



# A Study on the Current Mental Health Status and Influencing Factors of Firefighters in China

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**Abstract.** This study aims to assess the mental health status of firefighters from various provinces and cities in China and analyze its relationship with several demographic and rescue experience variables. Through cluster sampling, 1940 on-duty firefighters (1856 males, 84 females; average age  $27.57 \pm 4.95$  years) were selected from fire stations in Shanghai, Anhui, Jiangsu, Shanxi, and the Guangxi Zhuang Autonomous Region. The participants' mental health was evaluated using the Psychological Health Scale for Firefighters, which measures 14 dimensions of mental health. The results indicate that job position, age, years of service, and the extent of exposure to traumatic rescue experiences significantly impact firefighters' mental health. Specifically, fire officers exhibit poorer mental health compared to frontline firefighters. Older firefighters tend to have more mental health issues, while more experienced firefighters show better mental health. Firefighters who have experienced one traumatic event display the poorest mental health compared to those with no or multiple traumatic experiences, suggesting a self-regulation mechanism among firefighters.

**Keywords:** Firefighters, mental health, rescue experience, age, job position

## 1 Introduction

Firefighters, as a special occupational group, bear the significant responsibilities of fire prevention, fire suppression, and emergency rescue. Their work is characterized by danger, complexity, and uncertainty<sup>[1]</sup>. With the development of the economy and society, various public safety risk incidents occur frequently. According to the "2022 Annual China Fire and Rescue Yearbook," there were 852,000 fire incidents in China in 2022, resulting in over 4,000 casualties<sup>[2]</sup>. Both the number of disasters and casualties have been increasing yearly, making firefighters' training and rescue tasks more burdensome, and rescue operations more challenging, thereby greatly threatening their occupational health. As an essential component of occupational health, mental health significantly impacts firefighters' lives and work<sup>[3]</sup>. Numerous studies have indicated that fire and rescue personnel are at high risk for mental health disorders. A meta-analysis showed that the prevalence rate of PTSD among firefighters ranges from 6.4% to 57%, which is typically higher than that of the general working population<sup>[4]</sup>. Another survey revealed that the incidence of depression among firefighters ranges from 5% to 20%,

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which could reach up to 27% following major disaster rescue missions<sup>[5]</sup>. In recent years, there have been frequent incidents of firefighters retiring, being unable to perform their duties, or even self-harming due to mental health issues, drawing increased attention to the mental health of firefighters from both the firefighting community and society at large. Currently, the main methods for assessing the mental health levels of firefighters include scale-based assessments, individual interviews, and behavioral tests, with scale-based methods being the most widely used. However, most current research employs general scales such as the Symptom Checklist-90 (SCL-90)<sup>[6]</sup>, the Minnesota Multiphasic Personality Inventory (MMPI)<sup>[7]</sup>, and the PTSD Checklist for DSM-5 (PCL-5)<sup>[8]</sup> to measure firefighters' mental health levels, with a notable lack of studies using scales specifically designed for firefighters. Given the unique nature of their work, the work environment and stressors faced by firefighters differ from those of the general occupational population. Therefore, using general psychological scales to reflect the psychological characteristics of firefighters may have certain limitations. Moreover, the sampling scope of existing studies is often small, with participants usually coming from a single province or state, making it difficult to generalize the results to the entire population.

This study intends to use a psychological health scale specifically developed for firefighters to assess the mental health levels of active firefighters in multiple provinces and cities in China. Additionally, the study aims to analyze the correlation between test results and various demographic and rescue experience variables to gain a comprehensive understanding of the overall mental health status of active firefighters in China. This will provide valuable data to support the development of mental health education and intervention programs for firefighters.

## 2 Methods

### 2.1 Participants

Through cluster sampling, on-duty firefighters were selected from fire stations (the most basic fire organization units) in Shanghai, Anhui Province, Jiangsu Province, Shanxi Province, and the Guangxi Zhuang Autonomous Region in China to participate in the study. All participants met the following criteria: (1) provided informed consent and voluntarily participated in the study; (2) had completed all initial training and were officially employed and serving at the fire stations; (3) had participated in at least one fire rescue mission. A total of 2462 questionnaires were distributed, with 1940 valid responses collected, resulting in a response rate of 78.8%.

