

Examining the Relative Influences of the Risk Factors and Protective Factors That Affect Firefighter Resilience

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Abstract

The purpose of this study was to examine the relative influences of the risk factors and protective factors that affect firefighters' resilience. Based on previous studies, we selected three risk factors and four protective factors. The former included cognitive bias, socially prescribed perfectionism, and social anxiety. The latter included deliberate rumination, self-encouragement, family relations, and peer support. A total of 330 full-time professional firefighters in Korea participated in the study, and we analyzed 271 questionnaires. We conducted multiple regression analyses and the results were as follows. The risk factors explained 43.7% of resilience and both cognitive bias and social anxiety showed significant negative influences. Meanwhile, the protective factors explained 52.6% of resilience and we found both peer support and self-encouragement to be significant. Finally, we included seven variables in our multiple regression analysis to verify their relative influences on resilience, and these variables explained 59.5% of resilience. In the final analysis, we identified cognitive bias, peer support, and self-encouragement as the relatively significant variables that affect firefighters' resilience. We conclude this paper by outlining the relevant implications of our findings and discussing the study's limitations.

Keywords

firefighter, resilience, cognitive bias, peer support, self-encouragement

Firefighters are frequently exposed to a range of disaster situations. Due to the nature of their work, they endure intense stress (National Fire Agency, 2009), resulting in job stress, mental health problems, decreased quality of life, and even a high rates of post-traumatic stress disorder (PTSD) (H. C. Choi, 2013; Klimley et al., 2018). Research has shown that firefighters are 10 times more likely to suffer mental illnesses than members of the general population; likewise, they are 10 times more likely to suffer PTSD, five times more likely to be depressed, and seven times more likely to develop alcoholism (D. H. Yu, 2018). Another study found that 13.9% of firefighters were at risk of PTSD, while 11% of firefighters died due to suicide—three times higher than the percentage for the average population (National Fire Agency, 2009).

Firefighters' mental health issues have drawn significant attention, leading to increased academic interest in firefighter resilience over the last decade (Bernabé & Botia, 2016; H. C. Choi, 2013; Onyedire et al., 2017; Y. S. Song, 2017). Resilience refers to an individual's positive adaptation in situations of adversity or in response to negative life experiences (Masten et al., 2005). Resilience is seen as an individual psychological ability (Wagnild & Young, 1993), or a process of appropriate adjustment (Egeland et al., 1993). It plays a particularly important role in overcoming serious life

threats such as trauma. Krizas and Grobler (2005) defined resilience as the power to overcome, cope with, and escape the negative frame of trauma. Resilience is a necessary emotional strength that can turn difficulties or hardships into steppingstones for positive development. It is a personal ability that is not inherently innate; it changes dynamically over time and is influenced by various environmental interactions including personal, familial, and social factors (Colifman & Bonanno, 2010; Dyer & McGuinness, 1996). Just as we can increase our physical fitness through systematic exercise and training, we can enhance our resilience through systematic effort and training (J. H. Kim, 2018).

Previous studies of firefighter resilience have focused on the effects of resilience. Y. S. Song (2017) reported that firefighters' resilience had a significant impact on PTSD levels, specifically playing a role as a protective factor against

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PTSD. S. Y. Lee (2016) found that resilience moderates the relationship between firefighters' quality of life and their experiences of PTSD. In a similar vein, H. C. Choi (2013) found that resilience moderates the relationship between firefighters' job stress and depression. In addition, research has shown that resilience influences firefighters' perceptions of stress (J. Y. Lee, 2016) and that it helps firefighters overcome the pain of being diagnosed with PTSD (M. O. Choi et al., 2007; Onyedire et al., 2017). These results imply that resilience can have a significant impact on firefighters' mental health and quality of life.

Recent research has also focused on identifying resilience-related risk factors and protective factors in terms of the dynamic adaptation process, using a developmental perspective (Luthar et al., 2000). Resilience has been identified as a phenomenon caused by interactions between risk factors and protective factors. Risk factors are defined as the measurable personality traits or circumstances that lead to maladjustment (Masten et al., 2005). They increase people's likelihood of developing psychological, emotional, and behavioral problems and/or prevent people from exerting their expected levels of abilities (E. S. Hong, 2006). In contrast, protective factors generally buffer the negative effects of risk factors; thus, people with few protective factors may experience severe maladaptation even at low levels of adversity (Masten & Reed, 2005).

