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Psychological Disturbances and Associated Risk Factors in Chinese Mine Rescuers: A Cross-Sectional Study

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Purpose: This study aimed to assess the psychological disturbance profiles of Chinese mine rescuers and identify associated risk factors.

Methods: A stratified whole-group sampling method was employed to select 150 members of the Datong Mine Rescue Team in China as survey participants. These participants completed the following 6 assessment tools: the Injury Assessment Questionnaire for Mine Rescuers, the Symptom Checklist-90 (SCL-90), the Self-Rating Anxiety Scale (SAS), the Self-Rating Depression Scale (SDS), the Pittsburgh Sleep Quality Index (PSQI), and the Perceived Stress Scale (PSS). The relationships between sociodemographic variables, risk factors, and psychological disturbances were analyzed using logistic regression analysis.

Results: Based on the cut-off scores for the SAS, SDS, and SCL-90, the sample was categorized into high- and low-risk groups. Among the 150 participants of the Datong Mine Rescue Team in China, the prevalences of anxiety, depression, and psychological distress were 15.3%, 17.3%, and 43.3%, respectively. Logistic regression analysis revealed that self-perception of stress (OR=4.359, p=0.005), sleep quality (OR=4.338, p=0.010), training-related injuries history (OR=5.609, p=0.040), and training frequency (OR=3.013, p=0.047) were risk factors for anxiety among mine rescuers. Additionally, self-perception of stress (OR=7.371, p<0.001) was identified as a risk factor for depression, while sleep quality (OR=4.844, p<0.001) was a risk factor for psychological disturbance based on the SCL-90. Training with existing injuries was found to be a risk factor for interpersonal sensitivity (OR=10.054, p=0.006), depression (OR=4.698, p=0.033), anxiety (OR=6.472, p=0.027), hostility (OR=3.864, p=0.047), and other factor (OR=3.736, p=0.020) among rescuers.

Conclusion: Nearly half of the rescuers from the Datong Mine Rescue Team exhibited adverse psychological symptoms. Associated risk factors included self-perceived stress, sleep quality, training frequency, history of training-related injuries, and training with existing injuries. To promote mental health among rescuers, it is crucial to manage training-related injuries and proactively prevent training with under existing injury conditions.

Keywords: mental health, anxiety, depression, training-related injury, sleep quality, stress

Introduction

Currently, coal remains the cornerstone of China's national energy security, contributing to over 50% of the country's primary energy consumption.[1] Since 1949, more than 260,000 people have lost in coal mine safety accidents. Chinese mine rescue teams are at the forefront of responding to these disasters, serving as the primary force in protecting human lives. Due to the unique nature of their work, these rescuers often operate in high-risk, high-pressure environments, frequently confronting sudden accidents and large-scale underground disasters. This exposure makes them highly susceptible to mental health issues.

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In recent years, with increasing attention given to occupational health, the psychological disturbances experienced by mine rescuers and the associated risk factors have become significant topics of research. Reports indicate that approximately 19% of rescuers suffer from at least one mental health issue, such as depression, anxiety, or schizophrenia.[2] Psychological disturbances factors pose significant risk to occupational health and well-being. However, a review of the research on rescuers' mental health revealed that most studies have primarily focused on firefighters, with few investigations targeting other rescue teams. Mine rescuers who endure prolonged periods of pressure from accidents and large-scale underground disasters, are prone to psychological disturbances such as PTSD and acute stress disorders.[3]

Moreover, the irregular shift system and the nature of the work, which requires responding to emergency calls at any time, can disrupt circadian rhythms and reduce sleep quality, further exacerbating psychological disturbances.[4,5] Additionally, chemical pollution and hazardous substances may damage the nervous system of rescuers, increasing the risk of developing mental disorders.[6] Work-related chronic diseases and pain have also been shown to have a bidirectional correlation with mental disorders.[7] These working conditions not only pose a potential risk to the mine rescuers but also illustrate the complexity and variety of factors influencing the psychological disturbances of rescuers.

Given these circumstances, this study aimed to ascertain the current characteristics of the psychological disturbances among mine rescuers and to examine in detail the relationships between these psychological disturbances and various potential risk factors, including sleep quality, self-perception of stress, living habits, work characteristics, and training-related injuries. By constructing risk factor models and identifying the primary risk factors affecting the psychological disturbances of mine rescuers, this study aims to establish a foundation for effectively improving their overall physical and mental health.

