present study were assessed using self-report measures, which capture participants' subjective evaluations of fire-risk perception, individual resilience, and knowledge of intervention procedures. The use of self-administered questionnaires is methodologically appropriate given the nature of the investigated constructs, as fire-risk perception, psychological resilience, cognitive resilience, adaptive resilience, and perceived institutional resilience represent internal psychological and mental processes that cannot be reliably inferred through external observation alone (Paton, 2019; Slovic, 2016). Accordingly, empirical research in psychological and disaster-risk contexts has consistently relied on self-report methodologies, demonstrating their ecological validity and analytical suitability for examining complex cognitive and emotional mechanisms underlying risk appraisal and resilience (Hinkin, 1998; Netemeyer et al., 2003; DeVellis and Thorpe, 2021; Badía et al., 2024; Chen and Bonanno, 2020).

Nevertheless, reliance on self-report data may introduce certain sources of bias, including individual differences in self-awareness, memory accuracy, and social desirability tendencies, as well as the risk of common method variance. To minimise these potential limitations, several methodological safeguards were implemented. Participants were assured of complete anonymity and confidentiality, no external incentives were offered for participation, and all items were formulated using neutral, non-evaluative language to reduce socially desirable responding. In addition, online administration has been shown to yield data of comparable reliability and validity to traditional paper-based formats, while reducing social desirability pressures and enhancing participant comfort and openness (DeVellis and Thorpe, 2021). Although standard method variance cannot be entirely excluded, these procedures are consistent with best-practice recommendations for enhancing data quality, transparency, and methodological rigour in survey-based psychological research (Hinkin, 1998; Netemeyer et al., 2003).

Despite these precautions, the potential influence of self-report bias should be considered when interpreting the findings, as the study did not include objective behavioural or physiological indicators.

TABLE 1 Description of constructs and characteristics of the instrument used in the study.

Construct	No. of items	Response scale
Risk perception associated with fires	11	Likert scale, 5 points (1 = never, 5 = always)
Psychological resilience	4	Likert, 5 points
Cognitive resilience	4	Likert, 5 points
Adaptive resilience	4	Likert, 5 points
Institutional resilience	4	Likert, 5 points
Knowledge of intervention procedures (fire)	10	Dihotomic (Yes/No)

The "Natural Disaster Resilience Questionnaire" was developed by the authors specifically for this study, grounded in Paton's (2019) theoretical model of disaster preparedness and in contemporary frameworks of psychological, cognitive, and organisational resilience (Duchek, 2019; Mishra and Suar, 2011; Connor and Davidson, 2003). The instrument was designed to capture multidimensional resilience — psychological, cognitive, adaptive, and institutional — in the context of fire-related risk.

The initial item pool was generated based on operational definitions extracted from prior research on resilience, coping, and risk perception (DeVellis and Thorpe, 2021; Hinkin, 1998; Netemeyer et al., 2003). Recent studies have similarly grounded item generation in theoretical and empirical models of adaptive behaviour and psychological resilience, emphasising the importance of conceptual precision and ecological validity (Badía et al., 2024; Elkady et al., 2024; Zhang et al., 2024; Appleby-Arnold et al., 2020; Yanbei et al., 2023). These approaches support the construction of multidimensional instruments that capture both cognitive-evaluative and affective-motivational aspects of resilience and risk appraisal in disaster contexts.

To ensure content validity, the items were reviewed by three experts (two psychologists and one specialist in emergency management), who evaluated the conceptual clarity and relevance of each dimension. Following expert feedback, minor revisions were made to optimise the precision of wording and balance of the scales.

A pilot study ($N = 25$) was then conducted with university students to verify item clarity, internal consistency, and response variability. The pilot results confirmed adequate comprehension and internal reliability ($\alpha > 0.80$). Subsequent psychometric validation within the main sample demonstrated good construct validity and reliability, as reflected in the Exploratory Factor Analyses (KMO = 0.746–0.813; Bartlett's $p < 0.001$) and Cronbach's alpha coefficients between 0.791 and 0.899, supporting the robustness of the newly developed instrument.

Fire risk perception – assesses the degree of awareness as well as the cognitive and emotional evaluations regarding exposure to fire (11 items; 5-point Likert scale, ranging from 1 = never to 5 = always).

Psychological resilience – measures the ability to maintain emotional balance and control in risk situations (4 items; 5-point Likert scale).

Cognitive resilience – captures information-processing skills and decision-making in the context of fire-related emergencies (4 items; 5-point Likert scale).

TABLE 2 Results of the exploratory factor analysis for the scale "knowledge of fire intervention procedures."

Indicator	Value
KMO	0.813
Bartlett $\chi^2(55)$	772.824***
Number of factors extracted	2
Explained variance (cumulative)	60.75%
Factor loadings	0.45–0.93
Internal consistency (Cronbach's α)	0.899

The symbol "***" denotes statistical significance at the $p < 0.001$ level.

TABLE 3 Results of the exploratory factor analysis for the scale "perception of risk associated with fires."

Indicator	Value
SME	0.746
Bartlett $\chi^2(45)$	230.979***
No. of extracted factors	3
Variance explained (cumulative)	60.85%
Factorial loads	0.29–0.84
Internal consistency (Cronbach α)	0.791

The symbol "***" denotes statistical significance at the $p < 0.001$ level.

TABLE 4 Results of the exploratory factor analysis for the scale "Individual resilience to fires."

Indicator	Valoare
KMO	0.802
Bartlett $\chi^2(120)$	865.432***
Nr. factori extrași	4
Varianță explicată (cumulativ)	62.30%
Încărcături factoriale	0.40–0.81
Consistența internă (Cronbach α)	0.857

The symbol "***" denotes statistical significance at the $p < 0.001$ level.

Adaptive resilience – reflects the capacity for rapid and effective response to critical situations and the transformation of risk perception into adaptive behaviours (4 items; 5-point Likert scale).

Institutional resilience – refers to perceived organisational support as a protective and coordinating resource (4 items; 5-point Likert scale).

Knowledge of fire intervention procedures – indicates the level of familiarity with recommended operational steps in emergencies (10 items; dichotomous responses: Yes/No).