In this study, we examined the relative influence of the risk factors and protective factors that affect firefighters' resilience. Although previous studies have verified the influence of each factor, research examining the relative influence between these factors remains scarce. Based on previous research (Carpenter et al., 2015; Heinrichs et al., 2005; J. I. Kim & Byeon, 2013; Kwak & Byeon, 2013; H. K. Kwon et al., 2017; Meyer et al., 2012; Moon, 2017; E. H. Park & Jeon, 2010; Yoo, 2000), we considered three domains in our selection of risk and protective factors: the individual, family, and external domains. In addition, we developed selection criteria based on three psychological dimensions: the cognitive, emotional, and behavioral dimensions. Considering these three domains and three psychological dimensions, we selected three risk factors and four protective factors and examined their relative influence. The former included cognitive bias, socially prescribed perfectionism, and social anxiety. The latter included deliberate rumination, self-encouragement, family relations, and peer support. Among the factors, cognitive bias, socially prescribed perfectionism, and deliberate rumination mainly represent cognitive attributes, while social anxiety represents emotional attributes.

Cognitive bias, one of the risk factors, is an information-processing bias where individuals interpret circumstances based on their own prejudices or interpretation styles, rather than seeing things as they are. In their study of early adults, Mętel et al. (2020) showed that cognitive bias negatively affects resilience. Other researchers have argued that improving resilience requires the reduction of negative

cognitive biases and the promotion of positive cognitions (Peng et al., 2017).

Tied to the extreme pursuit of personal perfection and an unwillingness to accept any imperfection, perfectionism is a personality trait that involves imposing higher standards than given situations call for (Hamachek, 1978). Prior studies have found that only socially prescribed perfectionism consistently worsens psychological problems such as depression (Ha & Jang, 2011; H. J. Kim & Son, 2006; Son, 2013). Indeed, research has confirmed that socially prescribed perfectionism negatively affects resilience in college students (Klibert et al., 2014) and nurses (H. Y. Kim et al., 2019).

Social Anxiety is another risk factor that negatively affects resilience (Jang, 2018). Social anxiety refers to a conspicuous and persistent disturbance in social situations where one is afraid of engaging in embarrassing behavior (American Psychiatric Association, 2013). Khadem et al. (2017) found a negative correlation between anxiety and resilience in firefighters. Meanwhile, Hjemdal et al. (2011) reported that resilience increased when anxiety and depression were low.

Deliberate rumination is one of the protective factors that affect resilience. Tedeschi and Calhoun (2006) conceptualized deliberate rumination as an essential process leading to posttraumatic growth (PTG). PTG is a psychological process of growth after trauma (Tedeschi & Calhoun, 1996, 2004). People can discover their potential and strengths through the process of enduring and overcoming adversity, thereby increasing their confidence and self-control. Traumatic experiences may change one's view of life and/or result in spiritual growth. Therefore, deliberate rumination is an adaptive cognitive process that directly affects both PTG and resilience (S. J. Park, 2015). Research has shown that high levels of resilience are closely related to PTG in adolescents with PTSD (Levine et al., 2009). In addition, in a study of hemodialysis patients in China, Li et al. (2018) confirmed that deliberate rumination and resilience are positively related. S. K. Yang and Ha (2019) also found that deliberate rumination has a positive effect on PTG in firefighters.

Self-encouragement, one of the protective factors, has been shown to positively affect resilience (Afkhamaqda et al., 2016; Y. M. Ahn & Kim, 2018; Nourian et al., 2016; Skinner et al., 2013). When people encourage and reassure themselves without becoming discouraged, they are able to acknowledge themselves and their own self-worth. This allows them to become self-sufficient without comparing themselves to others (Dinkmeyer & Losoncy, 1996).

Family relations and peer support are also protective factors related to resilience. A study of American firefighters reported that family support relieves firefighters' posttraumatic symptoms (Stanley et al., 2019). Another study of Australian firefighters revealed that firefighters respond less resiliently to trauma if they feel less social support (Bernabé & Botia, 2016; Meyer et al., 2012). When firefighters feel that their bosses make numerous emotional demands, their

resilience decreases, whereas if they perceive strong social support, their resilience increases (Bernabé & Botia, 2016).

The primary goal of this study was to examine the relative influence of the risk factors and protective factors on resilience. Although previous studies have investigated the influence of each of these factors individually, few studies have examined the relative power of the influences among them. The high correlation between factors makes it necessary to compare the extent to which these factors affect resilience. For example, studies have shown that both cognitive biases and social anxiety negatively affect resilience. However, these two factors have a very high correlation with each other (Alden et al., 2008; Ko & Chang, 2020; Vassilopoulos, 2006). Thus, it is possible that certain influential factors appear valid thanks to other factors not covered in a given study. Therefore, verifying that specific factors are still influential when examining the influences of other significant factors is crucial. To this end, we set out to identify the relative influences between factors by selecting representative factors and conducting multiple regression analysis on them.