Materials and Methods

Participants

This study involved a cross-sectional survey of the Datong Mine Rescue Team, one of the first seven mine rescue teams established in China. With a rich history of over 2100 rescue operations and saving more than 1400 miners, the team represents a highly representative sample for this research.

The Datong Mine Rescue Team comprises ten squads, with approximately 200 frontline rescuers actively serving. On the day of questionnaire distribution, work-related commitments prevented some members from participating, leading to the collection of 169 complete questionnaires. However, 19 of these were subsequently excluded due to missing essential information, leaving 150 valid responses. This resulted in an effective response rate of 88.8%.

The questionnaires were administered at the workplace of the mine rescuers and completed under the supervision of specially trained researchers. Before distribution, the researchers meticulously explained the study's purpose, significance, and the measures taken to safeguard participants' personal information. Informed consent was secured from all subjects prior to the commencement of the study.

Demographic features (age, height, weight, marital status, and educational level) were systematically reviewed and recorded through the questionnaires. Marital status was classified as single, married and divorced. Education level was classified as junior high school and below, high school and college and above.

To comprehensively assess the psychological state of the rescuers, six validated tools were utilized:

Measures

Injury Assessment Questionnaire for Mine Rescuers

Questionnaire Design: This questionnaire is primarily based on the content and format of training-related injury questionnaires for rescuers. It comprises four sections: basic information, training conditions, exercise conditions, and injury conditions.

The work-related injuries examined in this survey are defined as injuries and illnesses that have occurred during rescue operations, training, or competitions since joining the mine rescue team. The following conditions are included within the scope of this questionnaire: ① injuries sustained during mine rescue training, competitions, or missions and

② injuries that result in the inability to participate in normal training for one or more days. Individuals with minor abrasions that did not affect training were excluded from this study.

The reliability and validity of the questionnaire were assessed using Cronbach's alpha (Cronbach's $\alpha > 0.7$), the KMO value (> 0.8), and Bartlett's test of sphericity. Using SPSS 26.0 software, the questionnaire's Cronbach's alpha was found to be 0.79, the KMO value was 0.831, and Bartlett's test of sphericity yielded a p value < 0.001. These results indicate that the questionnaire possesses good reliability and validity.

Symptom Checklist-90 (SCL-90)[8]

The SCL-90, a 90-item self-report symptom inventory, was used to assess psychological distress and symptoms of psychopathology. It encompasses nine primary dimensions: somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The Global Severity Index (GSI) was considered the overall index of psychological symptoms in this study and was calculated as the average of nine subscale scores. According to the standards set by the Chinese normative sample, a dimensional factor score and GSI exceeding 2 indicate a moderate or higher level of psychological symptoms and psychological distress, respectively.[9]

Self-Rating Anxiety Scale (SAS)[10]

The Chinese version of the SAS consists of 20 standardized items, each rated on a 4-point scale. The scores are then aggregated, and a cut-off score of 50 is used to determine anxiety levels, with higher scores indicating greater anxiety.

Self-Rating Depression Scale (SDS)[11]

The SDS consists of 20 items rated on a 4-point scale to evaluate individuals' subjective depression levels, with scores standardized upon accumulation. A cut-off score of 53 was used to determine the severity of depression: scores between 53 and 62 indicated mild depression, scores between 63 and 72 indicated moderate depression, and scores 73 or higher indicated severe depression. The SDS has been validated for its reliability and accuracy in assessing depression among rescuers with psychological disturbances.[12]

Pittsburgh Sleep Quality Index (PSQI)[13]

The PSQI is a tool designed to assess subjective sleep quality. It comprises 19 items distributed across seven categories: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of hypnotic drugs, and daytime dysfunction. Each category is scored on a scale from 0 to 3, with the total score ranging from 0 to 21 points. Scores above 7 indicate poor sleep quality, aligning with current study definitions.[13–15] The PSQI is widely utilized in sleep quality research due to its robust reliability and validity.

Perceived Stress Scale (PSS)[16]

The PSS consists of 14 items divided into two dimensions, loss of control and tension, with each dimension comprising seven items. Responses are rated on a 5-point Likert scale, contributing to an overall stress score. Scores above 29 indicate high stress levels. The PSS effectively assesses individual stress levels in daily activities and professional life, demonstrating high reliability and validity.

