

Mediating Effects of Firefighter Work Overload, Psychological Exhaustion, and Depression

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〈Abstract〉

Firefighters are exposed to extreme stress and risk owing to the nature of their work. This can lead to psychological burnout, and work overload can result in lethargy and depression. This study aims to analyze the mediating effect of depression on the impact of heavy workloads on psychological exhaustion among firefighters. We conducted a survey among firefighters in various regions of Korea to analyze the levels of work overload, depression, and psychological burnout. The analysis yielded the following results. First, work overload, depression, and psychological exhaustion showed positive correlations. Second, the mediating effect of depression on the relationship between work overload and psychological exhaustion was verified. This study confirms the necessity of the systematic management of psychological exhaustion by addressing the mediating role of depression in the context of heavy workloads. This study is expected to serve as foundational data for policy measures aimed at reducing the burden on firefighters, and maintaining their mental health.

Keywords : Firefighter, Work Overload, Psychological Exhaustion, Depression

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1. Introduction

Firefighters play an important role in protecting people's lives and property. They must respond quickly to various emergency situations such as fires, natural disasters, and traffic accidents; in this process, they are exposed to extreme stress and risk. Owing to the nature of their work, firefighters experience excessive physical and mental workload, which can lead to psychological exhaustion [1,2]. Psychological exhaustion appears in the form of emotional exhaustion, apathy, and reduced sense of accomplishment, lowering an individual's job performance [3], and ultimately negatively impacting organizational efficiency [4,5].

Particularly, the impact of firefighter workload on psychological exhaustion is emerging as a serious problem. They continuously experience stress through repeated emergency response and rescue activities, which can accumulate over time and cause psychological exhaustion [6]. Additionally, it can lead to lower morale and increased job desertion for the entire organization; therefore, systematic and in-depth research on this is necessary.

Recent studies have shown that depression plays an important mediating role in the relationship between workload and psychological exhaustion. Depression not only reduces an individual's overall mental health, but also negatively impacts work performance. Therefore, it is crucial to analyze the mediating role of depression in the process of firefighters' work overload leading to psychological exhaustion.

This analysis contributes to improving the psychological health of firefighters and suggests practical measures to increase work efficiency.

According to previous research, the rate of psychological exhaustion among emergency medical service providers has sharply increased since the COVID-19 pandemic [7]. Additionally, in a study on the work status of firefighters and the risk factors for depression after the coronavirus, the intensity of response work was found to be a risk factor for depression [8]. Work overload and depression have been found to influence psychological exhaustion [7]. Accordingly, as a way to relieve the job stress of firefighters, this study analyzes the impact of firefighters' work overload on psychological exhaustion, and the mediating effect of depression, thereby protecting the psychological health of firefighters, and creating a better working environment. We aim to provide the basic data for this purpose. The results of this study are expected to contribute to the development of policy measures to reduce the work burden on firefighters and maintain their mental health.

2. Research Method

2.1 Research Subject

To examine the impact of firefighters' workload on psychological exhaustion and the mediating effect of depression, we conducted a survey on firefighters nationwide from January

28 to May 10, 2024. The survey was conducted using the Onnara Administrative Business Management System 2.0. The final number of respondents was 205.

2.2 Reliability of Measurement Tools

2.2.1 Workload Measurement Tool

The measurement tool for work overload was modified and reorganized with reference to the relationship between work overload and depression, and the mediating effect of psychological exhaustion among 119 Jeju Special Self-Governing Province paramedics after the COVID-19 epidemic. There were a total of five questions, not at all. A 5-point Likert scale ranging from (1 point) to very much (5 points) was used, and the reliability analysis results showed a Cronbach's value of .852, which was higher than the standard value of 0.6, indicating internal consistency of the measurement data.

2.2.2 Depression Measurement Tool

The questionnaire in this study was developed as an evaluation tool for depression with reference to previous studies that investigated depression among firefighters. It consists of 16 questions, including six questions about general characteristics and 10 questions about depression. The depression questions were rated on a 5-point Likert scale ranging from 1 (not at all) to very much (5 points). As a result of the reliability analysis, Cronbach's was .948, which was higher than the

standard value of 0.6, indicating that there was internal consistency in the measurement data.

