



OPEN Research on the relationship between perceived social support and positive coping style of fire rescue personnel with the mediating effects of positive emotions and meaning in life

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In the realm of emergency response, the mental health of fire rescue personnel holds significant importance. Given that they are constantly confronted with sudden disasters, the coping style they adopt has a profound impact on their overall well-being. Although it is already known that there exists a connection between perceived social support and positive coping, the underlying mechanisms remain to be explored. This study was designed with the aim of clarifying how perceived social support influences the positive coping style among fire rescue personnel, as well as identifying the mediating roles played by positive emotions and the sense of meaning in life. To this end, we conducted a survey using relevant scales among 354 fire rescue personnel. The results demonstrated positive correlations among relevant factors and revealed that positive emotions and the sense of meaning in life have significant mediating effects. This paper reveals the internal mechanisms underlying the relationship between perceived social support and positive coping style among fire rescue personnel, aiming to contribute to the improvement of the mental health and rescue capabilities of fire rescue personnel by providing a theoretical basis and practical guidance for improving the mental health and rescue ability of fire rescue personnel. Moreover, they may serve as a guide for future intervention strategies and offer valuable insights for similar research in other high-stress occupations, thereby enhancing the overall effectiveness of emergency response efforts.

Keywords Fire rescue personnel, Occupational health, Perceived social support, Positive coping style, Positive emotion, Meaning of life

Fire rescue personnel are required to respond to a variety of emergency situations involving human suffering, danger, and death. For example, their occupational work includes providing emergency medical assistance to injured people and rescuing humans from accidents, fires, floods, or other natural or human-made disasters. Consequently, fire rescue personnel are regularly confronted with traumatic events^{1,2}. That is, they are confronted (directly or witnessing) with actual or threatened death, serious injury, sexual violence, and/or serious aversive details of those events. These situations go along with physical, psychological, and emotional stress. Subsequently, fire rescue personnel are at higher risk for experiencing strong negative emotions (e.g., fear, worry), and disturbed sleep or concentration^{3–6}, which in turn promotes the development of physical and mental health problems. Indeed, the more often fire rescue personnel are confronted with traumatic events on duty, the higher is their risk of clinically significant and often comorbid depressive and post-traumatic symptoms as well as physical complaints^{4,7–14}.

Besides the experience of traumatic events, the burden of fire rescue personnel is further complicated by their workload, resulting from adverse working conditions such as shiftwork and its known negative consequences on physical and mental health¹⁵. Further factors are chronic workplace stress such as false alarms, time pressure

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and tensed relationships with colleagues and managers due to increased stress in an already high-stress profession^{3,7,16,17}.

In sum, several factors might lead to the perception of increased work-related stress in fire rescue personnel, which accelerates the development of posttraumatic, depressive, and somatic symptoms^{13–21}. These mental and physical health problems can in turn cause sickness-related absence from work, earlier retirement and even complete withdrawal from the job^{11,22–24}. These challenges significantly hinder the stability and operational effectiveness of fire rescue personnel²⁵. Therefore, investigating the factors influencing the mental health of fire rescue members and providing a scientific basis for maintaining the mental health of fire rescue members are important topics that need to be addressed at present.

A positive coping style refers to a problem-solving orientation where individuals actively seek internal and external resources to develop strategies for addressing challenges²⁶. A positive coping style is not only an important factor influencing mental health but is also closely related to work performance^{27–29}. Research³⁰ has shown that adopting a positive coping style can help promote the mental health of fire rescue personnel. Moreover, perceived social support is crucial for physical and mental health³¹ and is closely related to positive coping style. Perceived social support refers to an individual's subjective perception of the support they receive from their social environment^{32,33}. According to the social support buffer model, social support indirectly affects mental health by influencing internal factors such as individual personality, cognition and coping style. In other words, greater perceptions of good social support increase individuals' tendency to choose positive coping style³⁴. Perceived social support can improve the use of positive coping style by enhancing positive self-evaluations³⁵. Armed police soldiers can obtain more support and help from family members and surrounding comrades. Some studies indicate that if armed police soldiers receive good perceived social support, they are more inclined to take active coping methods to solve problems and seek help³⁶.