Method

Participants

The participants in this study were full-time professional firefighters in Korea. A total of 330 firefighters on the active list answered the study's survey. Of these, 300 returned questionnaires to us. Excluding 29 incomplete questionnaires, we ultimately included 271 questionnaires in the analysis. Table 1 presents the subjects' personal and job-related variables frequencies. The types of services include administrative work, rescue, first aid, fire suppression, and driving. In Korea, firefighters do not perform fixed services; they circulate on a regular basis. The distribution results showed the specific services the participants were performing at the time of the survey.

Procedure

We conducted this study with the cooperation of 18 local fire departments located in metropolitan areas and small cities in Korea. We contacted a number of individual fire departments, asked for research participation, and visited the fire departments that agreed to participate in our survey. We explained the purpose of the research and ensured participants' spontaneity and confidentiality. Subsequently, we distributed the questionnaire and then collected them after an adequate period of time. We also obtained approval for this study from the Institutional Review Board of Hanyang University (HYU-2019-02-012).

Measures

We used the Resilience Factor Inventory–Korean version, the Interpretation of Positive Events Scale, the Discounting

Table 1. Participants' Personal and Job-Related Variables Frequencies ($N = 271$).

Variable	N	%
Age		
20s	64	23.6
30s	112	41.3
40s	60	22.1
50s	35	12.9
Marital status		
Unmarried	114	42.1
Married	155	57.2
Other	1	0.4
Education level		
Middle school	2	0.7
High school	38	14.0
2-year vocational college	54	19.9
4-year college	165	60.9
Graduate school	12	4.4
Socio-economic status		
Upper	2	0.7
Upper middle	22	8.1
Lower middle	208	76.8
Upper Lower	34	12.5
Lower	4	1.5
Present work service period		
< 1 year	72	26.6
1–3 years	64	23.6
3–5 years	46	17.0
5–10 years	38	14.0
10–15 years	18	6.6
15–20 years	11	4.1
20 years <	21	7.7
Sex		
Male	235	86.7
Female	36	13.3
Shiftwork		
Two-shift	17	6.3
Three-shift	209	77.1
Other	32	11.8
Position		
Firefighter	87	32.1
Senior firefighter	80	29.5
Fire sergeant	47	17.3
Fire lieutenant	51	18.8
Fire captain	6	2.2
Types of services		
Administration	26	9.6
Rescue	16	5.9
First aid	70	25.8
Situation room	4	1.5
Driving	35	12.9
First aid + driving	4	1.5
Firefighting + driving	9	3.3
Other	12	4.5
Entire Firefighter service period		
< 1 year	40	14.8
1–3 years	40	14.8
3–5 years	43	15.9
5–10 years	39	14.4
10–15 years	30	11.1
15–20 years	24	8.9
20 years <	41	15.1

of Positive Events Scale (DPES), the Multidimensional Perfectionism Scale (MPS), the Social Interaction Anxiety Scale, the Deliberate Rumination Scale, the Self-Encouragement Scale, the Abbreviated Family Relationship Scale-15, and the Peer Support Scale.

The Resilience Factor Inventory–Korean version. Reivich and Shatte (2002) developed the Resilience Factor Inventory Test to evaluate adults' resilience. J. H. Kim (2018) translated the test into Korean and validated it. This test features a total of 53 items in three domains: self-regulation, interpersonal relations, and positivity. Examples of items are as follows: "I can control the way I feel when adversity strikes," and "When a problem arises, I think carefully about what caused it before attempting to solve it." The items were rated using a five-point Likert-type scale. In Y. S. Song's (2017) study, the Cronbach's α was .96 for the total items, .89 for self-regulation, .91 for interpersonal ability, and .92 for positivity. In this study, the overall Cronbach's α was .95, while it was .87 for self-regulation, .89 for interpersonal skills, and .91 for positivity.

The Interpretation of Positive Events Scale (IPES). In order to measure the tendency to interpret positive events negatively, Alden et al. (2008) developed the IPES, which was translated into Korean and validated by Jeon and Park (2011). The IPES evaluates an individual's anxiety related to worrying that someone will have higher expectations of him/herself after a positive performance and that s/he will be unable to meet those expectations in his/her next performance. This scale consists of eight items on a seven-point Likert scale. Jeon and Park (2011) reported a Cronbach's α of .86, while this study found it to be .90.

The Discounting of Positive Events Scale (DPES). Vassilopoulos (2010) developed the DPES to measure the tendency to discount positive events. In this study, we used the Korean version of the DPES, which was translated and validated by Jeon and Park (2011). The DPES features 10 items rated on a 7-point Likert-type scale. The Cronbach's α was .91 in Jeon and Park's (2011) study, and we found it to be .95 in this study.