2.2.3 Psychological Exhaustion Measurement Tool

The psychological exhaustion measurement tool is used by referring to the questionnaire "6, The relationship between work overload and depression and the mediating effect of psychological exhaustion among 119 Jeju Special Self-Governing Province paramedics after the COVID-19 epidemic," [10] and modifying and reconstructing it to suit the reality of firefighters. There were ten response questions rated on a 5-point Likert scale ranging from 1 (not at all) to very much (5 points). As a result of the reliability analysis of this survey, Cronbach's value was .903, which was higher than the standard value of 0.6, indicating that there was internal consistency in the measurement data.

2.3 Analysis Method

Statistical data on the psychological exhaustion of firefighters were processed and analyzed using SPSS 28.0. The specific analysis process is as follows. First, to determine the general characteristics of the study participants, frequency analysis was conducted to calculate the frequencies and percentages (%). Second, we tested for differences in psychological exhaustion according to the general characteristics of the participants. Independent t-tests and one-way ANOVA were performed. Third, a correlation

analysis between major variables such as general characteristics, work overload, psychological exhaustion, and depression was conducted. Fourth, to verify the mediating effect of depression on the relationship between work overload and psychological exhaustion, bootstrap testing was performed using Model 4 among the 92 models using the path model presented by Hayes (2018).

3. Research Results

3.1 Degree of Work Overload, Depression, and Psychological Exhaustion

Table 1 presents the results of the descriptive statistics for the research variables. The average work overload, depression, and psychological exhaustion were 3.02 out of 5 (SD=0.84), 2.28 out of 5 (SD=0.86), and 2.93 out of 5 (SD=0.84), respectively.

Table 1. Degree of work overload, depression, and psychological exhaustion

Variables	Range	Mean ±SD
Ooerwork	1-5	3.02±0.84
Depressed	1-5	2.28±0.86
Psychological exhaustion	1-5	2.93±0.84

3.2 Differences in Psychological Exhaustion According to General Characteristics

Table 2 presents the results confirming the

Table 2. Differences in psychological exhaustion according to general characteristics

Variables	Categories	M±Sd	T/F (Duncan Test)
Gender	Man	2.89±0.81	-1.692
	Woman	3.34±1.05	
Age (Years)	21-30	2.95±0.71	5.254** D<B
	31-40	3.26±0.85	
	41-50	2.93±0.86	
	51-60	2.67±0.75	
Years Of Service (Years)	5 Years Or Less	2.96±0.87	2.289* F, G<B
	6-10	3.25±0.76	
	11-15	2.79±0.98	
	16-20	3.18±0.66	
	21-25	3.15±1.01	
	26-30	2.69±0.79	
Position	31 Years Or More	2.68±0.67	11.861*** B, C, D<A
	First Aider	3.47±0.77	
	First Rescuer	2.63±0.76	
	Fire Fighter	2.88±0.75	
Classes	Administrative	2.55±0.86	3.596** E<A, B, D
	Firefighter	3.24±0.79	
	Senior Firefighter	2.98±0.92	
	Fire Sergeant	2.90±0.86	
	Fire Lieutenant	3.05±0.76	
	Fire Captain	2.42±0.74	
Entry Path	Deputyfire Chief Higher	2.63±0.76	7.328*** A, C, E<B
	Open Recruitment	2.80±0.76	
	Special Employment (First Aid)	3.50±0.81	
	Special Employment (Rescue)	2.68±0.79	
	Special Employment (Mandatory Fire Fighting)	2.98±0.73	
Etc.	2.72±0.96		

*P<.05, **P<.01, ***P<.001

differences in psychological exhaustion

according to general characteristics. The variables that showed differences in psychological exhaustion were age, years of service, position, rank, and employment path. As a result of the post hoc test, psychological exhaustion was higher among those aged 31-40 than among those aged 51-60 ($F=5.254, p=.002$), and the number of years worked was higher among those aged 6-10 years than among those aged 26-30 years and over 31 years ($F=5.254, p=.002$). $F=2.289, p=.037$). The paramedic position was higher than that of other positions ($F=11.861, p=.000$), and psychological exhaustion was higher for firefighters, firefighters, and firefighters than for firefighters ($F=3.596, p=.004$).