Positive emotion is a pleasant feeling³⁷. Broaden and build theories of positive emotions suggest that positive emotions can improve an individual's way of thinking about daily events and coping style^{38,39}. Studies have shown that individuals can improve their coping style by expressing positive emotions^{40,41}. Moreover, positive emotions may also be predictive of perceived social support. Conservation of resources theory suggests that people always tend to use a kind of resource for storage⁴². By increasing reserves, people will actively invest and construct resources to cope with all possible types of pressure or risk in the future⁴³. According to the source and stability of resources, Ten Brummelhuis and Bakker divided perceived social support and positive emotions into exogenous resources and internal resources, respectively⁴⁴. Exogenous resources promote or hinder the acquisition of internal resources, and exogenous resources can penetrate into internal resources in different situations. That is, an individual's perceived social support resources can affect his emotional resources. Moreover, other studies have shown that individuals' perceived social support can indeed play a protective role in their psychological adjustment and help them experience positive emotions⁴⁵. Therefore, positive emotions may play a mediating role in the relationship between the perceived social support and positive coping style.

The meaning in life also plays an important role. In this study, in addition to positive emotions, meaning in life plays a mediating role in the relationship between the perceived social support and coping style. The meaning in life is a subjective experience; it refers to the individual's pursuit and determination of goals, thinking about and interpreting life events and experiences, and feeling that life is worth living^{46,47}. The meaning in life has an important influence on individuals' mental health⁴⁸. The meaning-making model suggests that the general sense of meaning influences people's thoughts, behaviors and emotional states to a large extent^{49,50}. The meaning in life can effectively induce individuals to adopt positive coping style to adapt to the environment^{51,52}. The meaning in life contains values, a sense of purpose, and a sense of integration with time. Studies have shown that meaning of life has a significant predictive effect on coping style⁵³; that is, individuals with stronger meaning of life are more inclined to adopt positive coping style to address problems^{54–56}. Additionally, the meaningfulness of life maintenance and fluid models⁵⁷ indicates that when the meaning of life of an individual is threatened, the individual can be compensated from other fields to maintain the meaning of life. This compensation can be carried out in different fields; that is, when the meaning of life of an individual is reduced, it can be obtained from the support of others⁵⁸. The stronger the social support is, the better the adaptive state, and the greater meaning in life experienced in the social environment⁵⁹. Research has shown that individuals who feel more social support can construct their own positive belief system. The belief system helps them find solutions to problems associated with life difficulties, complete corresponding goals, obtain strong self-satisfaction, realize self-worth, and enhance their meaning in life⁶⁰.

Although previous studies have shown that perceived social support, positive emotions, meaning of life, and positive coping style are positively correlated, few scholars have studied the four as a whole to examine how they influence each other. The perceived social support and active coping methods is highly important to the group of fire rescue personnel, but the internal mechanism is not fully understood. On the basis of relevant theories and research results, this study examines the mechanism of positive emotions and meaning in life in the perceived social support and positive coping style of fire rescue personnel. The following hypothesis is proposed:

Hypothesis 1 There was a significant positive correlation between fire rescue personnel's perceived social support and positive coping style.

Hypothesis 2 Positive emotions play a mediating role in fire rescue personnel's perceived social support and positive coping style.

Hypothesis 3 The meaning in life plays a mediating role in the perceived social support and positive coping style of fire rescue personnel.

Hypothesis 4 Positive emotions and meaning in life play dual mediating roles in the perceived social support and positive coping style of fire rescue personnel, respectively.

Methods

Participants and procedure

This study uses a convenient sampling method, and 370 fire rescue personnel in a city were investigated and measured by completing paper questionnaire. After screening for validity, 354 valid responses were obtained, resulting in a recovery rate of 95.68%. Among the 354 fire rescue personnel in this study, 334 were male, accounting for 94.35%, and 20 were female, accounting for 5.65%. A total of 139 (39.27%) were aged 18–22 years, 154 (43.50%) were aged 23–26 years, and 61 (17.23%) were aged 27 years and above. There were 264 Han people, accounting for 74.58%, and 90 ethnic minorities, accounting for 25.42%. There were 102 students in high school or below, accounting for 28.81%; 188 students in junior colleges, accounting for 53.11%; 64 students with a bachelor's degree or above, accounting for 18.08%; 110 only children, accounting for 31.07%; 244 nononly children, accounting for 68.93%; and 167 rural residents (47.18%), 30 rural residents (8.47%), and 157 urban residents (44.35%). A total of 297 (83.90%) patients participated in rescue missions, and 59 (16.10%) did not participate in rescue missions. Among them, 118 (33.33%) were single, 92 (25.99%) were in love, and 144 (40.68%) were married. The questionnaires used in this study are paper-based, with Likert-type scales measuring different psychological characteristics. Ethical approval for this study was obtained from the Mahasarakham University Ethics Committee for research involving human subjects (ethics codes 382-220/2024). The study was conducted in accordance with the approved guidelines and regulations. Informed consent was obtained from the all participants.