The validation of the instrument focused on assessing reliability and construct validity. Reliability was examined through internal consistency using Cronbach's Alpha (and KR-20 for dichotomous items). At the same time, construct validity was assessed through an Exploratory Factor Analysis (EFA) using the Principal Axis Factoring method with Oblimin rotation, following verification of data adequacy via the Kaiser–Meyer–Olkin (KMO) index and Bartlett's test of sphericity.

The results confirmed an excellent adequacy of the data for factor analysis [KMO = 0.813; Bartlett $\chi^2(55) = 772.824$, $p < 0.001$]. Exploratory factor analysis (FAP, Oblimin rotation) extracted two main factors, which together explain 60.75% of the total variance. The factor loads ranged from 0.45 to 0.93, indicating the high relevance of the items to the latent structure. The internal consistency of the scale was excellent (Cronbach's $\alpha = 0.899$), demonstrating the high reliability of this measure (Table 2).

The results of exploratory factor analysis showed a good adequacy of the data for modelling [KMO = 0.746; Bartlett $\chi^2(45) = 230.979$, $p < 0.001$]. Three main factors were extracted, together explaining 60.85% of the total variance. The factor loads ranged from 0.29 to 0.84, exceeding the recommended minimum threshold (0.30), confirming the relevance of the items to the latent structure. The internal consistency of the scale was satisfactory (Cronbach's $\alpha = 0.791$), demonstrating good internal reliability. These results support the construct validity and reliability of the "Fire Risk Perception" scale (Table 3).

The results demonstrated the perfect adequacy of the data for analysis [KMO = 0.802; Bartlett's $\chi^2(120) = 865.432$, $p < 0.001$]. The exploratory factor analysis extracted four main factors, corresponding to the theoretical dimensions of resilience (psychological, cognitive, adaptive, and institutional), which together explain 62.30% of the total variance. The factor loads ranged from 0.40 to 0.81, confirming the relevance of the items for each factor. The internal consistency of the scale was high (Cronbach's $\alpha = 0.857$), supporting the reliability of this dimension (Table 4).

2.4 Procedure

Data collection was conducted using an online self-administered questionnaire distributed electronically to students enrolled in higher education institutions in the Dobrogea region. This mode of administration was selected to facilitate accessibility, ensure participant anonymity, and enable efficient data collection in an academic setting. Before participating, respondents were informed of the study's general purpose, the voluntary nature of participation, and the confidentiality and anonymity of their responses. Informed consent was obtained electronically before participants completed the questionnaire.

The questionnaire required approximately 15–20 min to complete. Responses were collected in a single session with no time constraints, and participants were allowed to pause or discontinue at any time without penalty. No material or academic incentives were offered for participation to minimise response bias and ensure that participation reflected a genuine willingness to contribute to the research.

Following data collection, responses were centralised, coded, and prepared for statistical analysis using SPSS version 28. All data was processed exclusively for scientific purposes.

2.5 Data analysis

The data analysis strategy was designed to ensure a precise methodological alignment between the research objectives, the nature of the collected data, and the statistical techniques employed. All analyses were conducted using SPSS version 28, complemented by the PROCESS macro (version 4.2) for mediation and moderation analyses (Hayes, 2022).

In a first step, descriptive statistics (means, standard deviations, and frequencies) were computed to examine the distributional

characteristics of the variables and to provide an initial overview of fire-risk perception and resilience dimensions. Before hypothesis testing, assumptions relevant to regression-based analyses were assessed, including linearity, independence of observations, and multicollinearity. Variance Inflation Factor (VIF) and tolerance values indicated the absence of problematic multicollinearity among predictors.

In the second step, exploratory factor analyses (EFA) were conducted to evaluate the construct validity of the measurement instruments. Principal Axis Factoring with Oblimin rotation was employed, as this method is appropriate for analysing latent psychological constructs that are theoretically expected to correlate. Sampling adequacy was verified using the Kaiser–Meyer–Olkin (KMO) index and Bartlett's test of sphericity.

Subsequently, multivariate and univariate regression analyses were performed to examine the direct effects of perceived fire risk on the multiple dimensions of individual resilience. Multivariate analyses assessed the overall impact of the predictor on the combined set of dependent variables, followed by univariate models examining dimension-specific relationships.

To test indirect mechanisms, mediation analyses were conducted using PROCESS Model 4 with bootstrapping (5,000 resamples). This approach was selected due to its robustness in estimating indirect effects without assuming normality of the sampling distribution (Hayes, 2022).

Finally, moderation analysis was performed using PROCESS Model 1 to examine whether institutional resilience conditioned the relationship between fire-risk perception and overall individual resilience. Conditional effects were estimated at low, moderate, and high levels of the moderator to facilitate the interpretation of interaction patterns.

Overall, the selected analytical methods were appropriate for the cross-sectional design, the scale level of the variables, and the theoretical objective of examining direct, mediating, and moderating relationships among psychological constructs.

3 Results

The results presented in this section highlight the testing of research hypotheses through descriptive and inferential statistical analyses, including multivariate, univariate, mediation and moderation models, to examine the relationships between fire risk perception, individual resilience dimensions and knowledge of intervention procedures.

To test this hypothesis, the perception of fire risk was introduced as a predictor variable (X), and as dependent variables (Y), the four dimensions of individual resilience were analysed: psychological, cognitive, adaptive, and institutional.

Table 5 presents the descriptive statistics for the four dimensions of individual resilience in the context of fire risk perception. The results indicate relatively high levels of resilience at the group level, with variations across different dimensions. The highest average value was recorded for cognitive resilience (M = 6.20, SD = 2.40), followed by psychological resilience (M = 5.93, SD = 2.06), suggesting that respondents rely mainly on cognitive mechanisms (situation analysis, planning, critical thinking) and internal psychological resources (emotional stability, self-efficacy) when faced with risks associated with fires.

TABLE 5 Descriptive statistics for resilience dimensions (N = 86).

