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Influencing Factors for Work Engagement of COVID-19 Response Workers in Public Health Centers: Based on the Job Demands-Resources Model

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Purpose: This study aimed to identify the influencing factors for work engagement of COVID-19 response workers in public health centers based on the JD-R model.
Methods: The participants were 119 civil servants and professionals of 20 public health centers with at least 6 months of work experience and have experience of COVID-19 response tasks in cities, districts and counties. The collected data were analyzed by descriptive statistics, t-test, ANOVA, Pearson's correlation coefficient and multiple regression using IBM SPSS 27.0.
Results: The factors influencing work engagement were age, career development opportunity, and person-job fit. The explanatory power of these variables was 61%.
Conclusion: In order to enhance the work engagement of public health center workers in responding to future infectious disease outbreaks, it is necessary to develop various strategies such as assigning job roles that aligned with individual characteristics, providing career growth opportunities even during infectious disease outbreaks, and designing tasks by taking into account age.

Keywords: Work Engagement; Public Health Practice; COVID-19; Occupational Stress; Burnout

Introduction

1. Background

As the coronavirus disease (COVID-19) spread rapidly around the world in 2020, each community in Korea focused on infection control in response to COVID-19 centered on public health centers for responding to COVID-19 infections simultaneously occurring and spreading across the country on a large-scale [1]. During the COVID-19, public health centers completely suspended or partially adjusted most health services, including various health promotion programs such as chronic disease management programs, screenings, tests, and focused on responding to the spread of COVID-19. In Korea, public health centers played a pivotal role in infection prevention and control against COVID-19 that rapidly spread to communities, and the dedication and passion of COVID-19 response workers at public health centers served as the main impetus for Korea' effective responses to COVID-19 [2].

Work engagement enables individuals to perform their job duties with enthusiastic attitude and to willingly take on even challenging tasks [3]. Persons with a high level of work engagement occupy themselves with their duties sufficiently energetically despite the job stress and work engagement enables them to immerse themselves in their tasks and carry them out completely [4]. In a previous study on work engagement among public health workers during the COVID-19, it was found that a high

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level of work engagement not only has a positive impact on individuals' growth and development, but it can also improve organizational performance [5]. In light of these findings, to effectively respond to future outbreaks of new and re-emerging infectious diseases, there is a need to examine work engagement among the COVID-19 response workers of public health centers in Korea.

Theories on nursing practice perform the roles of explaining, exploring, and predicting phenomena in nursing, so it is necessary to use an appropriate theoretical framework to effectively explore factors influencing work engagement among the COVID-19 response workers of public health centers. The Job Demands-Resources model (JD-R model) is well known as a theory that proposes job demands and job resources explain organizational performance through strain and motivation [6]. The JD-R model includes dual processes: the job demands process, which is the energy depletion process, and the job resources process, which is the motivational process [6]. According to a previous study, job demands such as job stress increase burnout and consequently reduce work engagement, while job resources such as resilience and career development opportunities generate motivation and have a positive effect on work engagement [6].

COVID-19 response workers at public health centers had to struggle with overwhelming workloads in a situation where they were not sufficiently prepared to prevent the spread of an emerging infectious disease, endured poor working conditions due to a severe shortage of workers, and were not guaranteed regular work hours or holidays during a very long period. A number of studies reported that the continuous heavy workloads of healthcare workers during the COVID-19 in their burnout, posing a major threat to their jobs and health [7]. Meanwhile, few studies have been conducted on the effects of a high level of job stress and burnout on work engagement among COVID-19 response workers of public health centers in Korea, so there is a need to examine the relationship between the factors.

According to the JD-R model, job resources such as resilience and career development opportunities increase motivation and thereby improve work engagement even in situations involving excessive job demands [6]. Career development opportunities are defined as members' perception of various learning and development opportunities provided by the organization. It has been reported that members who have a greater degree of career development opportunities through the performance of job duties or tasks in the organization show a higher level of work engagement because they perceive that they are able to continuously develop their capabilities and grow professionally through the capability development process [8]. Such findings suggest there is a need to analyze whether resilience and career development opportunities had a positive impact on COVID-19 response workers even in unpredictable and various situations such as the COVID-19 situation.

In recent years, there has been growing interest in the impact of person-job fit on organizational performance. Person-job fit refers to the degree to which an individual's responsibilities and tasks required by his or her specific job position match his or her interests and capabilities [9]. In several previous studies, person-job fit has been shown to be positively associated with individuals' job satisfaction, work engagement, and organizational immersion, and a study of public health center nurses also found that person-job fit has a positive effect on work engagement [10]. However, few studies have so far been conducted on the relationship between person-job fit and work engagement among healthcare workers in the COVID-19, so it is necessary to investigate the relationship between the two factors.