The Multidimensional Perfectionism Scale (MPS). To evaluate firefighters' socially prescribed perfectionism, we used the MPS originally developed by Hewitt and Flett (1991), translated into Korean by G. Y. Han (1993), and later revised by Y. S. Kim (1999). This scale is composed of three subscales to evaluate self-oriented, other-oriented, and socially prescribed perfectionism according to the object of perfectionism. We focused exclusively on socially prescribed perfectionism, which has been consistently found to be a factor that worsens psychological problems such as depression. The MPS features 15 items on a 7-point Likert-type scale. In this scale, the higher the final scores, the stronger

the tendency toward perfectionism. The Cronbach's α was .76 in this study.

The Social Interaction Anxiety Scale. This scale was originally developed by Mattick and Clarke (1998) to measure anxiety experienced in social interactions. H. S. Kim (2001) translated the scale into Korean and validated it. The scale is composed of 19 items across three domains including cognitive, emotional, and behavioral responses in various social situations. The items were rated using a 5-point Likert-type scale. The higher the total score, the more severe the anxiety that is experienced in social interactions. The Cronbach's α was .92 in H. S. Kim's (2001) study and .93 in this study.

The Deliberate Rumination Scale. Deliberate rumination was assessed through the Event Related Rumination Inventory, which was developed by Cann et al. (2011) and then translated into Korean and validated by H. N. Ahn et al. (2013). This scale consists of 10 items of intrusive rumination and another 10 items of intentional rumination. We used only the deliberate rumination items, which were rated on a four-point Likert-type scale. The larger the score sum, the higher the deliberate rumination. H. N. Ahn et al. (2013) reported a Cronbach's α of .95, while we found it to be .93 in this study.

The Self-Encouragement Scale. We used the Self-Encouragement Scale (from the Self-Encouragement/Self-Disencouragement Scale) developed and validated by Noh and Jeong (2007). The Self-Encouragement Scale is composed of 30 items across three domains: cognitive domain, behavioral domain, and emotional domain. The items were rated using a five-point Likert-type scale. The Cronbach's α in Noh and Jeong's (2007) study was .85 for the cognitive domain, .87 for the behavioral domain, and .87 for the emotional domain. We found the Cronbach's α to be .93 for the cognitive domain, .89 for the behavioral domain, .94 for the emotional domain, and .97 for the total scale.

The Abbreviated Family Relationship Scale-15. O. K. Yang (2001) developed the Family Relations Scale to evaluate relationships between family members. Subsequently, O. K. Yang and Kim (2007) revised the scale and developed the Abbreviated Family Relationship Scale-15, which we employed in this study. This scale features two sub-scales: the emotional intimacy subscale and the acceptance and respect subscale. The emotional intimacy subscale consists of 10 questions that ask about family members' intimate interactions, while the acceptance and respect subscale consists of five questions that evaluate reciprocal respect between family members and whether they take responsibility for their own behaviors. All items were rated on a five-point Likert-type scale. The higher the sum score, the better the family

Table 2. Correlation Between Main Variables and Descriptive Statistics.

Variable	1	2	3	4	5	6	7	8
Risk factors								
1. Cognitive bias								
2. Perfectionism	.56**							
3. Social anxiety	.39**	.35**						
Protective factors								
4. Deliberate rumination	-.03	.05	-.052					
5. Self-encouragement	-.43**	-.34**	-.42**	.21**				
6. Family relations	-.34**	-.26**	-.37**	.12**	.59**			
7. Peer support	-.55**	-.37**	-.44**	.17**	.60**	.54**		
8. Resilience	-.61**	-.42**	-.45**	.12*	.61**	.49**	.67**	
<i>M</i>	3.14	3.70	0.95	2.73	3.59	3.76	3.71	3.52
(<i>SD</i>)	0.92	0.52	0.63	0.52	0.54	0.69	0.66	0.43
Minimum	1.00	1.40	0.00	1.00	2.17	1.47	1.80	2.57
Maximum	5.33	5.27	2.84	4.00	5.00	5.00	5.00	5.00
Skewness	-0.47	-1.14	0.89	-0.67	0.38	-0.03	0.12	0.61
Kurtosis	-0.51	2.50	-0.12	1.74	-0.10	-0.18	-0.67	0.21

* $p < .05$. ** $p < .01$.

relations. The Cronbach's α in O. K. Yang and Kim's (2007) study was .93 for the total scale, .92 for the emotional intimacy area, and .84 for the acceptance and respect area. We found the Cronbach's α to be .97 for the total scale, .96 for the emotional intimacy area, and .92 for the acceptance and respect area.