Measure

To assess the participants' state of mind, the Perceived Social Support Scale (PSSS), the Positive Affect and Negative Affect Scale (PANAS), the Meaning in Life Questionnaire (MLQ) Scale and the Simplified Coping Style Questionnaire (SCS) were used.

Perceived social support scale

This study adopts the “Perceived Social Support Scale” compiled by Zimet⁶¹. The scale measures the degree to which an individual perceives support from the environment, including the degree to which support is available and the level of different sources of support, in 12 items. The scale uses a 7-point scale (1 = “strongly disagree”, 7 = “strongly agree”), and the higher the score is, the greater the degree of perceived social support. The Cronbach's α of this scale was 0.874. Confirmatory factor analysis revealed that the scale had good structural validity ($\chi^2/df=1.830$, $RMSEA=0.048$, $CFI=0.987$, $TLI=0.983$).

The positive affect and negative affect scale

This study uses the positive affect and negative affect scale developed by Watson et al.⁶². Composed of 20 adjectives used to describe positive or negative emotions, the participants were asked to use a 5-point scale (1 = “not at all”, 5 = “almost always”) according to their actual situation in the past two weeks. In this study, the top 10 positive emotions sub-scale was used, and the greater the score in this part was, the greater the number of recent positive emotions. The Cronbach's α coefficient of this scale was 0.909. Confirmatory factor analysis revealed that the scale had good structural validity ($\chi^2/df=2.989$, $RMSEA=0.075$, $CFI=0.959$, $TLI=0.947$).

Meaning in life questionnaire

The scale of college students' sense of meaning in life questionnaire revised by Wang⁶³ was adopted in this study, with a total of 10 items, including two dimensions of meaning ownership and meaning seeking. A 7-point scale was used (1 = ‘completely incorrect’, 7 = ‘completely correct’), with higher scores indicating a stronger sense of meaning in life. The Cronbach's α coefficient of this scale was 0.863. Confirmatory factor analysis revealed that the scale had good structural validity ($\chi^2/df=2.023$, $RMSEA=0.054$, $CFI=0.987$, $TLI=0.982$).

Simplified coping style questionnaire

This study uses the simplified coping style questionnaire revised by Xie⁶⁴, which has a total of 20 questions, of which 12 questions measure positive coping and 8 questions measure negative coping. The scale is graded on a 4-point scale (1 = “never”, 4 = “always”), with higher scores indicating more positive or negative coping style. In this study, the first 12 subscales of positive coping style were used, and the Cronbach's α coefficient of this scale was 0.806. Confirmatory factor analysis revealed that the scale had good structural validity ($\chi^2/df=1.904$, $RMSEA=0.051$, $CFI=0.939$, $TLI=0.925$).

Data processing

SPSS 26.0 and Mplus 8.3 were used for statistical analysis. SPSS 26.0 was used for reliability analysis, descriptive statistics, Pearson product difference correlation analysis and the common method deviation test. Mplus 8.3 was used for structural validity analysis and mediation tests, and a bootstrap program was used to test the indirect effect interval. The sample size in the model was set to 5000, and the confidence interval was set to 95%.

Results

Common method deviation test

The measurements of all the variables in this study were based on self-reports of the subjects, and there may be some common methodological bias⁶⁵. To avoid the influence of common method bias, according to the method

recommended by Zhou and Long⁶⁶, the Harman single-factor test was used to test the common method bias of the variables involved in the study. The data show that there are 9 factors with eigenvalues greater than 1 in the case of no rotation, and the variance explanation rate of the first factor is 22.513%, which is less than the critical value of 40%⁴¹, indicating that there is no serious common method bias in this study.