Variable	M	SD	*N*
Psychological resilience	5.93	2.06	86
Cognitive resilience	6.20	2.40	86
Adaptive resilience	5.56	2.29	86
Institutional resilience	5.56	1.50	86

Adaptive resilience and institutional resilience had similar mean values (M = 5.56), but the standard deviation was lower for institutional resilience (SD = 1.50) compared to adaptive resilience (SD = 2.29). This suggests that, although individuals vary more in their ability to adapt to critical situations, perceptions of institutional support and trust in formal structures are more homogeneous across the sample.

These findings are congruent with the literature, which shows that cognitive and psychological resources are often the central pillars of resilience to natural or technological hazards. In contrast, adaptive and institutional resilience depend more on context and available external support (Linnenluecke, 2015).

Table 6 presents the results of multivariate analyses that assessed the effect of fire risk perception on the four dimensions of individual resilience. All reported indicators (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) confirmed a substantial and statistically significant effect of the predictor on the set of dependent variables [$F(4, 81) = 710.90$, $p < 0.001$].

The very large partial η^2 value ($\eta_p^2 = 0.972$) reflects a strong explanatory magnitude *within the studied sample*, consistent with conventional benchmarks for effect size interpretation (Cohen, 1988). This finding indicates robust within-sample associations between fire-risk perception and the set of resilience dimensions, and should be interpreted in line with the exploratory, mechanism-oriented nature of the study rather than as a population-level effect.

Thus, the hypothesis that "the perception of risk associated with fires significantly predicts the level of individual resilience" is supported by multivariate tests. These findings are consistent with the literature, which indicates that risk perceptions are a central determinant of the adaptation, preparedness, and response processes in hazard situations (Paton, 2019; Connor and Davidson, 2003).

Table 7 presents the results of univariate analyses that investigated the effect of fire risk perception on each dimension of individual resilience. All models were statistically significant ($p < 0.001$), confirming the hypothesis that risk perception is a robust predictor for all forms of resilience analysed.

The most substantial effects were recorded for cognitive resilience [$F(1.84) = 191.33$, $p < 0.001$, $\eta_p^2 = 0.695$, R^2 adj. = 0.691] and psychological resilience [$F(1.84) = 125.77$, $p < 0.001$, $\eta_p^2 = 0.600$, R^2 adj. = 0.595], indicating that an increased perception of fire risk is associated with a higher ability to think critically, assess situations and maintain emotional stability in crisis conditions.

In the case of adaptive resilience [$F(1.84) = 95.03$, $p < 0.001$, $\eta_p^2 = 0.531$, R^2 adj. = 0.525] and institutional resilience [$F(1.84) = 66.84$, $p < 0.001$, $\eta_p^2 = 0.443$, R^2 adj. = 0.436], the effects were significant but

TABLE 6 Multivariate tests of the effect of fire risk perception on resilience dimensions.

Effect	Test	Value	*F*	Hyp df	Error df	*p*	Partial η^2
Fire risk perception	Pillai's Trace	0.972	710.90	4	81	<0.001	0.972
	Wilks' Lambda	0.028	710.90	4	81	<0.001	0.972
	Hotelling's Trace	35.106	710.90	4	81	<0.001	0.972
	Roy's Largest Root	35.106	710.90	4	81	<0.001	0.972

TABLE 7 Univariate tests for the effect of fire risk perception on resilience dimensions.

Dependent variable	*F*	df (1,84)	*p*	Partial η^2	R^2 (adj.)
Psychological resilience	125.77	(1, 84)	<0.001	0.600	0.595
Cognitive resilience	191.33	(1, 84)	<0.001	0.695	0.691
Adaptive resilience	95.03	(1, 84)	<0.001	0.531	0.525
Institutional resilience	66.84	(1, 84)	<0.001	0.443	0.436

TABLE 8 Direct and indirect effects of fire risk perception on psychological resilience through cognitive resilience (PROCESS Model 4, *N* = 86).

Path	Effect	SE	*t*	*p*	95% CI [LL, UL]
X → M (Fire risk → Cognitive Resilience Fire)	0.264	0.019	13.83	<0.001	[0.226, 0.302]
X → Y (Fire risk → Psychological Resilience Fire, direct)	0.339	0.030	11.33	<0.001	[0.280, 0.399]
M → Y (Cognitive Resilience Fire → Psychological Resilience Fire)	−0.483	0.094	−5.12	<0.001	[−0.671, −0.295]
Indirect effect (X → M → Y)	−0.128	0.027	—	—	[−0.179, −0.073]

of lower intensity, suggesting that risk perception influences to a lesser extent the ability to mobilize adaptive resources and trust in institutions compared to cognitive and psychological processes.

Overall, these results show that fire risk perception differentially predicts resilience dimensions, with a more substantial impact on internal mechanisms (cognitive and psychological) and a more moderate impact on external mechanisms (adaptive and institutional).

To test the H2 hypothesis, a simple mediation model was used (PROCESS Model 4, Hayes, 2022), in which the perception of fire risk was introduced as a predictor (X), cognitive resilience was considered as a mediator (M), and psychological resilience was the dependent variable (Y)."

The results presented in Table 8 tested the hypothesis that the relationship between fire risk perception and psychological resilience is mediated by cognitive resilience. The analyses were carried out using bootstrapping (5,000 resamples), which eliminates the assumption of normality in the distribution of indirect effects.

The analysis revealed that risk perception has a positive and significant relationship with cognitive resilience (b = 0.264, SE = 0.019, t = 13.83, $p < 0.001$, 95% CI [0.226, 0.302]). In turn, cognitive resilience had a significant adverse effect on psychological resilience (b = −0.483, SE = 0.094, t = −5.12, $p < 0.001$, 95% CI [−0.671, −0.295]).

In terms of direct effect, risk perception remained a positive and robust predictor of psychological resilience even after the introduction of the mediator (b = 0.339, SE = 0.030, t = 11.33, $p < 0.001$, 95% CI [0.280, 0.399]).

Most importantly, the indirect effect of risk perception on psychological resilience, mediated by cognitive resilience, was significant and negative (b = −0.128, BootSE = 0.027, 95% CI [−0.179, −0.073]), as the bootstrap confidence interval does not include zero.