The Peer Support Scale. This study used the Peer Support Scale, which was originally developed as the Social Provision Scale by Cutrona and Russell (1987) and revised by M. K. Yang (2013). The scale's original items include friends, family, colleagues, and communities; however, this study used only the social support of colleagues, juniors, and senior firefighters, as in J. Y. Lee's (2016) study. This scale has five subscales and it is composed of 20 items rated on a 5-point Likert-type scale. The higher the sum score, the higher the peer support. The scale's reliability coefficient was .94 in M. K. Yang's (2013) study and .96 in this study.

Analysis Method

We used IBM's SPSS Statistic 21.0 to perform the study's frequency analysis, descriptive statistics, correlation analysis, and multiple regression analysis. We conducted multiple regression analysis using the stepwise method to examine the relative influence of risk factors and protective factors on firefighters' resilience. In addition, we performed multiple regression analyses on the subscales of each variable, but found no differences between the subscale analysis and our analysis of the complete scales for each variable. Therefore, we only report the analysis results for the

complete scales of each variable here, not the subscale analysis results.

Results

Descriptive Statistics and Correlation Analysis Results of the Study Variables

Table 2 presents the descriptive statistics and the results of the correlation analyses among the variables in the scales. Except for deliberate rumination, the variables were highly correlated with one another.

Impact of Risk Factors on Resilience

We conducted a multiple regression analysis to identify the relative influences of the risk factors on resilience. For this analysis, we used demographic variables as control variables (see Table 3). The demographic variables explained 5.2% of resilience ($R^2 = .05$). Among the demographic variables, only age had a significant negative effect on resilience ($\beta = -0.31, p < .05$).

Next, the risk factors explained 43.7% of resilience ($R^2 = .44$). We found that both cognitive bias and social anxiety— independent variables—had statistically significant negative effects on resilience ($\beta = -0.51, p < .001$; $\beta = -0.21, p < .001$). In other words, the higher the levels of cognitive bias and social anxiety, the lower the resilience. Cognitive bias had a more substantial influence than social anxiety. However, socially prescribed perfectionism had no significant effect on resilience when we controlled the relative influence of other variables.

Table 3. Impact of Risk Factors on Resilience.

Variable	B	SE	β	T	VIF	95% confidence intervals		
						Lower	Upper	
First step (demo-graphical variable)								
(Constants)	4.15	0.23		18.06***		3.65	4.60	$R^2 = .05$
Age	-0.01	0.01	-0.31	-2.49*	3.96	-0.02	0.00	<i>Adjusted R</i> ² = .03
Education level	-0.01	0.03	-0.03	-0.41	1.05	-0.08	0.05	$F = 2.75^*$
Socioeconomic status	-0.06	0.05	-0.07	-1.15	1.01	-0.15	0.04	
Position	0.04	0.06	0.11	0.65	8.17	-0.09	0.15	
Entire service period	0.00	0.04	0.00	0.02	8.41	-0.08	0.07	
2nd step (Risk factors)								
(Constants)	4.84	0.22		22.34***		4.33	5.33	$R^2 = .44$
Age	-0.01	0.00	-0.19	-2.01*	3.99	-0.02	0.00	<i>Adjusted R</i> ² = .42
Education level	0.02	0.03	0.03	0.66	1.07	-0.04	0.07	$\Delta R^2 = .39$
Socioeconomic status	-0.08	0.04	-0.10	-2.16*	1.02	-0.15	-0.01	$F = 24.10^{***}$
Position	0.06	0.05	0.17	1.22	8.52	-0.04	0.15	Durbin-Watson = 1.77
Entire service period	-0.01	0.03	-0.03	-0.21	8.73	-0.06	0.05	
Cognitive bias	-0.23	0.03	-0.51	-8.49***	1.59	-0.29	-0.17	
Perfectionism	-0.02	0.05	-0.02	-0.41	1.48	-0.14	0.09	
Social anxiety	-0.14	0.04	-0.21	-3.88***	1.27	-0.21	-0.07	

Note. B = unstandardized coefficients; β = standardized coefficients; VIF = variance inflation factor.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Impact of Protective Factors on Resilience

We conducted a multiple regression analysis to identify the relative effects of protective factors including deliberate rumination, self-encouragement, family relations, and peer support on resilience. Again, we used demographic variables as control variables (see Table 4). The demographic variables explained 5.2% of resilience ($R^2 = .05$), and only age had a significant negative effect on resilience ($\beta = -0.31, p < .05$).

The protective factors explained 52.6% of resilience ($R^2 = .53$). We found that both peer support and self-encouragement—the independent variables—had statistically significant positive effects on resilience, the dependent variable ($\beta = 0.39, p < .001$; $\beta = 0.33, p < .001$). In other words, the higher the level of peer support and self-encouragement, the stronger the resilience. Peer support had a more substantial influence than self-encouragement. However, deliberate rumination and family relations had no significant effect on resilience when we controlled the relative influence of other variables.