Descriptive analysis of perceived social support, positive emotions, meaning in life and positive coping style of fire rescue personnel under different demographic variables

The results revealed that the positive emotions scores of different age groups were significantly different ($p < 0.05$). The positive emotions scores of those aged 18–22 years was significantly greater than that of those aged 23–26 years. There was no significant difference in positive emotions between people aged 23–26 years and those aged over 27 years. There were no significant differences in the other age groups. The positive coping style scores of only children were significantly different ($p = 0.06$), with only children scoring slightly higher than non-only children. There was a statistically significant difference in the scores of positive coping style across different educational backgrounds ($p < 0.05$). The positive coping style score of those with an undergraduate education was significantly higher than that of individuals with a high school education or lower, but there is no significant difference in positive coping style between those with a high school education and those with a junior college education. The positive coping style scores in different marriage and love states were compared, and the difference was statistically significant ($p = 0.05$). Positive coping style scores were significantly higher in romantic relationships than in single and married couples, and there was no significant difference between single and married positive coping style scores. See Table 1.

Correlation analysis of perceived social support, positive emotions, meaning in life and positive coping style among fire rescue personnel

After controlling for 8 demographic variables, such as gender, age, ethnicity, residence registration, education background, whether they are only children, whether they participate in rescue missions and marriage status, descriptive statistical analysis of perceived social support, positive emotions, meaning in life, and positive coping style was performed, the results of which are shown in Table 2. Table 2 shows that perceived social support, positive emotions, meaning in life and positive coping style are significantly positively correlated ($p < 0.01$).

Mediation effect analysis

To verify the mediating effects of positive emotions and meaning in life on fire rescue personnel's perceived social support and positive coping style, Mplus 8.3 was used for path analysis, and the mediating analysis was carried out via the deviation-corrected percentile bootstrap method. This method was repeated 5000 times^{67–69}, and the confidence interval estimation was 95%. Eight demographic variables, including gender, age, ethnicity, residence registration, education level, only child status, participation in rescue missions, and marriage status, were used as control variables. The results revealed that the overall fit index of the intermediate model was good, $\chi^2/df = 1.472$, $RMSEA = 0.037$, $CFI = 0.952$, $TLI = 0.949$. The path coefficients and effect decomposition of the model are shown in Tables 3, 4, respectively.

The results of the regression analysis have been shown in Table 3.

The results are in line with our assumption (Fig. 1), its mediation effect size analysis show (Table 4) that there is a significant positive correlation between social support and positive coping style, and positive emotion and life meaning play a double mediating role. All in all, Hypotheses 1, 2, 3 and 4 have all been verified.

Discussion

Differences in the demographic variables of perceived social support, positive emotions, meaning in life and positive coping style among fire rescue personnel

This study found significant differences in the positive emotion scores of fire rescue team members across different age groups. The positive emotions score of team members 23–26 was significantly lower than that of team members 18–22 and that of team members over 27. This may be because fire rescue team members in this age group are in a period of job burnout, unlike those in 18–22-year-old team members. In terms of enthusiasm and momentum for work, unlike the age group over 27 years, both economic status and job position significantly improve, and life is more stable. There are also fewer people over the age of 27, and most people may choose to leave the fire and rescue service at the age of 23–26. Therefore, compared with the other two stages, the 23–26 age group has certain variables related to work and life, and its emotional state greatly fluctuates.

This study also revealed that the scores of the positive coping style of fire rescue team members with different educational backgrounds were different, which was similar to the results of previous studies⁷⁰. With the improvement of education, more knowledge and skills will be learned, and more opportunities will be available to learn about positive coping style. Therefore, fire rescue personnel with higher education levels can choose relevant positive coping style to address difficult situations. There are also significant differences in the scores of positive coping style of fire rescue personnel in different marriage and love states. The scores of positive coping style of fire rescue personnel in love are significantly higher than those of single and married fire rescue personnel, which may be because in love, they are more concerned about their image in the other half's mind, so they want to show all aspects of themselves positively, including positive coping style. It may also be that fire rescue personnel feel more social support from each other when they are in love, whereas married people may feel less social support from each other when they are already familiar with each other.