Statistical Methodology

All study variables were meticulously selected based on the responses obtained from the questionnaire. Specifically, certain variables were coded as binary indicators ("No" = 0, "Yes" = 1), while others were categorized into multiple groups, as detailed in Table 1. Chi-square tests were first conducted to identify significant differences in demographics, sleep quality, stress levels, and history of training-related injuries between mine rescuers with and without psychological disturbances. To ensure that no potentially meaningful findings were overlooked, variables exhibiting p-values below 0.10 or clinically significant were subsequently included in a series of multivariable logistic regression analyses.[17] These analyses were conducted to evaluate their impact on anxiety, depression, and adverse psychological symptoms. Furthermore, additional multivariable logistic regression models were constructed to predict the effects of history of training-related injuries, training frequency, and training with existing injuries on various SCL-90 subscales, which

Table 1 Demographic Characteristics of the Study Sample by Psychological Disturbances (n = 150)

Category	N	SAS (%)	SDS (%)	SCL-90 (%)
Age (years)				
< 35	85	18.8	17.7	50.6[a]
≥ 35	65	10.8	16.9	33.9
Work experience (years)				
< 10	59	15.3	13.6	39.0
11–15	68	16.2	22.1	44.1
> 15	23	13.0	13.0	52.2
Education level				
Junior high school and below	33	12.1	12.1	39.4
High school	82	13.4	14.6	43.9
College and above	35	22.9	28.6	45.7
Body mass index (BMI) (kg/m^2)				
< 18.5	5	20.0	20.0	100.0
18.5–23.9	52	13.5	17.3	38.5
24–27.9	64	14.1	15.6	43.8
≥ 28	29	20.7	20.7	41.9
Marital status				
Single	12	8.3	25.0	16.8[a]
Married	131	16.0	16.8	43.5
Divorced	7	14.3	14.3	85.7
Smoking habit				
Smoker	99	13.1	17.2	37.4[a]
Nonsmoker	51	19.6	17.7	54.9
Alcohol use (≥ 1/week)				
Yes	59	17.0	22.0	45.8
No	91	14.3	14.3	41.8
PSQI				
Good	97	8.2[a]	12.4[a]	29.9[a]
Poor	53	28.3	26.4	67.9
PSS				
Low	93	8.6[a]	6.5[a]	46.2
High	57	26.3	35.1	38.6
History of training-related injuries				
No	53	20.6[a]	16.5[a]	37.7
Yes	97	5.7	18.9	46.4
Training frequency (days/week)				
1–3	70	10.0[b]	21.4	47.1
3–6	80	20.0	13.8	40.0
Training with existing injuries				
Never	63	15.9	19.1	39.7
Occasionally	45	11.1	15.6	44.4
Always	42	19.6	16.7	47.6

Notes: [a]$p < 0.05$; [b]$p < 0.1$.
Abbreviations: SAS, Self-rating Anxiety Scale; SDS, Self-rating Depression Scale; SCL-90, Symptom Checklist-90; PSQI, Pittsburgh Sleep Quality Index; PSS, Perceived Stress Scale.

served as dependent variables. Differences were considered statistically significant at the 5% level ($p < 0.05$). These models are reported as odds ratios (ORs) with corresponding 95% confidence intervals (CIs). The Hosmer-Lemeshow test was used to evaluate model fit. To control for the increased risk of Type I errors due to multiple comparisons, a Bonferroni correction was applied where necessary. Data analysis was performed using SPSS™ Statistics, version 26.

Results

This study surveyed 150 mine rescuers from the Datong Mine Rescue Team to assess their psychological health and associated risk factors. The average age of the participants was 35.64 ± 4.93 years, with a mean service duration of 11.57 ± 4.92 years. The findings revealed a significant prevalence of adverse psychological symptoms among the rescuers. Specifically, 15.3% of the respondents exhibited signs of anxiety, 17.3% experienced symptoms of depression, and 43.3% reported overall psychological distress.

The proportion of individuals with moderate or higher risk for nine adverse psychological symptoms ranked from highest to lowest were as follows: obsessive-compulsive (15.3%), somatization (12.0%), interpersonal sensitivity (10.6%), hostility (10.7%), depression (10.0%), anxiety (9.3%), psychoticism (8.0%), paranoid ideation (7.3%), and phobic anxiety (4.6%) (Table 1).

