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Trauma Exposure and Suicidal Ideation among Korean Male Firefighters: Examining the Moderating Roles of Organizational Climate

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ABSTRACT

Background: This study investigated the relationship between trauma exposure and suicidal ideation. Moreover, this study examines the moderating roles of organizational climate on the association between trauma exposure and suicidal ideation in Korean male firefighters.
Methods: A total of 15,104 male firefighters who completed a questionnaire were analyzed. The data were obtained using an online self-administered questionnaire from the Firefighter Research on Enhancement of Safety and Health Study. Poisson regression analysis was performed to determine the effects of trauma exposure on suicidal ideation and the moderating effect of organizational climate.
Results: The results showed that 389 firefighters (2.6%) responded that they had experienced suicidal ideation. In the final model, trauma exposure was positively related to suicidal ideation (adjusted risk ratio [aRR], 1.076; 95% confidence interval [CI]: 1.051–1.103), and organizational climate was negatively associated with suicidal ideation (aRR, 0.772; 95% CI: 0.739–0.806). Additionally, the interaction term (trauma exposure × organizational climate) was related to suicidal ideation (aRR, 1.016; 95% CI: 1.009–1.023).
Conclusions: This study suggests that trauma exposure might play a significant role in developing suicidal ideation and that positive organizational climate moderates the negative effects of trauma exposure on suicidal ideation among firefighters. It is necessary to perform a follow-up study of various intervention strategies to maintain a healthy organizational climate or work environment. Such interventions should promote lasting trust within teams, provide social support and belonging, and nurture job value.

1. Introduction

Firefighters are exposed to various types of occupational stress. They are the first responders to disasters and safety incidents, perform various tasks on the front lines of the disaster, and play an essential role in protecting the lives and property of individuals through fire suppression, rescue, and emergency medical services [1]. Previous research has shown that 84.3% of firefighters are exposed to traumatic events such as life-threatening situations or fear of injury. They often must recover the bodies of disaster victims or witness the death of an accident victim or colleague. 5.8% of firefighters reported that they were dispatched several times a day to the scene of such an incident, and 8.4% had experienced a horrific situation more than once a month at a dispatch scene [2].

Firefighters' prolonged emergency duties and hazardous working environments may increase their risk of physical health problems [3–6]. Recently, psychosocial stress has been considered a risk factor for health problems among firefighters. For example, Igboanugo et al. [7] reported that firefighters' psychosocial stressors, including interpersonal conflict and concerns over organizational

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fairness, were related to depression-suicidality, nondepressive mental health problems, burnout, alcohol use disorders, sleep quality, physiological parameters, and somatic disorders.

Trauma exposure in fire suppression, dangerous rescue operations, natural disasters, and posttraumatic stress disorder are common among firefighters [8–10]. Many firefighters exposed to traumatic events may experience posttraumatic stress disorder symptoms. Furthermore, this skill deficit can negatively affect health and wellness, resulting in suicidal ideation. Recent research has shown that firefighter's repeated and chronic trauma exposure is positively related to suicidality [11–14].

The risk factors for suicidal ideation range from biological to environmental and psychological; however, several previous studies have consistently referred to stress or traumatic experiences as environmental variables associated with suicidal ideation [10]. In general, the negative emotions and thoughts experienced after a traumatic event are natural reactions, and those negative emotions and thoughts are naturally relieved over time. It has also been shown that a frequency of traumatic exposure can increase the incidence of mental illness and suicidal thoughts and attempts due to psychological distress from depression, anger, and anxiety [10,15]. A recent study found that higher levels of emotional labor, as a psychosocial factor, increase firefighters' risk of suicidal ideation [16].

A growing body of literature has identified and emphasized the moderating factors that amplify or buffer the harmful effects of traumatic exposure. Some studies have identified organizational culture and climate as moderating factors in the relationship between traumatic exposure and adverse outcomes [17–19]. The concept of organizational climate has been widely discussed. Jorde-Bloom [20] defined organizational climate as "the awareness of the organization members of the status and situation of the organization." The organizational climate may play a crucial role in members' behavior, levels of motivation, and organizational commitment [21].