These results suggest that cognitive resilience functions as a reverse mediator: although the perception of risk increases mental resilience, it has a diminishing effect on emotional resources and psychological stability. Thus, cognitive mechanisms represent the way in which subjective risk assessments influence psychological resilience, but in a complex and ambivalent manner: supporting analysis and planning processes, while at the same time increasing emotional vulnerability when the perceived level of risk becomes excessive.

The mediation model shows that the perception of fire risk (X) positively predicts cognitive resilience (M) (b = 0.264, $p < 0.001$), which in turn hurts psychological resilience (Y) (b = −0.483, $p < 0.001$). However, the direct impact of risk perception on psychological resilience remains positive and significant (b = 0.339, $p < 0.001$) (Figure 1).

This pattern indicates a partial and inverse mediation: the increased perception of risk directly enhances psychological resilience, but at the same time, it intensifies cognitive mechanisms, which can diminish emotional resources through an additional stress load.

The hypothesis that the relationship between risk perception and psychological resilience is mediated by cognitive resilience can be supported by literature that emphasises the role of mental processes in transforming risk assessments into emotional and behavioural reactions (Chen and Bonanno, 2020). Studies show that cognitive strategies, such as reassessment and planning, are essential

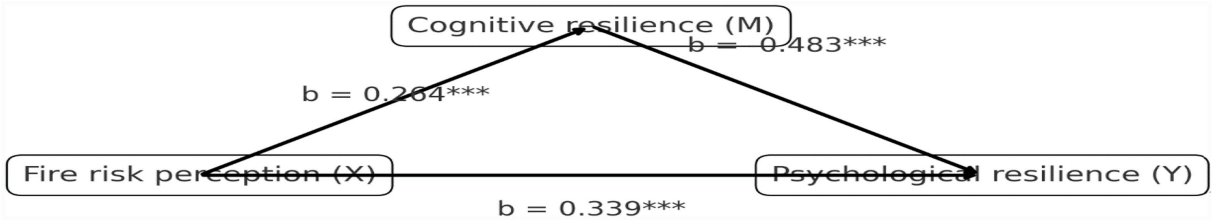

FIGURE 1
Mediation model testing the indirect effect of fire risk perception (X) on psychological resilience (Y) through cognitive resilience (M). Standardized coefficients are presented. ***$p < 0.001$.

TABLE 9 Direct and indirect effects of fire risk perception on adaptive resilience through knowledge of intervention procedures (PROCESS Model 4, $N = 86$).

Path	Effect	SE	*t*	*p*	95% CI [LL, UL]
X → M (Fire risk perception → Knowledge of intervention procedures)	0.284	0.062	4.58	< 0.001	[0.160, 0.408]
M → Y (Knowledge of intervention procedures → Adaptive resilience)	0.258	0.073	3.54	< 0.001	[0.113, 0.402]
Direct effect (X → Y, controlling M)	0.332	0.059	5.63	< 0.001	[0.215, 0.449]
Indirect effect (X → M → Y)	0.073	0.026	—	—	[0.032, 0.139]

mechanisms by which individuals maintain their psychological balance in threatening conditions.

The study by Badía et al. (2024) shows that resilience and satisfaction of psychological needs mediate the relationship between risk perception and psychological wellbeing, supporting the mediating role of psychological/cognitive mechanisms.

To test the H3 hypothesis, a simple mediation model was used (PROCESS Model 4, Hayes, 2022), in which fire risk perception was included as a predictor variable (X), knowledge of fire response procedures was considered a mediator (M), and adaptive resilience was the dependent variable (Y).

Table 9 tested whether knowledge of intervention procedures mediates the association between fire-risk perception and adaptive resilience (PROCESS Model 4; 5,000 bootstrap resamples). The analysis revealed that fire-risk perception significantly predicts procedural knowledge (b = 0.284, SE = 0.062, t = 4.58, $p < 0.001$, 95% CI [0.160, 0.408]), suggesting that individuals who perceive higher levels of danger are more motivated to learn and retain information regarding emergency actions. In turn, knowledge of intervention procedures significantly predicts adaptive resilience (b = 0.258, SE = 0.073, t = 3.54, $p < 0.001$, 95% CI [0.113, 0.402]), indicating that people who are familiar with emergency protocols exhibit greater behavioural flexibility and confidence when faced with crisis situations.

The direct effect of fire-risk perception on adaptive resilience remained positive and significant even after controlling for the mediator (b = 0.332, SE = 0.059, t = 5.63, $p < 0.001$, 95% CI [0.215, 0.449]), showing that risk perception directly contributes to proactive coping. Importantly, the indirect effect through knowledge of intervention procedures was also significant (b = 0.073, BootSE = 0.026, 95% CI [0.032, 0.139]), as the bootstrap confidence interval did not include zero. This confirms a partial positive mediation, where operational readiness amplifies the effect of risk awareness on adaptive behavioural outcomes.

These findings suggest that perceived risk functions as a cognitive trigger that enhances learning motivation and preparedness behaviours. Individuals who acknowledge a potential threat tend to seek practical knowledge and engage in planning and self-protective routines. This procedural knowledge subsequently strengthens adaptive resilience, allowing them to transform awareness into concrete, goal-oriented actions under pressure. In this sense, operational preparedness acts as the behavioural bridge between cognitive appraisal and effective adaptation.

This interpretation aligns with prior studies demonstrating that procedural familiarity, training, and preparedness education significantly enhance coping capacity during disasters (Mishra and Suar, 2011; Elkady et al., 2024). As Paton (2019) argues, adaptive resilience depends not only on how individuals perceive risks but also on their capacity to operationalize that perception through knowledge, planning, and coordinated response. Therefore, these results highlight the importance of hands-on safety education and the inclusion of simulation-based interventions in academic and organisational contexts, helping to convert abstract risk awareness into practical and adaptive competencies.

The model-fit indices shown in Table 10 indicate a good level of statistical fit and explanatory capacity of the mediation model proposed in Hypothesis 3 within the studied sample.