### 2.2 Measurement

#### **Psychological Health.**

The psychological health levels of the participants were assessed using the “Psychological Health Scale for Firefighters”, developed by Hong and Fan<sup>[9]</sup>. This scale comprises 156 items, scored on a 4-point Likert scale, where higher scores indicate more severe psychological health issues. The scale includes two subscales—emotional and

behavioral—and a validity scale, covering a total of 14 dimensions: inferiority vs self-acceptance (I-S), anxiety (ANX), depression (DEP), physical symptoms (PHY), somatization (SOM), sexual maladjustment (SEM), alienation (ALI), pathological dependency (PAT), Hypomania (HYP), antisocial behavior (ANT), need for attention (NEE), distortion of reality (DIR), paranoia (PAR), and eating disorders (EAT). The specific structure of the scale can be referred to in Figure 1. The Cronbach’s  $\alpha$  coefficients for the dimensions range from 0.83 to 0.91, with a structural validity index RESEA of 0.079 and a CFI of 0.939, indicating good overall reliability and validity.

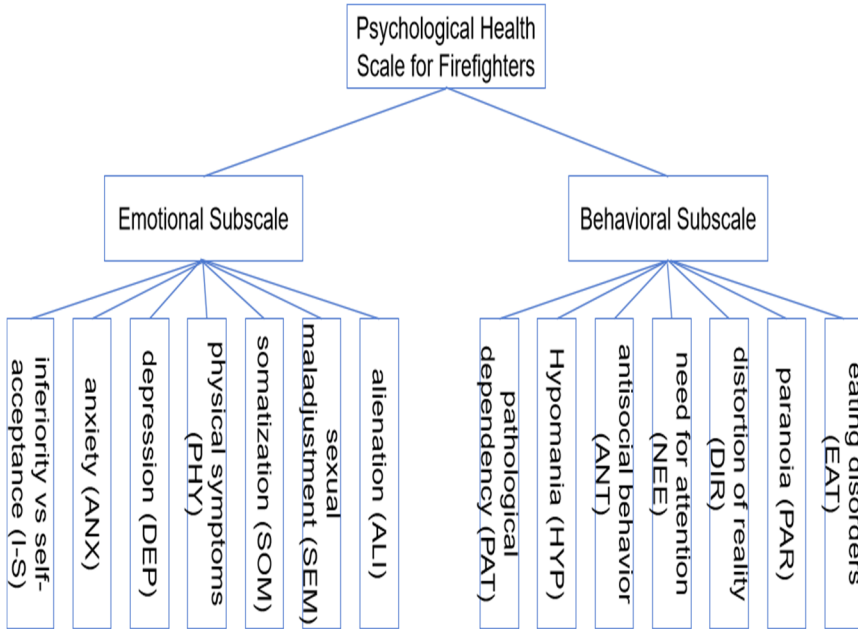


Fig. 1. Structure of the scale.

**Rescue Experience.**

The rescue incidents experienced by firefighters, especially those involving injuries and fatalities, are significant factors affecting their mental health. Therefore, during the assessment, we also collected data on participants' direct or indirect experiences of injuries and fatalities in previous rescue missions. Specific aspects include their own experiences of injuries or fatalities, witnessing comrades' injuries or fatalities, and learning about comrades' injuries or fatalities through other means.

**2.3 Data Analysis**

All empirical data from the scales will be analyzed and visualized using IBM SPSS 22.0.

### 3 Results

#### 3.1 Demographics

A total of 1940 firefighters participated in this mental health assessment, including 1856 males and 84 females, with an average age of  $27.57 \pm 4.95$  years and an average of  $5.53 \pm 5.48$  years in service. For detailed demographic statistics, see Table 1.

**Table 1.** Demographic data (n=1940).

demographic variables		n	%
gender	female	84	4.33
	male	1856	95.67
job position	frontline firefighter	1712	88.25
	fire officer	228	11.75
marital status	unmarried	1192	61.44
	married	748	38.56
rescue experience		n	%
witnessed comrades' sacrifice during training or missions	no experience	104	5.36
	experienced once	1820	93.81
	experienced more than twice	16	0.82
learned of comrades' sacrifice during training or missions	no experience	96	4.95
	experienced once	1224	63.09
	experienced more than twice	620	31.96
participated in rescue operations involving injuries or fatalities	no experience	92	4.74
	experienced once	996	51.34
	experienced more than twice	852	43.92
Injured during rescue missions	no experience	124	6.39
	experienced once	1764	90.92
	experienced more than twice	52	2.68

#### 3.2 The impact of demographic factors on mental health

##### 3.2.1 Gender

An independent samples t-test was conducted to examine the differences in mental health levels between male and female firefighters. As shown in Table 2, there were no significant differences in mental health levels between male and female firefighters. However, due to the considerable disparity in the number of participants in each group and the fact that female firefighters in China typically do not undertake direct fire-fighting and rescue duties (most of them are engaged in administrative work), the results of this analysis may have limited practical significance.