This study attempted to identify the magnitude of suicidal ideation among male firefighters and investigate the relationship between trauma exposure and suicidal ideation. Finally, we examined the moderating roles of perceived organizational climate on the association between trauma exposure and suicidal ideation. The present study's results provide the basis for organization-based interventions and the development of customized mental health programs for firefighters.

2. Materials and methods

2.1. Participants

Participants were recruited from the nationwide population of Korean firefighters. As of 2015, the total population is 42,742 firefighters in Korea, of which 19,170 (response rate: 44.85%) completed the survey. A total of 15,104 firefighters were finally analyzed, excluding those who were unfaithful and those who did not perform emotional labor.

2.2. Procedures

The data were obtained from the Firefighter Research on Enhancement of Safety and Health (FRESH) Study (2015–2019) and collected using an online self-administered questionnaire. FRESH study consisted of two parts. First, a dynamic cohort of 1022 firefighters completed questionnaires and underwent screening for cardiovascular and mental health issues either once or twice between 2016 and 2019. Second, these firefighters completed a Web survey to gather information concerning job-related factors and their health status, such as quality of life, presenteeism, social psychological health status, and health behavior. In this study, we analyzed the data obtained from the Web survey.

2.3. Measures

The data were obtained from the FRESH study and collected using an online self-administered questionnaire. The questionnaire covers sociodemographic characteristics, job characteristics, traumatic exposure, organizational climate, health behavior, subjective well-being status, and suicidal ideation.

2.3.1. Trauma exposure

Trauma exposure consisted of six questions using tools developed in the FRESH study. Trauma exposure was measured on a 5-point Likert scale, with scores ranging from 1 ("never") to 5 ("always"). Total scores ranged from 6 to 30, and higher scores indicated higher exposure to trauma. The Cronbach α for trauma exposure was 0.881. The following six questions were asked regarding trauma exposure for the past 1 year:

(1) I have witnessed the terrible accidents and deaths of the victims.
(2) I have brought the news of the tragic event to the survivors.
(3) I have experienced situations where I can't prevent people from dying.
(4) I have experienced horrific traumatic accidents or child deaths.
(5) I have experienced major disasters or major casualties.
(6) I have witnessed the death or horrific accident of a fellow firefighter.

2.3.2. Organizational climate

The organizational climate was measured using a five-item scale from the FRESH study as described below:

(1) There is good harmony between the members of the organization.
(2) Members have many disputes or arguments regarding how to work.
(3) There is no collaboration among members.
(4) The relationship between my department and others is good.
(5) There is good cooperation between my departments and other departments.

Items (1), (4), and (5) were rated using a 4-point Likert scale where 1 = "disagree completely," 2 = "disagree," 3 = "agree," and 4 = "agree completely." Items (2) and (3) are rated using reverse scoring. Organizational climate was calculated by summing the five items, with total scores ranging from 5 to 20; the higher the score, the more negative the perception of organizational climate. The Cronbach α for organizational climate was 0.847.

2.3.3. Suicidal ideation

Suicidal ideation was assessed with the question. The question was measured by asking the two stages. First, "Have you ever thought of committing suicide for the past one year?" Second, if so, how many times did you have thoughts of committing suicide for the past one year? Therefore, suicidal ideation was measured as count data (0, 1, 2, 3. …).