The first regression equation, in which knowledge of intervention procedures was predicted by fire-risk perception, yielded $R^2 = 0.695$, $F(1, 84) = 191.33$, $p < 0.001$. This means that approximately 69.5% of the variance in procedural knowledge is accounted for by individual differences in how people perceive fire risk. Participants who perceive higher levels of danger report significantly greater familiarity with intervention rules and safety

TABLE 10 Model fit statistics.

Outcome variable	R	R^2	*F*	df (model, error)	*p*
Knowledge of intervention procedures (M)	0.834	0.695	191.33	(1, 84)	< 0.001
Adaptive resilience (Y)	0.834	0.696	94.80	(2, 83)	< 0.001

TABLE 11 Moderating effect of institutional resilience on the relationship between fire risk perception and total individual resilience (PROCESS Model 1, *N* = 86).

Predictor	b	SE	*t*	*p*	95% CI [LL, UL]
Constant	0.045	1.244	0.04	0.971	[−2.429, 2.520]
Fire risk perception (X)	0.661	0.046	14.40	<0.001	[0.570, 0.752]
Institutional resilience (W)	−1.333	0.240	−5.55	<0.001	[−1.810, −0.855]
Interaction (X × W)	0.023	0.008	3.00	0.004	[0.008, 0.038]

measures, indicating that risk appraisal functions as a learning catalyst for preparedness behaviour.

The second equation, which included both fire-risk perception and knowledge of procedures as predictors of adaptive resilience, also proved statistically robust [$R^2 = 0.696$, $F(2, 83) = 94.80$, $p < 0.001$].

This indicates that the combination of cognitive awareness and procedural familiarity accounts for a substantial proportion of the variability in adaptive resilience within the studied sample, suggesting coherence of the proposed mediational pathway. In other words, individuals who both understand the risks and possess concrete procedural knowledge are far more capable of adapting flexibly and acting efficiently during emergencies.

These coefficients indicate strong associations within the studied sample, suggesting that operational knowledge may function as a meaningful intermediary between cognitive and behavioural dimensions of resilience. From a practical perspective, this pattern supports the potential value of risk-literacy programmes, emergency-response workshops, and experiential simulations aimed at translating subjective threat awareness into adaptive action. This interpretation is consistent with prior research showing that preparedness education can enhance procedural competence and decision-making confidence in risk contexts (Paton, 2019; Elkady et al., 2024).

To test this hypothesis, a simple moderation model was used (PROCESS Model 1; Hayes, 2022), with fire-risk perception as the predictor (X), institutional resilience as the moderator (W), and total individual resilience (calculated as the sum of psychological, cognitive, and adaptive dimensions) as the dependent variable (Y).

Table 11 shows that the moderation pattern is significant and supports the H4 hypothesis. The results indicate that fire risk perception positively predicts total individual resilience (b = 0.661, SE = 0.046, t = 14.40, $p < 0.001$, 95% CI [0.570, 0.752]). At the same time, institutional resilience has a main adverse effect on individual resilience (b = −1.333, SE = 0.240, t = −5.55, $p < 0.001$, 95% CI [−1.810, −0.855]), suggesting that at low levels of risk perception, strong institutional support may diminish the perception of individual resilience.

Most importantly, the interaction between risk perception and institutional resilience is significant (b = 0.023, SE = 0.008, t = 3.00, $p = 0.004$, 95% CI [0.008, 0.038]). It confirms that institutional resilience moderates the relationship between risk perception and individual resilience, reinforcing the positive effect of risk perception when institutional resilience is high.

The results suggest that the perception of fire risk works as a psychological activation factor. When employees perceive risk as high, they develop personal coping strategies and mobilise their internal resources, leading to increased individual resilience.

At the same time, the adverse effect of institutional resilience as the main predictor can be interpreted as follows: in contexts where institutional support is strong and consistent, employees tend to rely more on the institution and less on their own resources, which reduces their sense of psychological autonomy. In other words, in the absence of risk pressure, institutional support can lead to an "outsourcing" of personal responsibility.

However, the meaningful interaction shows that when the perception of risk is high and institutional support is strong, employees perceive a higher level of personal resilience. This means that the institution provides a framework of safety and trust that strengthens the ability of individuals to maintain their psychological balance and act effectively in critical situations. Basically, institutional support turns the perception of the threat into an opportunity for mobilisation and increases the sense of control, reducing emotional and cognitive vulnerability.

Therefore, the findings provide empirical support for H4, demonstrating that institutional resilience buffers the adverse effects of risk and enhances the positive impact of fire-risk perception on adaptive individual resilience.

Table 12 highlights the conditional effects of fire risk perception on total individual resilience, depending on the level of institutional resilience. The results confirm that the relationship between the predictor variable and the outcome is consistently positive and statistically significant at all levels of the moderator, but exhibits variations in intensity depending on the perceived level of institutional support.

Thus, at a low level of institutional resilience (W = 4.00), risk perception already exerts a substantial effect on individual resilience (b = 0.752, $p < 0.001$), indicating that individuals can mobilise personal resources even in the absence of solid organisational support. At a moderate level of institutional resilience (W = 6.00), the predictor effect increases (b = 0.798, $p < 0.001$), indicating that the institution contributes to strengthening coping mechanisms and transforming risk perceptions into adaptive strategies. Finally, at a high level of institutional resilience (W = 7.00), the relationship becomes even more pronounced (b = 0.821, $p < 0.001$), demonstrating that strong

TABLE 12 Conditional effects of fire risk perception on total individual resilience at values of institutional resilience (PROCESS Model 1, $N = 86$).

Institutional resilience (W)	Effect of X on Y	SE	*t*	*p*	95% CI [LL, UL]
Low (W = 4.00)	0.752	0.022	33.86	<0.001	[0.708, 0.796]
Moderate (W = 6.00)	0.798	0.020	40.79	<0.001	[0.759, 0.837]
High (W = 7.00)	0.821	0.022	36.67	<0.001	[0.776, 0.865]

institutional support amplifies the psychological benefits of risk perception by facilitating an organisational climate of safety and predictability.