Variable	Number of people	Perceived social support	Positive emotions	Meaning in life	Positive coping style
Gender					
Male	334	4.93 ± 0.84	3.26 ± 7.53	4.95 ± 0.84	2.67 ± 0.43
Female	20	5.10 ± 0.66	3.19 ± 7.59	4.80 ± 0.77	2.79 ± 0.58
<i>t</i>		−1.12	0.43	0.85	−0.96
<i>p</i>		0.27	0.67	0.41	0.35
Age					
18–22	139	4.94 ± 0.89	3.37 ± 0.69	4.92 ± 0.79	2.67 ± 0.45
23–26	154	4.95 ± 0.78	3.15 ± 0.79	4.91 ± 0.86	2.67 ± 0.43
27 and above	61	4.92 ± 0.83	3.27 ± 0.76	5.07 ± 0.85	2.68 ± 0.44
<i>F</i>		0.04	3.27	0.93	0.01
<i>p</i>		0.96	0.04*	0.40	0.99
Ethnicity					
The Han nationality	264	4.98 ± 0.85	3.26 ± 0.76	4.93 ± 0.84	2.68 ± 0.43
National minority	90	4.84 ± 0.77	3.24 ± 0.73	4.99 ± 0.80	2.64 ± 0.47
<i>t</i>		1.44	0.21	−0.67	0.72
<i>p</i>		0.15	0.83	0.50	0.48
Education background					
High school and below	102	4.99 ± 0.83	3.34 ± 0.72	4.96 ± 0.81	2.62 ± 0.42
Junior college	188	4.94 ± 0.80	3.20 ± 0.74	4.89 ± 0.83	2.70 ± 0.43
Bachelor degree or above	64	4.87 ± 0.92	3.27 ± 0.84	5.06 ± 0.85	2.78 ± 0.47
<i>F</i>		0.39	1.17	0.98	3.31
<i>p</i>		0.68	0.31	0.38	0.04*
Only child					
Yes	110	5.01 ± 0.82	3.23 ± 0.74	4.95 ± 0.84	2.74 ± 0.42
No	244	4.91 ± 0.83	3.27 ± 0.76	4.94 ± 0.83	2.64 ± 0.44
<i>t</i>		1.11	−0.49	0.06	19.2
<i>p</i>		0.27	0.62	0.95	0.06
Residence registration					
Rural	197	4.92 ± 0.83	3.25 ± 0.72	4.95 ± 0.87	2.63 ± 0.44
Urban	157	4.97 ± 0.83	3.26 ± 0.79	4.94 ± 0.78	2.72 ± 0.43
<i>t</i>		1.71	−0.15	0.11	−1.89
<i>p</i>		0.18	0.89	0.91	0.06
Have you participated in a rescue mission					
Yes	297	4.94 ± 0.85	3.25 ± 0.76	4.95 ± 0.83	2.67 ± 0.42
No	59	4.96 ± 0.75	3.28 ± 0.72	4.90 ± 0.83	2.71 ± 0.50
<i>t</i>		−0.21	−0.23	0.42	−0.64
<i>p</i>		0.84	0.82	0.68	0.52
Marriage status					
Single	118	5.00 ± 0.88	3.34 ± 0.72	4.99 ± 0.86	2.63 ± 0.46
In love	92	4.99 ± 0.74	3.27 ± 0.72	4.95 ± 0.74	2.77 ± 0.40
Married	144	4.87 ± 0.84	3.18 ± 0.80	4.90 ± 0.86	2.65 ± 0.44
<i>F</i>		0.98	1.34	0.29	3.04
<i>p</i>		0.38	0.26	0.75	0.05*

Table 1. Descriptive statistics of key variables (perceived social support, positive emotions, meaning in life, positive coping style) across demographic subgroups of fire rescue personnel ($\bar{x} \pm s$). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, the same applies below.

The mediating effect of positive emotions and sense of meaning in life on the influence of perceived social support on the positive coping style of fire rescue personnel

In this study, the results show that there is a significant positive correlation between the perceived social support and the active coping style of fire rescue personnel. The higher the perceived social support level of fire rescue team members is, the higher the score of their positive coping style. This result is consistent with previous research results^{34–36}. However, most previous studies have tested the direct effects of perceived social support on positive coping style, and few studies have investigated the internal mechanism involved. However, this study found that there are two other mediating variables in the relationship between perceived social support and positive coping styles among fire rescue personnel, namely, positive emotions and meaning of life.

	$\bar{x} \pm s$	1	2	3	4
1.Perceived social support	4.94 ± 0.83	1			
2.Positive emotions	3.26 ± 0.75	0.413**	1		
3. Meaning in Life	4.94 ± 0.83	0.398**	0.307**	1	
4.Positive coping style	2.67 ± 0.44	0.243**	0.373**	0.272**	1

Table 2. Correlation matrix for perceived social support, positive emotions, meaning in life, and positive coping style (n = 354).