Impact of Risk and Protective Factors on Resilience

We conducted a multiple regression analysis to determine the relative impact of the risk factors and protective factors on resilience. Table 5 shows the extent to which the control

variables affected resilience. When we included both the risk and protective factors in the analysis, they accounted for 59.5% of resilience ($R^2 = .60$). This percentage represents the extent to which resilience was explained by cognitive bias, socially prescribed perfectionism, social anxiety, deliberate rumination, self-encouragement, family relations, and peer support. As for the independent variables, cognitive bias showed a statistically significant negative effect on resilience ($\beta = -0.29, p < .001$), while peer support and self-encouragement had statistically significant positive effects ($\beta = 0.24, p < .001$; $\beta = 0.26, p < .001$). The degree of influence followed this order: cognitive bias, peer support, and self-encouragement. In addition, when controlling for the relative influence of other variables, independent variables including socially prescribed perfectionism, deliberate rumination, and family relations did not have significant effects on resilience.

Discussion and Conclusion

The purpose of this study was to investigate the relative influences of the risk factors and protective factors that affect firefighters' resilience. We performed three multiple regression analyses. We first conducted an analysis using only the risk factors, then a regression analysis using only the protective factors, and finally an analysis analyzing all the factors. We discuss the main findings and their implications.

Table 4. Impact of Protective Factors on Resilience.

Variable	B	SE	β	T	VIF	95% confidence intervals		
						Lower	Upper	
1st step (demo-graphical variable)								
(Constants)	4.15	0.23		18.06***		3.66	4.58	$R^2 = .05$
Age	-0.01	0.01	-0.31	-2.49*	3.96	-0.02	0.00	<i>Adjusted R</i> ² = .03
Education level	-0.01	0.03	-0.03	-0.41	1.05	-0.08	0.05	$F = 2.75^*$
Socioeconomic status	-0.06	0.05	-0.07	-1.15	1.01	-0.15	0.04	
Position	0.04	0.06	0.11	0.65	8.17	-0.08	0.15	
Entire service period	0.00	0.04	0.00	0.02	8.41	-0.08	0.07	
2nd step (protective factors)								
(Constants)	1.83	0.23		7.95***		1.37	2.31	$R^2 = .53$
Age	-0.01	0.00	-0.21	-2.39*	3.99	-0.02	0.00	<i>Adjusted R</i> ² = .51
Education level	-0.02	0.02	-0.04	-0.80	1.05	-0.07	0.03	$\Delta R^2 = .47$
Socioeconomic status	-0.01	0.03	-0.01	-0.29	1.03	-0.08	0.05	$F = 30.42^{***}$
Position	0.05	0.04	0.14	1.11	8.18	-0.04	0.13	Durbin-Watson = 1.90
Entire service period	-0.00	0.03	-0.02	-0.15	8.44	-0.06	0.04	
Deliberate rumination	0.00	0.04	0.00	0.08	1.07	-0.08	0.09	
Self-encouragement	0.25	0.05	0.33	5.49***	1.83	0.15	0.35	
Family relations	0.06	0.03	0.09	1.64	1.67	-0.02	0.13	
Peer support	0.25	0.04	0.39	6.78***	1.72	0.17	0.33	

Note. B = unstandardized coefficients; β = standardized coefficients; VIF = variance inflation factor.

* $p < .05$. ** $p < .01$. *** $p < .001$.

The risk factors only multiple regression analysis identified cognitive bias and social anxiety as influential risk factors on resilience and showed that socially prescribed perfectionism was not an influential risk factor. We found that cognitive bias had more impact on resilience than social anxiety. This result confirms the findings of previous studies that have highlighted the direct link between cognitive bias and resilience. Beadel et al. (2016) found that cognitive bias modification resulted in enhanced resilience among people with anxiety symptoms, while J. H. Kim (2018) identified a link between the cognitive flexibility and resilience of call center agents. Together, these results support the conclusion that cognitive bias can have a significant effect on firefighters' resilience.

With respect to social anxiety, our analysis produced conflicting results. First, the risk factors only regression analysis showed that social anxiety had a significant influence on firefighters' resilience. Second, the analysis with all the risk factors and protective factors showed that social anxiety did not significantly influence resilience. Previous studies have consistently found a negative relationship between social anxiety and resilience (Y. J. Hong & Lee, 2014; Jang, 2018; J. I. Kim & Joo, 2013). In addition, a study examining firefighters' risk factors identified anxiety as a risk factor (Y. J. Kim et al., 2017). The strong