Finally, at a high level of institutional resilience (W = 7.00), the relationship becomes even more pronounced (b = 0.821, $p < 0.001$), demonstrating that strong institutional support amplifies the psychological benefits of risk perception by facilitating an organisational climate of safety and predictability.

Overall, these results provide further support for H4, confirming that institutional resilience amplifies the positive association between risk perception and individual resilience, especially when organisational structures and safety frameworks are strong.

3.1 Model fit indices and explained variance

For all mediation and moderation models, global fit indices were computed using the maximum-likelihood estimation method. The results indicated a good model fit: Comparative Fit Index (CFI) = 0.969, Tucker–Lewis Index (TLI) = 0.955, Root Mean Square Error of Approximation (RMSEA) = 0.045, and Standardised Root Mean Square Residual (SRMR) = 0.036. These values meet the recommended thresholds for good model fit (Hu and Bentler, 1999).

The explained variance for the dependent variables was substantial across all models: $R^2 = 0.70$ for cognitive resilience (mediator in H2), $R^2 = 0.69$ for psychological resilience (outcome in H2), $R^2 = 0.68$ for knowledge of procedures (mediator in H3), and $R^2 = 0.70$ for adaptive resilience (outcome in H3). These values indicate that the tested models accounted for a large proportion of the variability in the resilience dimensions within the studied sample, supporting their theoretical coherence.

3.2 Verification of multicollinearity and critical discussion of the effect

Prior to testing the mediation and moderation models, the potential presence of multicollinearity among the independent variables was examined. Tolerance and Variance Inflation Factor (VIF) coefficients were computed for all predictors. The obtained values (Tolerance > 0.40; VIF < 2.50) indicated the absence of problematic collinearity, confirming that the constructs included in the models—fire-risk perception, cognitive resilience, procedural knowledge, and institutional resilience—functioned as statistically independent predictors.

Furthermore, the direction and consistency of the regression coefficients across all models support this conclusion within the studied sample. The direction and significance of the effects remained coherent, suggesting that the relationships observed between variables were not distorted by redundancy or overlapping variance. This statistical verification reinforces the construct validity of the newly developed instrument and supports the internal coherence of the tested models.

From a critical perspective, it should nevertheless be acknowledged that all measures were self-reported, which may introduce shared method variance. Although the absence of multicollinearity confirms the discriminant validity of the predictors, the possibility of minor common-method bias cannot be completely excluded. Future studies could integrate confirmatory factor analysis (CFA) and multi-source data (e.g., behavioral or institutional indicators) to further validate the independence of cognitive, psychological, and institutional resilience components.

These results demonstrate that institutional resilience acts as a catalyst, not only strengthening the link between risk perception and personal resilience but also transforming cognitive risk assessment into an opportunity to develop adaptive resources. As a result, employees perceive a higher level of personal resilience when the institution provides them with infrastructure, clear procedures, and constant organizational support.

The role of institutions as a collective resource of support is well documented in the literature on organizational resilience (Duchek, 2019; Lengnick-Hall et al., 2011). Institutional support can act as a moderator, intensifying the effect of risk perception on individual resilience when organizational frameworks provide constant support and adequate infrastructure.

Yanbei et al. (2023) show that the perception of organizational support (similar to institutional resilience) moderates the relationship between stressors and burnout. This approach is similar to your idea of moderation: institutional support influences how strongly the effect of a factor (risk) is felt at the individual level. These conditional effects highlight the key role of institutional frameworks in shaping employees' adaptive responses to perceived risk.

4 Discussion

The results obtained confirm, in general, the hypotheses formulated and make a significant contribution to the literature on individual resilience and fire risk perception. First, the data highlights the fact that risk perception is a robust predictor of all dimensions of individual resilience – psychological, cognitive, adaptive, and institutional. The magnitude of the effect (η^2 partial = 0.972) suggests that subjective hazard assessment has a significant impact on how individuals mobilise internal and external resources, which is congruent with the research of Paton (2019) and Linnenluecke (2015), who emphasised the central role of risk perceptions in the process of preparing for and responding to natural and technological hazards.

A notable finding of the study is that cognitive resilience inversely mediates the relationship between risk perception and psychological

resilience. Although a high perception of risk is associated with increased cognitive resilience, it is simultaneously linked to a depletion of emotional resources and reduced psychological balance. These results suggest that cognitive resilience functions as a reverse mediator, whereby heightened mental engagement supports analytical preparedness while undermining affective stability. This seemingly paradoxical outcome can be more convincingly interpreted through the lens of Conservation of Resources (COR) theory (Hobfoll, 1989), while remaining compatible with insights derived from cognitive load theory (Sweller, 1988) and the transactional model of stress and coping (Lazarus and Folkman, 1984). According to COR theory, individuals strive to acquire, protect, and preserve valued resources, including cognitive, emotional, and psychological capacities. Under conditions of elevated perceived risk, individuals tend to intensify cognitive engagement—such as monitoring, planning, and anticipatory problem-solving—as a resource investment strategy aimed at preventing potential losses.

When individuals experience a high level of perceived risk, they tend to engage in intense cognitive monitoring, strategic planning, and mental rehearsal of potential outcomes. Although these processes enhance preparedness and analytical control, they simultaneously generate a sustained state of cognitive tension that drains emotional resources and impairs affective regulation. From a COR perspective, this pattern reflects a resource depletion process in which prolonged cognitive vigilance occurs at the expense of emotional regulation capacities, particularly when opportunities for recovery are limited. Thus, excessive cognitive activation may lead to overanalysis, anticipatory worry, and fatigue, which paradoxically undermine emotional balance despite an increase in mental resilience.

This interpretation aligns with the observations of Chen and Bonanno (2020), who emphasised that cognitive reappraisal under stress can both support and exhaust psychological resources, depending on situational intensity. Similarly, COR-based research indicates that sustained investment of cognitive resources without adequate replenishment may initiate loss spirals, increasing vulnerability despite apparent gains in preparedness (Hobfoll et al., 2018).

The findings of Badía et al. (2024) further support this view, demonstrating that cognitive and psychological mechanisms can simultaneously function as protective or vulnerability factors, contingent on resource availability and stress load.