The WHO has announced its prediction that recurrent epidemic outbreaks caused by new infectious diseases such as COVID-19 may occur at any time in the future, as currently observed in the COVID-19 [11]. In this situation, it is important to systematically support healthcare workers so that they can engage in their work with enthusiasm even in infectious disease outbreak by identifying factors influencing work engagement among the workers of public health centers, the frontline organizations responding to the outbreaks of emerging and re-emerging infectious diseases. Therefore, this study aimed to identify explore factors affecting work engagement. To provide basic data for establishing effective policy in the event of an emerging infectious disease outbreak crisis in the future.

2. Conceptual framework

According to the JD-R model, job demands have been shown to increase strain and thereby reduce motivation, and job resources have been found to have a positive effect on motivation [6]. Based on the JD-R model, this study defined job demands as job stress, strain as burnout, job resources as resilience and career development opportunities, and motivation as work engagement. In addition, based on a previous research [10] reporting that person-job fit has a positive effect on work engagement, this study also posited the relationship to examine how person-job fit affects work engagement.

Methods

1. Study design

This study is a descriptive survey research to identify factors affecting work engagement among civil servants and professionals working at public health centers during the COVID-19.

2. Participants

The target population of this study was civil servants and professionals working at public health centers in 20 areas including cities, counties, and districts in G Province. The inclusion criteria were as follows: 1) person with minimum 6 months of working experience at a public health center; 2) person with working experience of as a COVID-19 response worker during the period from January 2020 to June 2022. Part-time workers and medical staff were excluded from the study because their work characteristics were different from those of public health centers.

The sample size of this study was calculated using G*power 3.1.9.7 by applying a significance level (α) of .05, a medium effect size of .15, a power (1-β) of .80, 10 predictor variables, and the statistical technique of regression analysis. As a result, the minimum sample size was calculated to be 118 people, but considering the dropout rate of 10%, a total of 130 copies were distributed. All the 130 copies were collected, and a total of 119 copies were used in the final analysis, excluding 11 copies with insincere responses.

3. Measures

The general characteristics of the participants were examined using a total of 6 items about gender, age, marital status, location of the public health center, work period, and position. In addition, the participants' work-related characteristics about COVID-19 response tasks were examined using a total of 7 items about experience of abrupt task, time of notification about abrupt task, satisfaction with compensation related to COVID-19, satisfaction with work assignment related to COVID-19, satisfaction with the working support system related to COVID-19, satisfaction with the current job, and requirements to prepare for a future infectious disease disaster.

1) Job stress

Job stress was measured using the Korean Occupational Scale Short Form (KOSS-SF) developed by Jang et al. [12], which is a tool for assessing occupational stress among workers in Korea. The instrument was used excluding some items. In particular, this study did not use four items on workplace culture among the sub-domains because they were suitable for the COVID-19. In addition, two items on job insecurity were also excluded because they were not related to the characteristics of civil servants working at public health centers. The instrument used consists of a total of 18 items in the following five subdomains: job demands (4 items), insufficient job control (4 items), interpersonal conflict (3 items), organizational system (items), and lack of reward (3 items). Each item is rated on a 4-point Likert scale ranging from 1 point (='Strongly disagree') to 4 points (='Strongly agree'). Higher scores indicate higher levels of job stress. As for the reliability of the tool, the value of Cronbach's α was .92 for the original tool, and it was calculated as .86 in this study.

2) Burnout

Burnout was measured using a Korean adapted version of the Burnout Measure Short Version (BMS) developed by Malach-Pine [13], and the Korean version used was developed by Cho [14]. This scale consists of a total of 10 items in the following three subdomains: physical exhaustion (3 items), emotional exhaustion (3 items), and mental exhaustion (4 items). Each item is rated on a 7-point Likert scale ranging from 1 point (='Never') to 7 points (='Always'), and higher scores indicate higher levels of burnout. Regarding the reliability of the tool, the value of Cronbach's α was reported as .86 for the original tool and as .89 in Cho [14], and it was calculated as .93 in this study.

3) Resilience

Resilience was assessed using a Korean version of the resilience scale from the Psychological Capital Questionnaire (PCQ) developed by Luthans et al. [15]. The resilience scale used was the Korean version presented on the website of Mind Garden (https://www.mindgarden.com), and it was used after receiving approval for use from Mind Garden. The tool contains 6 items in total, each item is rated on a 6-point Likert scale ranging from 1 point (='Strongly disagree') to 6 points (='Strongly agree'), and higher scores indicate higher levels of resilience. The value of Cronbach's α was reported as .87 for the original tool, and it was calculated as .92 in this study.