**Table 2.** T-test analysis of gender differences.

	Gender		t	p
	Male (n=1856)	Female (n=84)		
Score on the scale	1.29±0.31	1.29±0.16	0.061	0.952

\* p<0.05 \*\* p<0.01, hereinafter referred to as.

**Job Position.**

An independent samples t-test was conducted to analyze the differences in mental health levels between frontline firefighters and fire officers. As shown in Table 3, the scale scores of fire officers were significantly higher than those of frontline firefighters (p < 0.01), indicating that fire officers generally have poorer mental health compared to frontline firefighters.

**Table 3.** T-test analysis of job position differences.

	Job position		t	p
	Frontline (n=1712)	Officer (n=228)		
Score on the scale	1.24±0.24	1.63±0.46	-12.399	0.000**

**Age and Years in Service.**

A linear regression analysis was conducted to examine the impact of age and years of service on firefighters' mental health levels. As shown in Table 4, although the effect size is low (0.013), both age and years of service significantly influence mental health levels (F=13.655, p=0.000 < 0.05). The regression coefficients indicate that age has a positive effect on mental health levels (B=0.009), while years of service has a negative effect (B=-0.006). In other words, as age increases, firefighters' mental health tends to deteriorate, whereas an increase in years of service mitigates this trend.

**Table 4.** Linear Regression Analysis of Age and Years of Service.

	Unstandardized Coefficients		Standardized Coefficients	t	p	Collinearity Diagnostics	
	B	Standard Error	Beta			VIF	Tolerance
Constant	1.060	0.045	-	23.564	0.000**	-	-
Age	0.009	0.002	0.155	5.226	0.000**	1.729	0.578
Years in Service	-0.006	0.002	-0.102	-3.426	0.001**	1.729	0.578
R <sup>2</sup>				0.014			
Adjusted R <sup>2</sup>				0.013			
F				F (2, 1937) =13.655, p=0.000			
D-W (Durbin-Watson) Value				1.429			

### Marital Status.

An independent samples t-test was conducted to examine the differences in mental health levels among firefighters with different marital statuses. As shown in Table 5, although the effect size is small, the mental health status of unmarried firefighters is statistically significantly poorer than that of married firefighters.

**Table 5.** T-test analysis of marital status differences.

	Marital status		t	p
	Unmarried( <i>n</i> =1192)	Married ( <i>n</i> =748)		
Score on the scale	1.30±0.32	1.27±0.28	2.032	0.042*

### 3.3 The Impact of Rescue Experience on Mental Health

A multifactorial analysis of variance (MANOVA) was conducted to examine the impact of rescue experience (particularly traumatic experiences from past missions) on firefighters' mental health. As shown in Table 6, the main effect of rescue experience is significant (*p* values are all less than 0.01), indicating that different rescue experiences indeed affect the mental health of firefighters.

To further analyze this effect, we used Bonferroni multiple comparisons to examine the mental health status of firefighters with different rescue experiences. The results showed that, except for the comparison involving "injured during rescue missions," firefighters with one experience had the poorest mental health compared to those who had two or more experiences or no experience at all in the other three categories. The specific comparison results are shown in Table 7 (0: no experience, 1: experienced once, 2: experienced more than twice).