2.3.4. Covariates

Covariates used in the study were age, marital status, and education as sociodemographics; main duty and shiftwork as job characteristics; and smoking status, alcohol consumption, and

Table 1
Distribution of suicidal ideation according to general and job characteristics of the study participants (N = 15,104)

Variables		Suicidal ideation		p
		Yes	No	
		389 (2.6)	14,715 (97.4)	
Age	20–29	5 (0.5)	944 (99.5)	<0.001
	30–39	119 (2.1)	5,502 (97.9)	
	40–49	142 (3.0)	4,652 (97.0)	
	50–	123 (3.3)	3,617 (96.7)	
Marital status	Unmarried	77 (1.9)	3,883 (98.1)	0.007
	Married	304 (2.8)	10,644 (97.2)	
	Divorced/widowed/separation	8 (4.1)	188 (95.9)	
Main duty	Fire fighting	250 (2.9)	8,475 (97.1)	0.023
	Rescue	47 (2.4)	1,893 (97.6)	
	Emergency medical aid	92 (2.1)	4,347 (97.9)	
Education	less than or equal to high school	216 (2.5)	8,342 (97.5)	0.004
	College	162 (2.5)	6,218 (97.5)	
	University	11 (6.6)	155 (93.4)	
Shift work	No	11 (2.9)	362 (97.1)	0.209
	Group 2, 2 shifts	15 (2.9)	510 (97.1)	
	Group 3, 2 shifts	7 (2.2)	309 (97.8)	
	Group 4, 3 shifts	347 (2.6)	12,818 (97.4)	
	Others	9 (1.2)	716 (98.8)	
Smoking	Yes	163 (3.2)	4,892 (96.8)	<0.001
	No	226 (2.2)	9,823 (97.8)	
Alcohol drinking	No	104 (2.4)	4,176 (97.6)	<0.001
	One or two times a week	252 (2.4)	10,271 (97.6)	
	More than three times a week.	33 (11.0)	268 (89.0)	
Subjective health status	Healthy	60 (0.9)	6,984 (99.2)	<0.001
	Not so bad	169 (2.6)	6,227 (97.4)	
	Unhealthy	160 (9.6)	1,504 (90.4)	
Trauma exposure	Low	69 (1.8)	3,732 (98.2)	<0.001
	Moderate	159 (2.1)	7,289 (97.9)	
	High	161 (4.2)	3,694 (95.8)	
Organizational climate	Good	152 (1.4)	10,986 (98.6)	<0.001
	Poor	237 (6.0)	3,729 (94.0)	

subjective health status as health-related behaviors and status. Those variables were measured using a self-report and entered as control variables in the models.

2.4. Data analysis

A *t*-test and chi-square test were performed to determine the differences between the general characteristics of the participants, job characteristics, health behaviors, health status, trauma exposure, and suicidal ideation. In this study, trauma exposure and organizational climate were measured using the continuous variables of the sums of the items. But, to perform the univariate analyses, the relationship between the two variables and suicidal ideation, the categorical variables were grouped into “good” and “poor” based on the cut-offs of median value for organizational climate, and “low,” “moderate,” and “high” based on the cut-offs of the tertile levels for trauma exposure. Poisson regression analysis was performed to determine the effects of trauma exposure on suicidal ideation and the moderating effect of organizational climate after controlling for sociodemographics, job characteristics, health-related behaviors, and subjective well-being. Poisson regression is used to analyze count data and answer questions such as what factors can predict the frequency of an event. The count data follow a Poisson distribution, which is positively skewed and usually contains a large proportion of zeros. In this study, the distribution of the dependent variable, suicidal ideation, is not normal, but positively skewed (Poisson distribution) to the right, and linear model can’t be applied. Therefore, we performed General Linear Model (GLM) instead of Ordinary Linear Model (OLM) because of the distribution. Additionally, because suicidal ideation is thought to be a lower probability of occurrence, Poisson regression analysis was performed in this study to estimate the risk ratio (RR) and 95% confidence interval (CI) for suicidal ideation. We included the transformed data in regression models using mean centering for the independent variables. Mean centering is an additive transformation of a continuous variable and has been offered as a remedy for collinearity problems in moderated multiple regression models or polynomial regression models. All statistical analyses were performed using SPSS/WIN 24.0, and statistical significance was set at $p < .05$.