3.3 Correlation between Work Overload, Depression, and Psychological Exhaustion

Table 3 the results of the verification of the correlations between workload, depression, and psychological exhaustion. Psychological exhaustion was positively correlated with workload ($r=.800, p<.001$) and depression ($r=.624, p<.001$). Additionally, work overload ($r=.56, p<.001$) positively correlated with depression ($r=.352, p<.001$).

Table 3. Correlation between work overload, depression, and psychological exhaustion

Variables	Overwork	Depressed	Psychological exhaustion
Overwork	1		
Depressed	.352**	1	
Psychological exhaustion	.800**	.624**	1

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

3.4 Mediating Effect of Depression in the Relationship between Work Overload and Psychological Exhaustion

3.4.1 Relationship between Work Overload and Depression

To verify the mediating effect of depression on the relationship between work overload and psychological exhaustion, we employed Process Macro Model 4 proposed by Hayes (2018).

In the first model, we examined the influence of the independent variable of workload and the mediating variable of depression. The explanatory power of the mediating variable, depression, accounted for 17% ($R^2 = .170$), and the research model was confirmed to be appropriate ($F=8.133, p<.001$). As a result of the analysis, age, a control

Table 4. Effect of work overload on depression

Division		B	S.E.	β
Constant		5.059	3.194	
Control	Gender (ref.=Male)	1.365	2.068	0.044
	Age	2.392	1.075	0.263*
	Work experience	-0.476	0.308	-0.120
	Classes	-0.118	0.765	-0.019
Independent	Overwork	0.860	0.143	0.417***
R^2				0.170
F(sig.)				8.133***
N				205

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

variable, was confirmed to significantly affect depression ($\beta=.263, p<.05$). In other words, the older the person, the more depressed they were. As a result of the analysis, work overload ($\beta=.417, p<.001$) was found to significantly affect depression. In other words, the higher the level of work overload, the higher the depression. The control variables of gender, work experience, and class had no significant effect on depression Table 4.

3.4.2 The Relationship between Work Overload and Depression and Psychological Exhaustion

In the second model, we examined the effects of the independent variable, work overload, and the mediating variable, depression, on the dependent variable, psychological exhaustion. The explanatory power of the

dependent variable, psychological exhaustion, accounted for 78.9% ($R^2=.789$), and the research model was confirmed to be appropriate ($F=123.056, p<.001$). As a result of the analysis, the control variables age ($\beta=-.164, p<.01$) and work experience ($\beta=.093, p<.05$) were confirmed to significantly affect psychological exhaustion. In other words, the younger the age and the longer the work experience, the higher the psychological exhaustion. The independent variable, work overload ($\beta=.623, p<.001$), and the mediator, depression ($\beta=.411, p<.001$), were found to significantly affect psychological exhaustion. In other words, the higher the workload and depression, the higher the psychological exhaustion. The control variables of gender and class had no significant effect on psychological exhaustion Table 5.

3.4.3 Verification of Mediation Effect

The mediating effects of the model parameters were tested. Table 6 presents the results of the verification of the mediation effect. To examine the mediation effect, 5,000

Table 5. Effects of work overload and depression on psychological exhaustion

Division		B	S.E.	β
Constant		2.866	1.567	
Control	Gender (ref.=Male)	1.980	1.009	0.065
	Age	-1.440	0.531	-0.164**
	Work experience	0.355	0.151	0.093*
	Classes	0.411	0.373	0.067
Independent	Overwork	1.239	0.076	0.623***
Mediation effect	Depressed	0.396	0.035	0.411***
R ²		0.789		
F(sig.)		123.056***		
N		205		