The present study examined prevalent factors associated with self-perception of stress and sleep quality among mine rescuers and identified psychological distress. The findings revealed that 38% of the participants experienced high stress levels, while 35.3% reported poor sleep quality. Further exploration of work-related activities revealed that a substantial 64.6% of team members incurred injuries during rescue operations and training sessions, whereas only 34.6% had no history of such injuries. Regarding their training frequency, 53.3% of members engaged in sessions more than three times weekly. Among them, 28.0% of the rescue team members frequently trained with existing injuries, and 30.0% of the rescue team members occasionally trained with existing injuries.

This research utilized the chi-square test to explore the relationship between potential psychological disturbances factors and the prevalence of psychological distress among mine rescuers. The findings indicate significant associations between sleep quality, self-perception of stress, and history of training-related injuries and anxiety ($p < 0.05$). Similarly, these factors exhibited a strong correlation with depressive symptoms ($p < 0.05$). Additionally, variables such as age, marital status, sleep quality, and smoking habits were significantly correlated ($p < 0.05$) with the overall mean self-assessment scores for psychological symptoms (Table 1).

Association of Risk Factors with Psychological Disturbances

Risk Factor Model for Psychological Disturbances

In examining the association of risk factors with psychological disturbances, sleep quality emerged as the main risk factor for psychological distress (OR=4.844, p<0.001) (Table 2). Significant risk factors for anxiety symptoms included poor sleep quality (OR=4.338, p=0.010), training frequency (OR=3.013, p=0.047), self-perception of stress (OR=4.359, p=0.005), and history of training-related injuries (OR=4.060, p=0.042) (Table 3). Self-perception of stress (OR=7.371, p<0.001) was identified as a major risk factor for depressive symptoms (Table 4).

Predictive Model of the Effect of Training Conditions on Psychological Disturbances Risks

The predictive model revealed that training with existing injuries had a notable impact on various psychological factors. Specifically, it significantly influenced interpersonal sensitivity (with an odds ratio of 10.054, p = 0.006), depression (OR

Table 2 Factors Associated With Psychological Disturbances Based on the SCL-90

Variables		OR	LCL	UCL	p
Smoking	No	1			
	Yes	0.606	0.285	1.292	0.195
Age	< 35	1			
(years)	≥ 35	0.541	0.261	1.122	0.099
PSQI	Good	1			
	Poor	4.844	2.313	10.146	<0.001

Abbreviations: PSQI, Pittsburgh Sleep Quality Index; OR, Odds Ratio; LCL, Lower Confidence Limit; UCL, Upper Confidence Limit.

Table 3 Factors Associated with Anxiety Based on the SAS

Variables		OR	LCL	UCL	p
PSQI	Good	1			
	Poor	4.338	1.413	13.312	0.010
Training frequency	1–3	1			
	4–6	3.013	1.017	8.927	0.047
PSS	Low	1			
	High	4.359	1.566	12.138	0.005
History of training-related injuries	No	1	-	-	
	Yes	4.060	1.054	15.651	0.042

Abbreviations: PSQI, Pittsburgh Sleep Quality Index; PSS; Perceived Stress Scale; OR, Odds Ratio; LCL, Lower Confidence Limit; UCL, Upper Confidence Limit.

Table 4 Factors Associated with Depression Based on the SDS

Variables		OR	LCL	UCL	p
PSQI	Good	1			
	Poor	2.369	0.911	6.161	0.077
PSS	Low	1			
	High	7.371	2.701	20.119	< 0.001
History of training-related injuries	No	1			
	Yes	0.860	0.321	2.303	0.860

Abbreviations: PSQI, Pittsburgh Sleep Quality Index; PSS, Perceived Stress Scale; OR, Odds Ratio PSS; LCL, Lower Confidence Limit; UCL, Upper Confidence Limit.

= 4.698, p = 0.033), anxiety (OR = 6.472, p = 0.027), hostility (OR = 3.864, p = 0.047), as well as other psychological domains (OR = 3.736, p = 0.020), as detailed in Table 5.