3. Results

Of the participants, 389 (2.6%) responded that they had experienced suicidal ideation. Suicidal ideation was more common in older adults ($p < .001$) and divorced/bereaved/separated participants ($p = .007$). Firefighting (2.9%) showed the highest prevalence of suicidal ideation, followed by rescue (2.4%) and medical emergency aid (2.1%) ($p = 0.023$). People who graduated from a 4-year or longer college course (6.6%) were more likely to experience suicidal ideation than those who graduated from a 2-year college course (2.5%) and high school ($p = 0.0\ 04$). Current smokers (3.2%) and drinkers more than 3 days a week (11.0%) were more likely to experience suicidal ideation than their counterparts ($p <. 001$). People who perceived their subjective health status as “unhealthy” (9.6%) were more likely to have an increased risk of suicidal ideation compared to those who perceived their subjective health status as “poor” ($p < 0.001$). The magnitude of trauma exposure was associated with higher suicidal ideation (“high”: 4.2%, “moderate”: 2.1%, and “low”: 1.8%) ($p < 0.001$), and organizational climate was negatively associated with suicidal ideation ($p < 0.001$) (Table 1).

A stepwise Poisson regression analysis was performed to investigate the relationship between trauma exposure and suicidal

Table 2
Result of Poisson regression of trauma exposure, organizational climate, and interaction term of trauma exposure × organizational climate on suicidal ideation (mean centering)

	Crude	Model 1	Model 2
Trauma exposure (TE)	1.089 (1.064-1.115)	1.096 (1.070-1.122)	1.076 (1.051-1.103)
Organizational Climate (OC)	0.709 (0.682-0.739)	0.716 (0.687-0.746)	0.772 (0.739-0.806)
TE × OC	1.014 (1.008-1.021)	1.015 (1.008-1.022)	1.016 (1.009-1.023)

Model 1: Age, education, and marital status.
Model 2: Model 1 + smoking, alcohol consumption, subjective health status, and main duty.

ideation and the moderating effects of organizational climate on the relationship between the two variables. In the final model, trauma exposure was positively related to suicidal ideation (aRR: 1.076; 95% CI: 1.051–1.103), and organizational climate was negatively associated with suicidal ideation (aRR: 0.772; 95% CI: 0.739–0.806). Additionally, the interaction term (trauma exposure × organizational climate) was related to suicidal ideation (aRR, 1.016; 95% CI: 1.009–1.023) (Table 2).

In this study, we formulated six groups using the combination of trauma exposure ("low," "moderate," and "high") with organizational climate ("good" or "poor") to estimate the risk of suicidal ideation. The results show that Group III ("high" trauma exposure [TE] and "good" organizational climate [OC]) (aRR: 1.894, 95% CI: 1.209–2.968), Group IV ("low" TE and "poor" OC) (aRR: 3.467, 95% CI: 2.150–5.591), Group V ("moderate" TE and "poor" OC) (aRR: 3.273, 95% CI: 2.163-4.953), and Group VI ("high" TE and "poor" OC) (aRR: 4.389, 95% CI: 2.907-6.627) were more likely to have suicidal ideation compared to Group I ("low" TE and "good" OC) (p for trend <0.001) (Table 3, and Fig. 1).

Table 3
Combined effects of trauma exposure and organizational climate on suicidal ideation

Groups	Crude	Model 1*	Model 2**
Group I (OC*** "good" and TE*** "low")	1(Ref)	1(Ref)	1(Ref)
Group II (OC*** "good" and TE*** "moderate")	1.137 (0.742-1.742)	1.213 (0.791-1.860)	1.052 (0.684-1.618)
Group III (OC*** "good" and TE*** "high")	2.219 (1.429-3.446)	2.377 (1.528-3.696)	1.894 (1.209-2.968)
Group IV (OC*** "poor" and TE*** "low")	4.841 (3.012-7.779)	4.717 (2.935-7.583)	3.467 (2.150-5.591)
Group V (OC*** "poor" and TE*** "moderate")	5.146 (3.428-7.728)	5.224 (3.478-7.846)	3.273 (2.163-4.953)
Group VI (OC*** "poor" and TE*** "high")	7.400 (4.860-10.821)	7.414 (4.963-11.073)	4.389 (2.907-6.627)

* Model 1: Adjusted for age, education, and marital status.
** Model 2: Adjusted for Model 1 + smoking, alcohol drinking, subjective health status, and main duty.
*** TE, trauma exposure; OC, organizational climate.