Equation of regression		Goodness of fit			Regression coefficient	Significance
Outcome variable	Predictive variable	R	R ²	F	β	t
Positive emotions	Perceived social support	0.425	0.181	8.420	0.416	8.439**
Meaning in life	Perceived social support	0.426	0.181	8.480	0.409	8.313**
Positive coping style	Perceived social support	0.422	0.178	6.740	0.057	0.997
	Positive emotions				0.322	5.864**
	Meaning in life				0.114	2.076*

Table 3. Regression analysis results.

	Effect size	Boot standard error	Boot CI lower	Boot CI upper	Relative mediation effect (%)
Total effect	0.238	0.052	0.135	0.341	
Direct effect	0.057	0.057	-0.056	0.170	
Total mediation effect	0.181	0.035	0.116	0.253	76.05
Perceived social support—positive emotions—positive coping style	0.134	0.029	0.081	0.195	56.30
Perceived social support—meaning in life—positive coping style	0.047	0.024	0.002	0.098	19.75

Table 4. Mediation effect analysis for perceived social support and positive coping style.

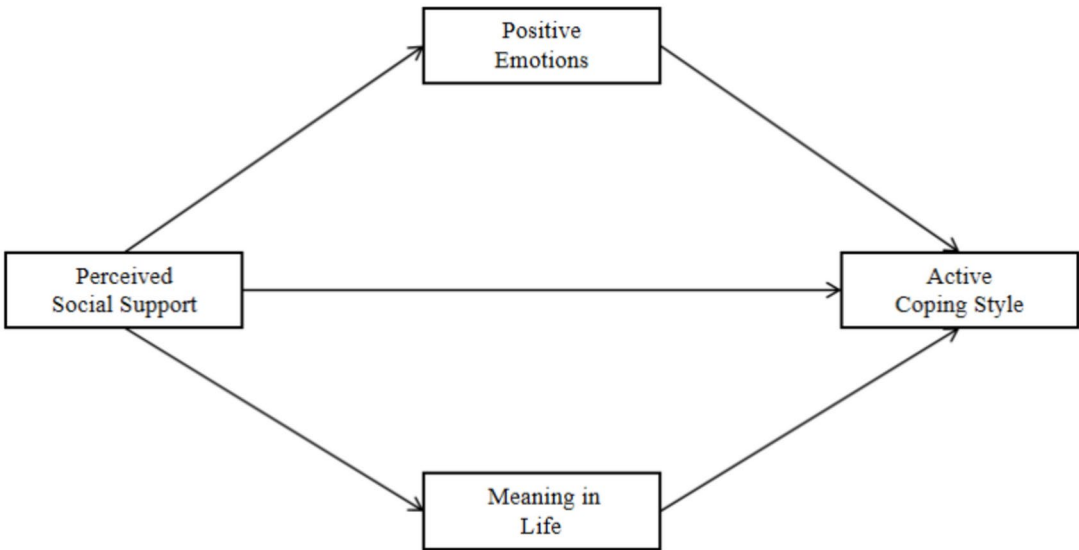


Fig. 1. Hypothesized mediating model of positive emotions and meaning in life.

Above all, according to resource conservation theory, perceived social support as an exogenous resource can provide certain external conditions for internal resources, such as positive emotions, and promote the increase in and accumulation of internal resources [12, 14]. For example, if fire rescue personnel can obtain the support and understanding of their leaders, teammates, friends, family, etc., then they will experience more positive emotions. According to the extended theory of positive emotions, such emotions help individuals broaden their cognitive perspectives, approach life with a more positive attitude, and

find constructive ways to cope with challenges [³⁸]. For instance, fire rescue personnel with greater positive emotional resources are more likely to adopt constructive coping methods when dealing with disasters or routine challenges.