correlation between social anxiety and cognitive bias is a plausible explanation for these conflicting results (Alden et al., 2008; Vassilopoulos, 2006). People with high social anxiety tend to have interpretive biases that are divided into two main categories: negative interpretation of positive events and discounting of positive events (Alden et al., 2008; Vassilopoulos, 2010; Weeks, 2010). Negative interpretation of positive events refers to the tendency of certain people to both interpret positive events as increasing others' expectations of them and believe they will be unable to adequately respond to these expectations. In other words, this interpretative bias reflects anxiety that the positive event in question will eventually become a negative event (Alden et al., 2008). Discounting of positive events includes not accepting others' positive feedback as it is and/or discounting its meaning (B. N. Han & Park, 2013). Meanwhile, social anxiety disorder is a type of cognitive bias that causes individuals to minimize positive issues and exaggerate negative issues. In particular, individuals with this disorder can easily turn to catastrophizing when negative events occur. They overestimate the emotional costs of negative events and underestimate the likelihood of positive social interactions, not expecting any positive possibilities for the future (Vassilopoulos, 2006). In this study, we also found a strong correlation between the two variables, and consequently, the

Table 5. Impact of Risk and Protective Factors on Resilience.

Variable	B	SE	β	T	VIF	95% confidence intervals		
						Lower	Upper	
First step (demo-graphical variable)								
(Constants)	4.15	0.23		18.06***		3.66	4.60	$R^2 = .05$
Age	-0.01	0.01	-0.31	-2.49*	3.96	-0.02	0.00	<i>Adjusted R</i> ² = .03
Education level	-0.01	0.03	-0.03	-0.41	1.05	-0.08	0.05	$F = 2.75^*$
Socioeconomic status	-0.06	0.05	-0.07	-1.15	1.01	-0.15	0.04	
Position	0.04	0.06	0.11	0.65	8.17	-0.08	0.15	
Entire service period	0.00	0.04	0.00	0.02	8.41	-0.08	0.07	
Second step (Risk factors and protective factors)								
(Constants)	2.83	0.28		10.15***		2.25	3.41	$R^2 = .60$
Age	-0.01	0.00	-0.18	-2.18*	4.00	-0.02	0.00	<i>Adjusted R</i> ² = .58
Education level	0.00	0.02	0.00	0.03	1.08	-0.05	0.04	$\Delta R^2 = .54$
Socioeconomic status	-0.04	0.03	-0.05	-1.16	1.05	-0.10	0.02	$F = 29.91^{***}$
Position	0.05	0.04	0.14	1.19	8.54	-0.03	0.13	Durbin-Watson = 1.93
Entire service period	-0.00	0.02	-0.01	-0.06	8.76	-0.05	0.04	
Cognitive bias	-0.13	0.03	-0.29	-5.19***	1.94	-0.19	-0.08	
Perfectionism	-0.02	0.04	-0.02	-0.46	1.52	-0.11	0.07	
Social anxiety	-0.05	0.03	-0.07	-1.41	1.40	-0.11	0.02	
Deliberate rumination	0.03	0.03	0.04	0.86	1.11	-0.05	0.11	
Self-encouragement	0.20	0.04	0.26	4.61***	1.91	0.11	0.29	
Family relations	0.04	0.03	0.07	1.35	1.69	-0.03	0.12	
Peer support	0.15	0.04	0.24	4.13***	2.04	0.08	0.23	

Note. B = unstandardized coefficients; β = standardized coefficients; VIF = variance inflation factor.

* $p < .05$. ** $p < .01$. *** $p < .001$.

influence of social anxiety did not appear because of the large influence of cognitive bias and other significant factors on resilience. Thus, social anxiety might be regarded as a factor that has a limited effect on resilience.

We conducted the second multiple regression analysis with protective factors only, and found that both peer support and self-encouragement had significant positive impacts on resilience. This result aligns with the results of previous studies examining the resilience of various subjects. Specifically, a study examining the relationship between nurses' resilience and burnout showed that peer support had a moderating effect (J. S. Song & Huh, 2018). In addition, J. H. Yu and Cho (2018) reported that nurses' peer support was a protective factor affecting resilience. Another study examining the protective factors of resilience in soldiers reported that units' teamwork and cohesion were important protective factors (Chu, 2016). Similarly, a study of adolescents identified friendship as an important protective factor in the resilience of ordinary youth and of delinquent adolescents (Moon, 2017). Lim (2006) also reported that social support decreases firefighters' burnout and/or physical symptoms.