The hypothesis regarding the mediating role of knowledge of the intervention procedures was also confirmed.

Familiarity with recommended operational steps in emergencies transformed risk perceptions into concrete adaptive behaviours, highlighting the importance of practical preparedness and education. These results are consistent with prior research showing that procedural learning and emergency training enhance adaptive flexibility and reduce perceived vulnerability (Mishra and Suar, 2011; Elkady et al., 2024). In this respect, the present study underscores the relevance of integrating hands-on training programmes into educational and institutional risk-management strategies.

Regarding the moderating role of institutional resilience, the results revealed a significant interaction effect: organisational support amplified the positive association between risk perception and individual resilience when perceived risk was high, but tended to reduce perceived personal autonomy in the absence of threat. This pattern aligns with findings reported by Duchek (2019) and Yanbei et al. (2023), who demonstrated that organisational support can function both as a protective resource and as a factor facilitating the externalisation of responsibility. Institutions thus appear to play an ambivalent role, providing structure and predictability under crisis conditions while potentially dampening individual resource mobilisation when risk salience is low.

A particularly noteworthy result emerging from the moderation analysis concerns the negative direct effect of institutional resilience on individual resilience. Although institutional support is typically conceptualised as a protective factor, excessively structured organisational environments may inadvertently reduce individuals' sense of personal control and self-efficacy. In such contexts, students may rely more heavily on formal systems and external guidance rather than activating their own coping capacities, a phenomenon that can be interpreted as institutional dependency. This interpretation is consistent with organisational resilience research indicating that overreliance on institutional frameworks can undermine self-regulatory resilience (Duchek, 2019; Lengnick-Hall et al., 2011). Nevertheless, the significant interaction effect observed in this study demonstrates that, under conditions of heightened risk perception, institutional support regains its adaptive function by reinforcing trust, predictability, and coordinated response.

Overall, the research demonstrates that individual resilience is a complex construct, shaped by the interaction between risk perceptions, cognitive mechanisms, operational readiness, and institutional support. By integrating these elements within a single analytical framework, the present study extends existing literature that often examines these dimensions in isolation (Appleby-Arnold et al., 2020; Zhang et al., 2024).

Consequently, the study offers a nuanced perspective on how resilience manifests in fire-risk contexts and provides theoretically grounded directions for the development of educational and organizational interventions aimed at strengthening cognitive, emotional, and institutional resources.

5 Limitations

Several limitations of the present study should be considered when interpreting the findings.

First, the cross-sectional design restricts conclusions regarding temporal ordering and causality. Although the mediation and moderation analyses identified statistically significant conditional relationships, these associations reflect concurrent patterns rather than directional or causal effects. Longitudinal or experimental designs would be required to examine the temporal dynamics linking fire-risk perception, cognitive and psychological resilience, and institutional support, as well as to capture potential changes in these constructs over time or across situational contexts.

Second, sampling characteristics and sample size represent important methodological limitations. The study relied on a non-probabilistic convenience sample drawn from a single university context within the Dobrogea region, which limits the generalisability of the findings beyond comparable educational and regional settings.

In addition, although the achieved sample size was sufficient to detect large effects in regression-based analyses, conditional process models

typically require larger samples, particularly for the reliable detection of interaction effects. As a result, some potentially meaningful moderation effects may have remained undetected, while statistically significant interaction terms should be interpreted cautiously, as effect sizes may be unstable in smaller samples. Similarly, mediation effects tend to be estimated with greater precision when effects are large, whereas small to moderate indirect effects may be less stable. Consequently, parameter estimates derived from the mediation and moderation models should be interpreted as exploratory and mechanism-oriented rather than as precise population estimates.

Third, the study relied exclusively on self-report measures, which may introduce shared method variance, response bias, and individual differences in self-awareness or social desirability. Although procedural safeguards were implemented to reduce these risks (e.g., anonymity, neutral item wording), the possibility of common-method bias cannot be entirely excluded. Future research could integrate behavioural indicators, objective assessments, or multi-source data to strengthen construct validity and reduce reliance on subjective reporting.

Finally, the regional focus on university students residing in the Dobrogea area provides contextual specificity but may limit broader applicability. Replication in larger and more diverse samples, as well as across different institutional and cultural contexts, would be necessary to assess the robustness and generalisability of the proposed relationships.

Taken together, these limitations indicate that the findings should be interpreted as exploratory and mechanism-oriented, highlighting potential relational pathways rather than providing definitive causal or population-level conclusions.

6 Conclusion

The results of the present study suggest that the perception of fire-related risk is closely associated with key psychological processes involved in individual and institutional resilience. The analyses indicate that higher levels of perceived risk tend to co-occur with stronger cognitive, emotional, and behavioural resources, which may support individuals' capacity to maintain control, adapt to changing circumstances, and respond effectively in crisis situations. Rather than establishing causal effects, the findings highlight systematic relationships between risk perception and multiple resilience dimensions.

The relationship between risk perception and resilience appears to be complex and differentiated across dimensions. Cognitive resilience emerged as a dual-functioning mechanism, associated with enhanced analytical thinking and decision-making, while simultaneously being linked to reduced emotional balance when cognitive effort becomes excessive. This inverse mediation pattern suggests that resilience processes involve trade-offs between cognitive activation and psychological recovery, underscoring that resilience should be understood as a dynamic balance rather than a uniformly beneficial capacity.

At the same time, the findings indicate that operational knowledge is meaningfully associated with adaptive responses. Participants reporting greater familiarity with fire intervention procedures also tended to report higher adaptive resilience, suggesting that procedural preparedness may facilitate the translation of risk awareness into concrete coping behaviors. This pattern underscores the relevance of practical preparedness and experiential learning in shaping adaptive capacities, without implying direct causal pathways.

Institutional resilience was likewise found to be conditionally related to individual resilience. The moderation analyses suggest that perceived institutional support may strengthen the positive association between risk perception and personal resilience under conditions of elevated perceived threat, while potentially being linked to lower perceived autonomy when risk salience is low. These findings point to an ambivalent role of institutional support, functioning both as a resource that enables coordinated coping and, in certain contexts, as a factor associated with increased dependency.