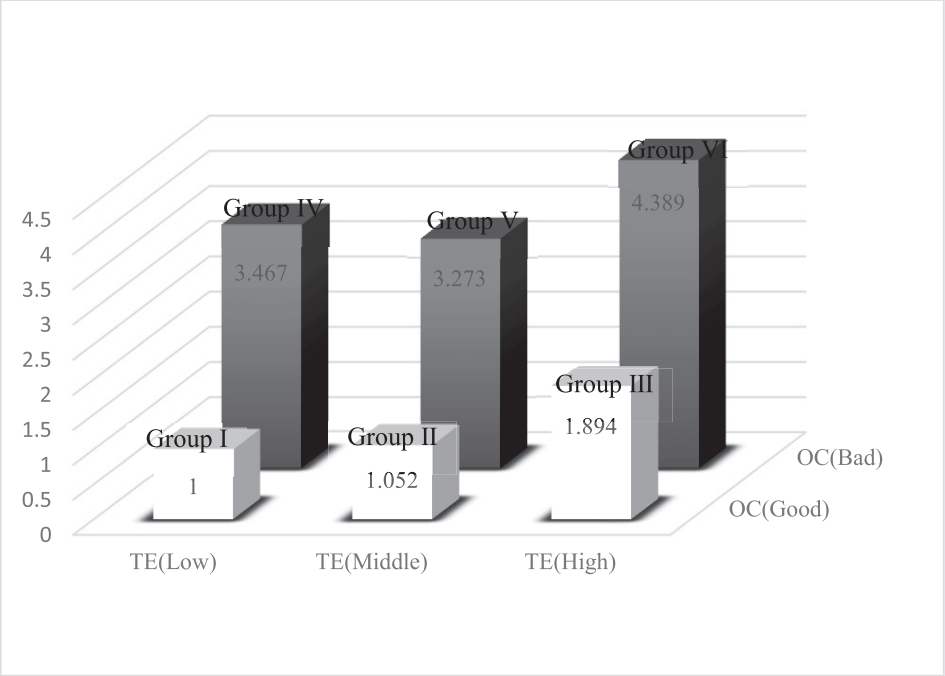
4. Discussion

Suicide is a comprehensive crystal of suicidal thoughts, suicide attempts, and successive processes that lead to suicidal behaviors [22,23]—suicidal thoughts can precede suicide. Granello and Granello [24] reported that 60% of persons who switch from suicidal thoughts to suicidal planning attempt suicide within a year. This means that suicidal thoughts can carry over to suicide attempts within a year, and suicidal thoughts are critical predictors of suicide. As it can be an indicator, it may be effective to focus on suicide prevention by expanding interventions to target people who have attempted suicide and those who have thought about suicide. In the Mental Health Survey of the National Fire Agency in Korea, 8.6% of respondents had suicidal thoughts in the past year, of which 4.9% were classified as suicidal concerns [25]. In a study of new firefighters, 2.8% had suicidal thoughts [26]. In another study, 19.5% of the respondents reported having suicidal thoughts, of which 4.18% had even attempted suicide [10].