**Table 6.** MANOVA on the Impact of Rescue Experience on Mental Health.

	Sum of Squares	df	Mean Square	F	p	$\eta^2$
Intercept	137.003	1	137.003	1541.831	0.000**	0.444
Witnessed comrades' sacrifice during training or missions	0.842	2	0.421	4.739	0.009**	0.005
Learned of comrades' sacrifice during training or missions	2.563	2	1.282	14.424	0.000**	0.015
Participated in rescue operations involving injuries or fatalities	2.884	2	1.442	16.227	0.000**	0.017
Injured during rescue missions	0.830	2	0.415	4.673	0.009**	0.005
residual	171.5841931		0.089			

**Table 7.** Bonferroni multiple comparisons.

Comparison Item	Mean Difference	Standard Error (SE)	t	p	Cohen's d
0 - 1	-0.066	0.068	-0.979	0.984	-0.222
0 - 2	0.156	0.101	1.538	0.372	0.522
1 - 2	0.222	0.076	2.926	0.010	0.743
Learned of comrades' sacrifice					
0 - 1	-0.080	0.150	5.371	0.000	2.698
0 - 2	0.079	0.150	5.330	0.000	2.675
1 - 2	0.007	0.017	0.393	1.000	0.023
Participated in rescue operations involving injuries or fatalities					
0 - 1	-0.095	0.175	-5.428	0.000	-3.193
0 - 2	-0.091	0.174	-5.244	0.000	-3.064
1 - 2	0.038	0.016	2.342	0.058	0.128
Injured during rescue missions					
0 - 1	0.160	0.054	2.967	0.009	0.536
0 - 2	0.187	0.067	2.770	0.017	0.626
1 - 2	0.027	0.042	0.628	1.000	0.089

## 4 Discussion

The analysis results indicate that job position significantly impacts firefighters' mental health, specifically showing that fire officers have poorer mental health compared to frontline firefighters. This finding differs from some previous research conclusions, which suggest that frontline firefighters, due to higher physical demands and risks, generally have a higher risk of mental health issues than office workers<sup>[10]</sup>. However, this study shows the opposite. This suggests that, in addition to intense stressors like high temperatures, explosions, and thick smoke, the management, coordination, command, and administrative pressures within the fire service also adversely affect fire officers' mental health<sup>[11]</sup>. Therefore, while improving the mental health of frontline firefighters, it may also be necessary to address the mental health concerns of those in administrative positions.

Both age and years of service significantly impact firefighters' mental health, but their effects are in opposite directions. Older firefighters exhibit more mental health

issues, while more experienced firefighters have better mental health. In a profession that demands high physical exertion and strong physical fitness, aging often leads to a decline in professional abilities, which is associated with decreased job performance and subsequent income reduction<sup>[12]</sup>. This, in turn, results in higher levels of anxiety and depression among older firefighters<sup>[13]</sup>. However, firefighting is also a technical job that requires skills and experience. As firefighters gain more years of service, their professional competence increases, which can partially offset the decline in physical abilities<sup>[14]</sup>. Therefore, when intervening in firefighters' mental health, it is important to focus on older individuals with shorter service durations, as this group typically consists of those who have transitioned from other industries into firefighting.

Regarding rescue experiences, most previous studies have shown a positive correlation between exposure to traumatic events and firefighters' mental health<sup>[15]</sup>. Specifically, as the number of traumatic rescue events increases, firefighters tend to develop more psychological disorders, including sleep disturbances and acute/chronic stress disorders. However, this study found that firefighters who had experienced one traumatic event had the poorest mental health compared to those who had never experienced or frequently experienced traumatic rescue events. In the category of "participated in rescue operations involving injuries or fatalities," the extent of experience was even negatively correlated with the mental health level of the participants. This suggests that firefighters may possess a self-regulation mechanism that helps them adjust and restore their mental state after repeatedly experiencing traumatic events. Furthermore, as their rescue experience grows, the improvement in their professional competence also contributes to better mental health, as discussed in the section on age and years of service.

## 5 Conclusions

This study assessed the mental health status of firefighters from various provinces and cities in China and analyzed its relationship with several demographic and rescue experience variables. The results indicate that job position, age, years of service, and the extent of exposure to traumatic rescue experiences all impact firefighters' mental health. This suggests that mental health professionals in the firefighting industry should increase their focus on the mental health of fire officers, older but less experienced firefighters, and those who have had fewer traumatic rescue experiences.

## Reference

1. Gulliver, S. B., Zimering, R. T., Knight, J., Morissette, S. B., Kamholz, B. W., Pennington, M. L., Dobani, F., Carpenter, T. P., Kimbrel, N. A., Keane, T. M., Meyer, E. C. (2021). A prospective study of firefighters' PTSD and depression symptoms: The first 3 years of service. *Psychol. Trauma*, 13(1): 44–55. <https://doi.org/10.1037/tra0000980>.
2. China National Fire and Rescue Bureau. (2022). *China Fire and Rescue Yearbook (2022 Edition)*. Beijing: Fangzhi Publishing House.