Moreover, sense of meaning in life is another mediating variable in fire-rescue personnel's perceived social support and positive coping style. Above all, according to the maintenance and flow model of meaning in life, the meaning in life is not fixed but can be supplemented and enhanced from other places [⁵⁷]. In this study, perceived social support was one of the ways to enhance the meaning in life. If the firefighter receives trust and support from the people around him, this further enhances his meaning in life. Second, according to the meaning construction model of meaning in life, individuals actively participate in the process of constructing their own life meaning, in which individuals are positive rather than passive. Moreover, when individuals acquire life meaning through cognition, emotions and motivation, these life meanings will have a positive impact on their agreeable behaviour^{25,26}. Positive coping style is one of the important dependent variables. For example, fire rescue personnel with a greater meaning in life will more strongly appreciate the significance of this job to the safety of people's lives and property. In the face of dangerous situations and disasters, they are more proactive in regulating their own behavior and adopt positive coping methods to address the difficulties faced.

On the basis of positive psychology research on fire rescue team members, this study comprehensively explored the internal mechanism of fire rescue team members' perceived social support and positive coping style. The study revealed the dual mediating role of "fire rescue team members perceived social support → positive emotions → positive coping style; fire rescue team members' perceived social support → meaning in life → positive coping style". This study expands the understanding of the interactions among perceived social support, positive emotions, meaning in life and positive coping style of fire rescue personnel and extends the research scope of the emergency rescue ability of fire rescue personnel, which has certain theoretical and practical significance.

Theoretical contributions and practical values

Although positive emotions and the sense of meaning in life serve as two mediating variables in the relationship between fire rescue team members' perceived social support and positive coping mechanisms, an interesting finding from Table 4 indicates that the mediating effect of positive emotions is approximately three times stronger than that of the sense of meaning in life. Firstly, from the perspective of the Conservation of Resources Theory, positive emotions, in contrast to the sense of meaning in life, are more directly influenced by perceived social support. When fire rescue team members obtain social support, this external resource promptly transforms into positive emotions. For instance, upon receiving encouragement from teammates, which represents perceived social support, members immediately experience emotions like relief and confidence. In contrast, the construction of the sense of meaning in life is a relatively more complex and long-term process. As an immediate psychological reaction, positive emotions can swiftly respond to external support, enabling team members to quickly broaden their cognitive-behavioral patterns in challenging situations. At a rescue site, positive emotions can help them devise effective rescue strategies more rapidly, thereby playing a more prominent mediating role. Secondly, according to the Broaden-and-Build Theory of positive emotions, such emotions assist individuals in expanding their cognitive perspectives, adopting a more positive attitude towards life, and identifying constructive ways to handle challenges. In the context of fire rescue, positive emotions allow team members to perceive more possibilities in a short time frame. While the sense of meaning in life is undeniably crucial, its influence on behavior is predominantly centered on long-term value orientation and deep-seated motivation. For example, it may encourage members to remain committed to their positions over the long haul, believing in the worth of their work. However, during specific rescue operations, positive emotions prompt quicker action. Members with higher levels of positive emotions are more likely to actively search for trapped individuals, whereas the sense of meaning in life exerts a more macroscopic influence on their perception of the entire rescue profession. Finally, given the urgency and high stress levels inherent in fire rescue work, positive emotions assume particular importance during the coping process. In emergency rescue scenarios, there is little time for team members to deeply contemplate the sense of meaning in life to drive immediate actions. At a fire scene, for example, they must respond instantaneously, and positive emotions enable them to plunge into rescue operations more speedily, such as bravely entering a blaze. Meanwhile, the sense of meaning in life functions more as a source of professional perseverance in routine times, with its mediating effect during specific actions being less immediate and potent compared to that of positive emotions.

The conclusions of this study further deepen the Conservation of Resources Theory and the Broaden—and—Build Theory of Positive Emotions. In terms of the Conservation of Resources Theory, it emphasizes that positive emotions are the result of the rapid transformation of external resources. This strengthens the connection between resource gains and losses and individuals' immediate psychological responses, indicating that the acquisition of resources can quickly bring about key resources such as positive emotions, and reinforces the direct impact of resources on individual states. Regarding the Broaden—and—Build Theory of positive emotions, it highlights the role of positive emotions in prompting individuals to act quickly and expand their behavioral patterns in emergency and high—pressure scenarios. This supplements the application of this theory in special work situations and enriches the research on the influence of positive emotions on cognition and behavior.