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

Table 6. Mediation effect verification results

Path between variables	B	S.E.	95% CI	
			LLCI	ULCI
Work overload → depression → psychological exhaustion	.340	.072	.207	.490

B, non-standardized coefficients; SE, standard errors.
 * LLCI=boot Lower bound within the 95% confidence interval for the indirect effect
 **ULCI=boot Upper limit within the 95% confidence interval for the indirect effect

bootstrapping times were specified, and a 95% confidence interval was set. The 95% confidence interval for the path of 'work overload → depression → psychological exhaustion' was LLCI (.207) ~ ULCI (.490) and did not include 0, confirming that the mediation effect was significant. Therefore, depression partially mediated the relationship between work overload and psychological exhaustion (Table 6).

4. Discussion and Conclusion

This study attempts to identify the mediating effect of depression on the relationship between work overload and psychological exhaustion among firefighters and provides basic data for improving their mental health.

The average workload was 3.02 out of 5 points (SD=0.84), which was found to be medium; in a study on firefighters [7], 48.21% scored 22 or more out of 35 points, showing that work overload is high. The results were as follows.

The average score for depression was 2.28 out of 5 (SD=0.86), which was slightly lower than the average score. In a study on firefighters, 45.2% of 168 people exhibited high levels of depression [7]; a study on Chinese nurses found that they suffered from depression owing to increased workload after COVID-19 [9]. This study was also conducted after the coronavirus pandemic. However, it is believed that these results were obtained

slightly after the pandemic.

The average psychological exhaustion was 2.93 out of five (SD=0.84). According to previous research, the average exhaustion score in a study targeting firefighters was 60 out of 100, showing similar results [10]. In a study of paramedics, psychological exhaustion was high when people were worried about being infected by patients [7]; in a study of dedicated nurses, the level of exhaustion owing to work overload was found to be higher [11].

By identifying the differences in psychological exhaustion according to general characteristics, significant differences were found depending on age, years of service, position, rank, and employment route. Considering previous studies, sex, paramedic work experience, average number of dispatches per day, and protective gear were not significant variables. However, in the case of paramedics, who have experienced, confirmed, and suspected cases, when the number of dispatches is high, and when they are infected while performing their duties. Anxiety was also a statistically significant result [7]. This study also found that paramedics exhibited a higher level of psychological exhaustion than other positions; therefore, it is believed that work overload after COVID-19 is highly related to psychological exhaustion.

Psychological exhaustion was positively correlated with workload and depression. Additionally, workload was positively correlated with depression. A study targeting paramedics

also found that psychological exhaustion, work overload, and depression were positively related [6]; the more the work overload, the more psychological exhaustion and depression. A study by Bae Jin-seong et al. [9] also showed that the higher the job stress, the higher the exhaustion level. Therefore, the results showed that work overload, depression, and psychological exhaustion are highly related, and that depression mediates this relationship and is related to psychological exhaustion.

Lastly, this study tests the mediating effect of depression on the relationship between work overload and psychological exhaustion, and confirms a partial mediating effect. First, as a result of the analysis in the first stage of the mediating effect verification, it was found that older age and higher levels of workload significantly affected depression.

The results of the second stage showed that younger age, greater work experience, higher workload, and higher depression significantly affected psychological exhaustion. Bae Jin-seong et al. [10] found that gender, age, work experience, shift work, the physical burden of work, satisfaction with work, intention to change jobs, and job stress were significant variables, showing results similar to those of this study. .

Lastly, as a result of testing the mediating effect of the mediating variables in this study's model, depression showed a partial mediating effect between work overload and psychological exhaustion. This further improved the level of psychological exhaustion. According

to previous studies, the higher the level of burnout, the higher the level of depression. Moreover, exhaustion has the most significant impact on depression [7]. Therefore, both depression and exhaustion must be prevented. Moreover, there is a need to prevent or eliminate factors that can increase the work-stress index in preparation for sudden increases in work, such as the COVID-19 pandemic, and anxiety about infection problems.

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