In the present study, 2.6% of the sample had suicidal thoughts. The results show that suicidal thoughts are more common in people exposed to more traumatic events and a lower organizational climate. Noor et al. [10] reported that firefighters who experienced traumatic events engaged in avoidance behaviors by indulging in drinking, gambling, and smartphone games to forget them. Due to the nature of their work, traumatic experiences are inevitable. If the trauma is not dealt with properly, the firefighters become numb to their emotions, and stress accumulates. Relying on drinking, gambling, gaming, smoking, and so forth, to forget psychological pain results in numerous difficulties in the home and workplace. Unfortunately, the lack of measures available to handle these psychological symptoms can decrease the ability to cope with crises, promoting suicidal thoughts. Firefighters are exposed to various traumatic events, including witnessing mutilated bodies, severe trauma accident scenes, exposure to toxic substances, and flame-induced smoke. They are sensitive to an emergency bell's sound to prepare for an event. They are constantly exposed to danger, urgency, and irregularities in the line of duty, and hence, are continuously exposed to various stress stimuli. Stanley et al. [27] identified a relationship between the frequency of traumatic event experiences and the dose response of suicidal behaviors as an important risk factor for suicidal behavior. They argued that the more frequent the exposure to traumatic events, the greater the risk of suicidal behavior. Thus, repeated traumatic exposure results in more chronically diverse psychological symptoms that are not adequately treated, leading to more extreme suicidal behaviors.

Firefighters' repetitive traumatic experiences lead to negative emotional manifestations such as numbness, cynicism, invasive reminiscences, and memories. When traumatic experiences accumulate, they make it difficult to control emotions, resulting in emotional dissonance. In addition, without adequate intervention or processing, emotional exhaustion persists, and the person is more likely to be at risk of suicidality [15]. In Korea, suicide death rates among firefighters are at 11%, compared to 4% of the general population—almost three times higher. Recent statistics have shown that the number of suicides by firefighters is higher than the number of deaths in the line of duty. Twenty-eight firefighters committed suicide from 2007 to 2011, while 38 firefighters committed suicide from 2012 to 2016, indicating that the number of suicides of firefighters is constantly increasing [25].

In this study, we found that organizational climate moderated the relationship between trauma exposure and suicidal ideation. A



*TE: trauma exposure; OC: organizational climate.

* Group I (OC "good" & TE "low"), Group II (OC "good" & TE "moderate"), Group III (OC "good" & TE "high"), Group IV (OC "poor" & TE "low"), Group V (OC "poor" & TE "moderate"), Group VI (OC "poor" & TE "high")

Fig. 1. Result of Poisson regression analyses for suicidal ideation by the six groups.

cooperative and friendly organizational climate significantly reduces the negative effects of trauma exposure on suicidal ideation. In addition, we analyzed the combination effects of trauma exposure and organizational climate on suicidal ideation. The results reveal that the risk of suicidal ideation in Group VI ("poor" OC and "high" TE) was 4.389 times higher than in Group I ("good" OC and "low" TE). In contrast, the risk for suicidal ideation in Group III ("good" OC and "high" TE) was 1.894 times higher than in Group I ("good" OC and "low" TE). These results suggest that organizational climate is more important than trauma, unless trauma exposure is high. Additionally, the biggest effect changes between Model I and Model II occurred when the exposure consisted of the combination of "high" trauma and "poor" organizational climate. This finding is interesting because it shows that a negative organizational climate might amplify the adverse effects of trauma exposure on suicidal ideation.

Despite the negative impact of trauma exposure on several psychological symptoms and extreme behaviors such as suicidal ideation, traumatic experiences do not necessarily involve mental distress or trigger abnormal emotions. When individual experiences a traumatic event, they attempt to avoid emotional responses such as sadness, anguish, worry, and anxiety. Eventually, the repressed emotions must be fully expressed and processed. Without expression or processing, these emotions become unresolved tasks [28]. In other words, a traumatic experience that is not properly processed or recovered will decrease the quality of daily life, one's ability to work, and various unpredictable symptoms [29]. Previous research suggests that the improper processing of repeated traumatic experiences in female firefighters increases anxiety sensitivity, which has a mediating effect on the relationship with suicide crises [30]. Another study argued that traumatic events and their symptoms vary depending on the factors of the traumatic experience and circumstances in which they occur [31].