As General Secretary Xi Jinping said, as the main force of emergency rescue and the national team, fire rescue personnel bear the important responsibility of preventing and resolving major safety risks and dealing with various disasters and accidents. Their physical and mental health development and emergency rescue ability are related to the safety of people's lives and property, which is precisely the significance of this study. In summary, perceived social support is significantly positively correlated with fire rescue personnel's positive coping styles. Positive emotions and meaning in life play multiple mediating roles between the perceived social support and

positive coping style of fire rescue personnel, and the mediating role of positive emotions is stronger. Therefore, managers of relevant emergency rescue departments should give full play to the link between positive emotions and meaning in life and pay attention to improving positive emotions and meaning in life while providing care and support to fire rescue personnel to promote the formation of positive coping style. To achieve these goals, managers can take several measures. First, organize regular psychological training sessions led by professional psychologists. These sessions can teach fire rescue personnel relaxation techniques, stress—management strategies, and how to cultivate positive emotions. Second, create a positive work environment. For example, establish a recognition system to praise and reward outstanding work, which can enhance their sense of achievement and meaning in life. Third, encourage team—building activities. These activities can strengthen the bonds among team members, increasing the perceived social support. Finally, provide individualized counseling services for fire rescue personnel who are under high stress or show signs of negative emotions, to help them better cope with work—related pressures.

Limitations and future directions

Admittedly, there were several shortcomings in this study. This study employed questionnaires for explicit measurement, which may introduce social desirability bias. Future research could incorporate implicit measures to address this limitation. Second, a cross-sectional research design was adopted in this study, so it is not possible to investigate the causal relationship between the perceived social support and positive coping style of fire rescue personnel. Future studies can adopt tracking designs, cross-lag designs or other scientific longitudinal research designs to investigate causal relationships. Third, the demographic variables in this study are relatively broad and could be refined in future research, such as the setting of working years, the number of times that comrades were killed or wounded, the number of times that they were wounded in the mission, and personally participating in rescue and treatment. Finally, due to the convenient sampling, the external validity of the results of this study is limited. There are distinct differences in the mental health of fire rescue personnel between China and Western countries, mainly reflected in the influences of cultural and social environments and the sources of occupational stress. Chinese culture highly values collectivism and the spirit of dedication. Fire rescue personnel often prioritize collective interests over personal ones. While they enjoy wide—spread social respect and a strong sense of professional honor, they also face significant pressure from social expectations. Under quasi—military management, strict discipline, high—intensity training, and career—development competition are all major sources of occupational stress for them. In contrast, Western culture focuses on individualism and self—value realization. Western fire rescue personnel are more concerned about their own feelings. However, due to insufficient social awareness and support for their mental health, some are hesitant to seek help. Their occupational stress mainly comes from the high—risk and uncertain nature of rescue missions and extremely irregular working hours, which disrupt their life rhythms and make it difficult to balance work and life.

Although the model of this study is constructed based on the firefighter group, considering that military personnel, police officers, medical staff, and others possess similar occupational characteristics, it can be validated in other occupational groups in the future.

Conclusion

In conclusion, our research is grounded in previous relevant theoretical models and has established a dual-mediation model specifically for fire rescue personnel, a group characterized by unique high-risk attributes. Through meticulous data analysis, the robustness of this model has been rigorously verified. Fire rescue personnel's perceived social support was significantly positively correlated with their positive coping styles, which was consistent with our expectations. Simultaneously, positive emotions and the meaning of life respectively act as mediating variables between perceived social support and positive coping styles.

Consequently, we draw the conclusion that in the routine education and training of firefighters, in addition to enabling them to perceive the support for their work from leaders, relatives, and friends, emphasis should also be placed on cultivating their stable and positive emotional capabilities and enhancing their thinking abilities regarding the meaning of life. For instance, when they witness life-and-death scenes at the fire site, they should be guided on how to reconstruct and repair their views on life, thereby adopting more positive coping styles to buffer the pressure and trauma brought by their work.

Data availability

The data in this study was collected by questionnaire, which is crucial to understanding the study. Meanwhile data have been provided within the manuscript or supplementary information files. We are committed to ensuring the accuracy and integrity of our data. Anyone interested can download the data for subsequent research.

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Author contributions

Zhang was responsible for the conception of the full text, data processing, writing, selection, submission and other work. Wang was responsible for the full data collection and contacted the relevant fire rescue units. Qin was responsible for writing the first English draft of the full text. Jin was responsible for the ethical review of applications and the provision of fund project support.

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Declarations

Competing interests

The authors declare no competing interests.

Informed consent

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Additional information

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