Discussion

Mine rescue teams stand at the forefront of responding to mine disasters, playing a vital role in saving lives. The mental health of rescuers is crucial for the success and safety of their missions, necessitating a prioritization of safeguarding their mental well-being.[5] Our survey of members of the Datong Mine Rescue Team revealed that 15.3% of the rescuers suffered from anxiety, and 17.3% exhibited symptoms of depression. According to the SCL-90, 43.3% of the rescuers experienced psychological distress, with the obsessive-compulsive symptoms showing the highest prevalence. In terms of anxiety, a systematic review by Wagner et al[3] reported that the prevalence of anxiety disorders among firefighters in various countries ranged from 1.4% to 19.4%. The results of this study indicated that the prevalence of anxiety among Chinese mine rescuers was relatively high compared to that among foreign firefighters. Regarding depression, Sun et al[18] in a sample of 409 Chinese firefighters revealed a depression prevalence rate of 11.1%. The prevalence of depression among Chinese mine rescuers in this study was even greater. For psychological distress, the prevalence among mine rescuers was greater than the 27% reported among ambulance personnel.[19] The prevalence of psychological disturbances among rescuers varies by country. In China, major mining operations are predominantly conducted underground,[20] placing significant demands on mine rescuers in terms of manpower and work intensity. This makes occupational health, including mental health, crucial for these workers. Compared to firefighters and ordinary ambulance personnel, mine rescuers report higher rates of psychological disturbances. This elevated rate may be attributed to the unique challenges of mine rescue operations, such as extreme geological conditions, exposure to toxic gases, underground operations, confined spaces, and oxygen-deficient environments.[21] Additionally, compared with those of firefighters, mental health protection systems for mine rescuers are less developed in areas such as institutional development, professional staffing, working mechanisms, and scientific training. Therefore, it is essential to implement personalized assessments tailored to the unique working environment and experiences of mine rescuers.

Table 5 Predictive Model of the Training Conditions on the SCL-90 Subscales

Subscales	Training Frequency (days/week) OR (95% CI)		History of Training-Related Injuries OR (95% CI)		Training with Existing Injuries OR (95% CI)		
	≤ 3	> 3	No	Yes	No	Occasionally	Always
Somatization	1	1.360 (0.481, 3.84)	1	2.268 (0.584, 8.807)	1	0.974 (0.240, 3.944)	2.476 (0.721, 8.504)
Obsessive- compulsive	1	0.675 (0.262, 1.739)	1	3.468 (0.903, 13.318)	1	0.720 (0.184, 2.820)	2.900 (0.939, 8.950)
Interpersonal sensitivity	1	1.171 (0.394, 3.481)	1	0.872 (0.237, 3.211)	1	3.046 (0.522, 17.777)	10.054* (1.914, 52.804)
Depression	1	0.954 (0.308, 2.954)	1	2.499 (0.491, 12.71)	1	0.780 (0.122, 5.001)	4.698* (1.130, 19.540)
Anxiety	1	0.827 (0.262, 2.611)	1	2.133 (0.418, 10.873)	1	1.877 (0.292, 12.051)	6.472* (1.236, 33.897)
Hostility	1	1.155 (0.393, 3.394)	1	1.120 (0.308, 4.070)	1	1.025 (0.213, 4.926)	3.864* (1.017, 14.679)
Phobic anxiety	1	1.139 (0.240, 5.414)	1	2.123 (0.227, 19.846)	1	2.510 (0.214, 29.382)	5.153 (0.513, 51.783)
Paranoid ideation	1	0.710 (0.202, 2.503)	1	1.081 (0.239, 4.889)	1	0.923 (0.143, 5.970)	3.239 (0.677, 15.495)
Psychoticism	1	1.180 (0.348, 4.003)	1	2.166 (0.421, 11.133)	1	1.237 (0.232, 6.601)	2.617 (0.575, 11.918)
Other	1	1.346 (0.534, 3.391)	1	2.273 (0.688, 7.514)	1	1.020 (0.285, 3.660)	3.736* (1.23, 11.347)
GIS	1	0.708 (0.366, 1.372)	1	1.426 (0.683, 2.981)	1	1.141 (0.515, 2.525)	0.655 (0.523, 2.800)

Notes: *p < 0.05; Data are presented as Odds Ratio (Lower Confidence Limit, Upper Confidence Limit).
Abbreviation: GIS, Global Severity Index.