A cooperative and friendly organizational climate among members may be associated with collective attitudes, customer satisfaction, financial performance [32], employee productivity, motivation, and work performance [33]. It may also alleviate negative conditions such as emotional disharmony or dissonance. In turn, fewer adverse working conditions may decrease the risk of burnout [19]. Although firefighters cannot avoid trauma, a positive organizational climate can be achieved through organizations' internal efforts to reduce job stress and ameliorate negative outcomes. For example, Ryu et al. [18] reported that the organizational climate reduces the relationship between emotional labor and turnover intention among firefighters.

The job demand-resource model provides a relatively systematic framework for explaining how demands and resources in the work environment affect the well-being of workers. The job demand–resource model focuses on how the increase in job demand

undermines employees' mental and physical health. However, when various occupational resource factors are provided, they alleviate negative effects, such as burnout, while simultaneously promoting mental and physical health [34]. There is little research on the effects of organizational climate as a job resource. The emotional conditioning strategy characteristics of organizational climate might play a protective role against the negative emotions commonly experienced during or after traumatic exposure [35,36]. Research suggests that lasting, trusting relationships with colleagues, social support, belonging, and professional worth negatively correlate with the stress perceived by firefighters [37]. This result supports the finding that the more positive the job resources focusing on the relationship between internal and external team members, the fewer suicidal thoughts they have.

To become adaptable, one must endure and control biological deficiencies, exposure to trauma, and negative emotions; failure to adapt is the cause of suicidal behavior [38]. Adaptively dealing with the negative psychological symptoms and extreme pain experienced by firefighters can help reduce the risk of suicide, suicidal thoughts, and behaviors. The peer-to-peer counseling broadens the scope of support instead of relying solely on psychological counseling for severe posttraumatic stress [10,39]. Several studies have shown that peer support lowers levels of posttraumatic stress following traumatic events [37,40,41] and protects against the effect of firefighter stress on suicidal ideation [22]. In the firefighting industry, in particular, peers are teamed up and supported by one another in potentially life-threatening situations. Hence, the relationships with colleagues and team cohesion will significantly impact mental well-being.

This study has several methodological limitations. First, all the measures were self-reported. Every precaution was taken to ensure participants' anonymity; however, there is the possibility of under- or overreporting respondents' perceived experiences. Second, the study used a cross-sectional design. Therefore, significant results should not be interpreted as indicative of causal relationships. Third, trauma exposure was measured according to participants' memory. This means the magnitude or level of trauma exposure depends on participant recall. It is likely that seasonal variation and recall bias might be involved in this study's findings. Finally, the "healthy worker effect" could be problematic. Compared to other public officers, firefighters are required to have higher fitness levels to meet the physical demand and mental fatigue typical of their profession. Therefore, firefighters are expected to have better overall health than the general population.

In conclusion, this study attempted to test the effect of trauma exposure on suicidal ideation among firefighters and to examine the moderating effects of organizational climate on the relationship between the two factors. Based on the results of this study, some suggestions are provided. First, periodic and regular training should be conducted with firefighters to increase their awareness of psychological and physical symptoms caused by exposure to multiple traumatic events. Second, considering the nature of the firefighting profession, peer counseling training, activation, and personnel support training should be provided at the organizational level. This way, colleagues dealing with the same experience can adequately express and handle avoided or repressed emotions. Third, it is necessary to perform a follow-up study of various intervention strategies to maintain a healthy organizational climate or work environment. Such strategies can promote team trust, social support, belonging, and job value.

Data availability statement

Data are available to corresponding author.

Funding statement

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Ethical standards statement

This study was approved by the Institutional Review Board of Yonsei University for protecting the rights and privacy of the participants (approval no. CR318335) and was conducted in accordance with the World Medical Association Declaration of Helsinki.

Conflict of interest

The authors declared no conflict of interests.

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