3. Wolffe, T. A. M., Robinson, A., Clinton, A., Turrell, L., Stec, A. A. (2023). Mental health of UK firefighters. *Sci. Rep.*, 13(1): 62. <https://doi.org/10.1038/s41598-022-24834-x>.
4. Obuobi-Donkor, G., Oluwasina, F., Nkire, N., Agyapong, V. I. O. (2022). A Scoping Review on the Prevalence and Determinants of Post-Traumatic Stress Disorder among Military Personnel and Firefighters: Implications for Public Policy and Practice. *Int. J. Environ. Res. Public Health*, 19(3): 1565. <https://doi.org/10.3390/ijerph19031565>.
5. Wagner, S. L., White, N., Randall, C., Regehr, C., White, M., Alden, L. E., Buys, N., Carey, M. G., Corneil, W., Fyfe, T., Matthews, L. R., Fraess-Phillips, A., Krutop, E. (2021). Mental Disorders in Firefighters Following Large-Scale Disaster. *Disaster Med. Public Health Prep.*, 15(4): 504–517. <https://doi.org/10.1017/dmp.2020.61>.
6. Chen, X., Zhang, L., Peng, Z., Chen, S. (2020). Factors Influencing the Mental Health of Firefighters in Shantou City, China. *Psychol. Res. Behav. Manag.*, 13: 529–536. <https://doi.org/10.2147/PRBM.S249650>.
7. Chung, I. S., Lee, M. Y., Jung, S. W., Nam, C. W. (2015). Minnesota multiphasic personality inventory as related factor for posttraumatic stress disorder symptoms according to job stress level in experienced firefighters: 5-year study. *Ann. Occup. Environ. Med.*, 27: 16. <https://doi.org/10.1186/s40557-015-0067-y>.
8. Morrison, K., Su, S., Keck, M., Beidel, D. C. (2021). Psychometric properties of the PCL-5 in a sample of first responders. *J. Anxiety Disord.*, 77: 102339. <https://doi.org/10.1016/j.janxdis.2020.102339>.
9. Hong, S. Y., Zhang, J., Fan, W. Q., Zhong, X. (2022). Research on the occupational mental health scale for domestic fire and rescue personnel. *Fire Sci. Technol.*, 08: 1102–1105.
10. Zhang, S., Jiang, J., Hao, L., Yu, Y., Zhang, Q., Meng, H. (2023). What matters most? Network analysis of mental health, recovery experiences, sleep, and fatigue among career firefighters. *Stress Health*, 39(3): 663–672. <https://doi.org/10.1002/smi.3215>.
11. Gulliver, S. B., Pennington, M. L., Torres, V. A., Steffen, L. E., Mardikar, A., Leto, F., Ostiguy, W., Zimering, R. T., Kimbrel, N. A. (2019). Behavioral health programs in fire service: Surveying access and preferences. *Psychol. Serv.*, 16(2): 340–345. <https://doi.org/10.1037/ser0000222>.
12. Moffatt, S. M., Stewart, D. F., Jack, K., Dudar, M. D., Bode, E. D., Mathias, K. C., Smith, D. L. (2021). Cardiometabolic health among United States firefighters by age. *Prev. Med. Rep.*, 23: 101492. <https://doi.org/10.1016/j.pmedr.2021.101492>.
13. Vinnikov, D., Romanova, Z., Kapanova, G., Raushanova, A., Kalmakhanov, S., Zhigalin, A. (2021). Testosterone and occupational burnout in professional male firefighters. *BMC Public Health*, 21(1): 397. <https://doi.org/10.1186/s12889-021-10446-z>.
14. Nazari, G., MacDermid, J. C., Sinden, K. E., Overend, T. J. (2018). The Relationship between Physical Fitness and Simulated Firefighting Task Performance. *Rehabil. Res. Pract.*, 2018: 3234176. <https://doi.org/10.1155/2018/3234176>.
15. Teoh, K. R. H., Lima, E., Vasconcelos, A., Nascimento, E., Cox, T. (2019). Trauma and work factors as predictors of firefighters' psychiatric distress. *Occup. Med.*, 69(8-9): 598–603. <https://doi.org/10.1093/occmed/kqz168>.

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