The nature of the work performed by mine rescuers closely mirrors that of firefighters. Extensive research indicates that psychological disturbances risk factors for firefighters stem from intense workloads, shift systems, exposure to critical incidents and large-scale disasters, occupational stress, poor sleep quality, chronic conditions, and workplace injuries.[3,22,23] Additionally, preliminary findings from this study highlight a high prevalence of workplace injuries among mine rescuers, identifying such injuries as a significant psychological disturbances.[24] Consequently, this study aimed to explore the impact of sleep quality, perceived stress, and training-related injuries on psychological disturbances. Circadian rhythm disruption, characterized by shift work, emergency calls, sleep disturbances, and the demands of prolonged rescue operations, significantly impacts the sleep quality of mine rescuers.[25] Furthermore, evidence suggests that sleep disorders can increase the risk of psychological disturbances among rescuers.[26] A survey involving 1217 Canadian firefighters revealed that approximately 69% experienced poor sleep quality, with 21% potentially exhibiting clinical insomnia.[4] Similarly, research by Carey et al[27] reported that 59% of 112 urban firefighters in the United States experienced sleep deprivation, which was closely linked to depressive symptoms. The current study revealed poor sleep quality in 35.3% of rescuers, and sleep quality is a crucial determinant of psychological distress and anxiety among mine rescuers. The exposure of rescuers to both lethal and nonlethal hazards, combined with a stressful work environment, intense physical demands, and extended working hours, categorizes rescue work as an occupation marked by significant occupational stress and physical exertion.[28] Ziaei et al[29] demonstrated that the occupational stress faced by firefighters significantly surpasses that faced by people in other professions. Moreover, such stress is linked to a range of psychological disturbances, including anxiety, depression, increased sensitivity to criticism, and aggressive behaviors.[30] The study's findings indicate that 38% of mine rescuers experience a high level of perceived stress,

which is a critical risk factor for anxiety and depression. Notably, compared with their low-stress counterparts, rescuers under high stress conditions are found to have a quadrupled risk of anxiety and a tripled risk of depression.

Rescue work is recognized as the profession with the highest rate of work-related injuries globally.[31] A survey involving 524 rescuers revealed that approximately 49% had experienced at least one sports-related injury.[32] These injuries can lead to chronic pain, sleep disturbances, mood fluctuations, issues with self-identity, and strained interpersonal relationships, potentially even interrupting their careers.[33,34] Training-related injuries among mine rescuers frequently result from the rigorous physical training required by their profession.[35] A study by Phelps et al involving 249 firefighters in the United States found that 39% of physical impairments were attributable to athletic training, with half of these injuries occurring during mission simulation exercises.[36] A retrospective analysis, which included 18,285 individuals, demonstrated that those with work-related injuries were significantly more susceptible to psychiatric disorders than their uninjured counterparts.[37] The survey conducted in this study showed that the prevalence of training-related injuries among members of the Datong rescue team reached 64.7%, which may be an important cause of psychological symptoms among rescuers. Therefore, this paper goes beyond exploring psychological disturbances from the dimensions of demographic factors, sleep quality, and self-perceived stress by examining the impact of training sessions and injuries on the psychological disturbances mine rescuers. Our study discovered that the history of training-related injuries and an increased frequency of training sessions could heighten the risk of anxiety symptoms among rescuers. Furthermore, training with existing injuries is a significant predictor of various psychological symptoms, including depression, anxiety, interpersonal sensitivity, and hostility. These risks are likely linked to intense daily training routines and the significantly greater physical workload experienced by rescuers compared to the average individual.[28,38] Consequently, it is crucial to implement preventive measures and screenings for training-related injuries among rescuers. The development of a scientifically backed physical fitness regimen and a recovery plan to minimize training-related injuries is imperative for safeguarding both the physical and mental health of rescuers.

There were several limitations to this study. Cross-sectional design of the study is the major limitation of the study. Secondly, the studied population was in a single mine rescue team, and the convenience sample restricted the generalization of study findings on all the mine rescuers. Thirdly, the relatively small sample size of our study may induce bias. Despite these limitations, our study is novel as we systematically investigated the profiles and association of mine rescuers psychological disturbances and training-related injuries. Our results will provide a useful reference for further longitudinal studies of psychological disturbances attributed to raining-related injuries.

Conclusion

Nearly half of the rescuers on the Datong Mine Rescue Team experienced adverse psychological symptoms. Associated risk factors included self-perceived stress, sleep quality, training frequency, training-related injuries, and training with existing injuries. To promote mental health among rescuers, it is crucial to manage training-related injuries and actively prevent training with existing injuries.

Ethics Approval

This study was conducted with ethics approval from the Safety Science Experiments in China University of Mining and Technology-Beijing. This study was conducted in accordance with the declaration of Helsinki. Written informed consent was obtained from all participants.

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Disclosure

The authors report no conflicts of interest in this work.

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