Notably, family relations did not exert a significant effect on resilience when we examined the other factors that affect resilience simultaneously. This finding is also a surprising departure from previous studies. Prior studies investigating the risk factors and protective factors that affect resilience in various target groups have shown that family support and/or family relations are important protective factors. These studies' subjects included kindergarten teachers (E. H. Park & Jeon, 2010), poor youth (H. S. Park, 1999), and cancer patients (J. I. Kim & Byeon, 2013; Kwak & Byeon, 2013). One possible explanation for this discrepancy could be the occupational specificity of the firefighting profession. Namely, firefighters deal with a range of dangerous tasks including fire suppression, rescue, first aid, and life safety, which makes them a high-risk occupational group that is susceptible to PTSD (H. C. Choi, 2013). Due to the risky nature of firefighters' work, relationships between colleagues who perform tasks together are of paramount importance. In addition, co-workers' safety and support are critically important because the serious trauma experienced by firefighters includes witnessing the deaths or injuries of colleagues at work (National Fire Agency, 2008). Therefore, this study's

conclusions suggest that peer support is more important for firefighters than family support.

Self-encouragement emerged as another significant protective factor that affects resilience in this study. Self-encouragement refers to the idea of focusing on one's strengths and values and changing one's beliefs to adopt a positive self-image (Skinner et al., 2013). Previous studies of the relationship between self-encouragement and resilience have found that adolescents (Y. M. Ahn & Kim, 2018) and mothers of mentally retarded children (Afkhamaqda et al., 2016) who participated in group programs focused on self-encouragement exhibited higher resilience after participation.

We found that age, a control variable in this study, had a significant effect on resilience. The results from previous studies were inconsistent in this regard: Koo et al. (2017) reported that the higher the age, the higher the resilience. Meanwhile, a study of police officers found that resilience was highest among officers in their 20s and 30s, followed by those in their 50s and 40s (H. R. Kwon & Joo, 2017). In this study, the proportion of respondents in their 20s to 30s was relatively high, and the relationship between age and resilience may be negative. Future studies would benefit from examining the age-specific characteristics of resilience.

Our analysis showed that two other factors—socially prescribed perfectionism and deliberate rumination—did not significantly influence firefighters' resilience. We examined socially prescribed perfectionism as a risk factor based on the fact that it is closely related to psychological problems such as depression (Flett et al., 1991; Ha, 2012; Hewitt & Flett, 1991; Shahar et al., 2003). We assumed that firefighters with high levels of socially prescribed perfectionism would be vulnerable to stress and that, by extension, perfectionism would negatively impact their resilience. However, we found that perfectionism did not significantly affect resilience.

Regarding deliberate rumination, it warrants mention that while our analysis showed a significant correlation between deliberate rumination and resilience, deliberate rumination's relative impact was not significant when evaluated simultaneously with other factors. Deliberate rumination is a form of cognition that can be used to discover the potential benefits and meanings of adversity (Cann et al., 2011). It ultimately promotes PTG. Although resilience is an important variable leading to PTG (Tedeschi & Calhoun, 1995), we found that deliberate rumination was not associated with resilience in this study. The diversity of the types of services the participants performed and their varied past experiences of adversity might have affected the results. Specifically, we did not select participants who had recently experienced significant adversity or crises. Since deliberate rumination is a framework people use to understand personal changes before and after adversity (Linley & Joseph, 2004), its effectiveness may be more effective with subjects who had recently experienced painful life events.

Resilience has a multidimensional nature; it dynamically interacts with a number of factors and is difficult to explain

from only one angle. Thus, considering the personal, family, and social factors that affect resilience from a multidimensional point of view is crucial. The significance of this study is that we analyzed these various levels of factors that affect resilience together.

In this study, we examined the relative influence of the risk and protective factors that affect resilience with the aim of generating findings that would improve firefighters' quality of life. The findings of our integrated examination of the influence of firefighters' cognitive, emotional, and behavioral attributes on their resilience have practical implications for the target population. For example, to reduce cognitive bias—the factor that exerts the greatest influence on firefighters' resilience—cognitive therapy programs for firefighters could be developed and implemented. When cognitive bias decreases, social anxiety may also decrease. Based on our findings, professionals in the field might consider preparing mindfulness-based stress reduction programs and/or meditation programs that can enhance self-encouragement and peer support for firefighters.

This study's limitations can be summarized as follows. First, we randomly selected participants in Korea's metropolitan areas and small cities, making it difficult to generalize the results to all firefighters. Future studies may benefit from selecting broader samples that include firefighters from other communities and/or countries. Second, we used self-report questionnaires, which are sometimes prone to memory distortion, underestimation, and/or overestimation on the part of participants. Future studies should include in-depth interviews-based qualitative analyses of firefighters' experiences. Third, we used a cross-sectional design to obtain and analyze data related to firefighters' experiences. In Korea, firefighters continually circulate among various services, performing tasks that include both administrative work and various types of fieldwork such as first aid and fire suppression. Future studies may benefit from utilizing longitudinal designs, which would allow for detailed analyses of firefighters' experiences of adversity. Ultimately, we hope that further research will help to mitigate firefighters' specific mental health problems and improve their quality of life.

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