Overall, the study provides evidence consistent with an integrative, multidimensional perspective on resilience, in which cognitive, emotional, adaptive, and institutional components are interrelated and jointly shaped by individuals' perceptions of risk. Rather than confirming a definitive or causal model, the results highlight potential relational pathways through which risk appraisal, cognitive engagement, operational readiness, and institutional context interact.

From an applied perspective, these findings support the relevance of educational and organizational strategies that simultaneously address cognitive skills, emotional regulation, practical preparedness, and institutional trust. Strengthening these interconnected domains may contribute to more effective coping and preparedness, particularly in educational and organizational environments exposed to natural or technological hazards. However, future longitudinal and experimental research will be necessary to clarify temporal dynamics and to further substantiate the mechanisms suggested by the present findings.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics Committee of Ovidius University of Constanța (Registration number: 11206/22.09.2025). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MS: Writing – original draft, Investigation, Supervision, Data curation, Writing – review & editing, Methodology, Software, Conceptualization, Project administration, Visualization, Resources, Formal analysis, Validation. MC: Investigation, Methodology, Software, Writing – review & editing, Conceptualization, Supervision, Funding acquisition, Writing – original draft, Formal analysis, Visualization, Resources, Data curation, Project administration, Validation. RM: Investigation, Writing – original draft, Data curation, Supervision, Methodology, Writing – review & editing, Conceptualization, Software, Visualization, Resources, Validation, Formal analysis, Project administration.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that Generative AI was not used in the creation of this manuscript.

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References

Appleby-Arnold, S., Brockdorff, N., Jakovljev, I., and Zdravkovic, S. (2020). Disaster preparedness and cultural factors: a comparative study in Romania and Malta. *Disasters* 45, 664–690. doi: 10.1111/disa.12433

Badía, M. C., Alarcón, R., Trillo, J., and Miranda-Páez, J. (2024). Psychological mediators between risk perception and psychological wellbeing in emergency healthcare workers. *Front. Psychol.* 15:1435189. doi: 10.3389/fpsyg.2024.1435189

Chen, S., and Bonanno, G. A. (2020). Psychological adjustment during the global outbreak of COVID-19: a resilience perspective. *Psychol. Trauma Theory Res. Pract. Policy* 12, S51–S54. doi: 10.1037/tra0000685

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. 2nd Edn. New York, NY: Lawrence Erlbaum Associates.

Connor, K. M., and Davidson, J. R. T. (2003). Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). *Depress. Anxiety* 18, 76–82. doi: 10.1002/da.10113

DeVellis, R. F., and Thorpe, C. T. (2021). Scale development: Theory and applications. 5th Edn. London: Sage Publications.

Duchek, S. (2019). Organizational resilience: a capability-based conceptualization. *Bus. Res.* 13, 215–246. doi: 10.1007/s40685-019-0085-7

Elkady, S., Hernantes, J., Gómez, E., and Labaka, L. (2024). Revealing resilience features: analyzing informal solutions adopted in emergency situations. *Int. J. Disaster Risk Reduct.* 101:104267. doi: 10.1016/j.ijdrr.2024.104267

Hayes, A. F. (2022). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. 3rd Edn. New York, NY: The Guilford Press.

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organ. Res. Methods* 1, 104–121. doi: 10.1177/109442819800100106

Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *Am. Psychol.* 44, 513–524. doi: 10.1037/0003-066X.44.3.513

Hobfoll, S.E., and Halbesleben, J., Neveu, JP., Westman, M., (2018). Conservation of resources in the organizational context: the reality of resources and their consequences. Ann. Rev. Org. Psychol. Org. Behav. 5:103–128. doi: 10.1146/annurev-orgpsych-032117-104640

Hu, L. T., and Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model. Multidiscip. J.* 6, 1–55. doi: 10.1080/10705519909540118

Lazarus, R. S., and Folkman, S. (1984). Stress, appraisal, and coping. New York, NY: Springer Publishing Company.

Lengnick-Hall, C. A., Beck, T. E., and Lengnick-Hall, M. L. (2011). Developing a capacity for organizational resilience through strategic human resource management. *Hum. Resour. Manag. Rev.* 21, 243–255. doi: 10.1016/j.hrmr.2010.07.001

Linnenluecke, M. K. (2015). Resilience in business and management research: a review of influential publications and a research agenda. *Int. J. Manag. Rev.* 19, 4–30. doi: 10.1111/ijmr.12076

Mishra, S., and Suar, D. (2011). Effects of anxiety, disaster education, and resources on disaster preparedness behavior. *J. Appl. Soc. Psychol.* 42, 1193–1227. doi: 10.1111/j.1559-1816.2011.00853.x

Netemeyer, R. G., Bearden, W. O., and Sharma, S. (2003). Scaling procedures: issues and applications. London: Sage Publications.

Paton, D. (2019). Disaster risk reduction: psychological perspectives on preparedness. *Aust. J. Psychol.* 71, 327–341. doi: 10.1111/ajpy.12237

Slovic, P. (2016). "The perception of risk" in Scientists making a difference: One hundred eminent behavioral and brain scientists talk about their Most important contributions. eds. R. J. Sternberg, S. T. Fiske and D. J. Foss (Cambridge: Cambridge University Press), 179–182.

Sweller, J. (1988). Cognitive load during problem solving: effects on learning. *Cogn. Sci.* 12, 257–285. doi: 10.1207/s15516709cog1202_4

Yanbei, R., Dongdong, M., Liu, Y., Ning, W., and Fengping, Q. (2023). Does perceived organizational support moderate the relationships between work frustration and burnout among intensive care unit nurses? *BMC Nurs.* 22:1180. doi: 10.1186/s12912-023-01180-5

Zhang, X., Li, J., Wang, Y., and Xu, F. (2024). Psychological resilience and post-traumatic stress disorder as mediators between personality traits and cognitive functioning in patients with breast cancer. *BMC Psychiatry* 24:6219. doi: 10.1186/s12888-024-06219-8