4) Career development opportunities

Career development opportunities were measured using a Korean version of the scale for career development opportunity included in the Questionnaire on the Experience and Evaluation of Work (QEEW 2.0) developed by Van Veldhoven [16]. The Korean version used in this study was presented by Im [17], who developed it by translating and adapting the original scale. This assessment tool contains 6 questions in total. Each item is rated

on a 5-point Likert scale ranging from 0 points (='Strongly disagree') to 4 points (='Strongly agree'), and a higher score indicates a greater degree of career development opportunities. The value of Cronbach's α was reported as .87 for the original tool and as .87 in Im [17], and it was calculated as .83 in this study.

5) Person-job fit

Person-job fit was measured using the six-item tool developed by Yang [18]. This tool is designed to measure the degree of match between an individual' abilities, aptitude, and values and the demands and rewards of a specific job. Each item is rated on a 5-point Likert scale ranging from 1 point (='Strongly disagree') to 5 points (='Strongly agree'), and higher scores indicates higher levels of person-job fit. The value of Cronbach's α was reported as .98 in Yang [18] and calculated as .93 in this study.

6) Work engagement

Work engagement was assessed using a Korean version of the Utrecht Work Engagement Scale (UWES) developed by Schaufeli & Bakker [19], and the Korean version of the UWES was developed by Yi et al. [20]. This scale contains a total of 17 items in the following three subdomains: vigor (6 items), dedication (5 items), and absorption (6 items). Each item is rated on a 5-point Likert scale from 1 point (='Never') to 5 point (='Always'), and higher scores indicate higher levels of work engagement. The value of Cronbach's α was reported as .98 for the original scale and as .86~.87 in Yi et al. [20], and it was calculated as .93 in this study.

4. Data collection

After receiving approval from the IRB of Gyeongsang National University (IRB No.: GIRB-A22-Y-0075), data was collected from the participants of the job training for civil servants and professionals of the integrated health promotion program of G Province in July 2022. The researcher gave the participants explanations about the purpose and methods of the study, confidentiality of personal information, voluntary consent to participate in the study, and participants' right to refuse to participate. A questionnaire survey was conducted only with people who understood the purpose and content of the study and gave written informed consent to participate in the study after receiving sufficient explanations about the study. It took approximately 10 to 15 minutes to complete the questionnaire, and the completed questionnaires were collected after the respondents put them in sealed envelopes. The participants who completed the survey were given a small gift as a token of appreciation for their participation.

5. Statistical analysis

The statistical analysis of the collected data was conducted using IBM SPSS/WIN Ver. 27.0 as follows. First, the general and work-related characteristics of the participants were analyzed by using the frequency, percentage, mean, and standard deviation. Second, the frequency, percentage, mean, and standard deviation were calculated to analyze the levels of job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement. Third, the t-test and ANOVA were used to investigate differences in work engagement according to general and work-related characteristics, and the post-hoc test was conducted using Scheffé test to determine the significance of differences between groups. Fourth, Pearson's correlation coefficient was used to examine the correlations between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement. Fifth, multiple regression analysis was performed to identify factors affecting work engagement.

Results

1. General characteristics and characteristics related to COVID-19 response tasks

The participants were mostly married women with a mean age of 44.8 years. Locations of public health centers that were workplaces, the proportion of city/district areas was similar to that of county areas. The average period of working was 9.98±8.53 years and 53.8% was nurses as job position, 49.6% of the participants had experience of handling an abrupt task, and 33.8% received notification about abrupt tasks on the day of task assignment or the day before. 77.3% responded that they were dissatisfied or very dissatisfied with compensation for COVID-19 response tasks. As to work assignment related to COVID-19, 63.1% responded that they were dissatisfied or very dissatisfied. Regarding the working support system, 62.2% were dissatisfied or very dissatisfied. As for satisfaction with the current job, 81.5% were moderately satisfied or very satisfied. Requirements to prepare for future disasters, 57.1% responded that sufficient reward is needed, 53.8% answered that employment of flexible workforce is required, and 47.9% expressed the view that it is necessary to create an organizational support system (Table 1).

2. Degrees of job stress, burnout, resilience, career development opportunity, person-job fit, and work engagement

Among the participants of this study, the mean score for job stress was 2.46±0.30 points, the mean score for burnout was

Table 1. General Characteristics and Experience related to COVID-19 Response Work (*N*=119)

Characteristics	Categories	n (%) or M ± SD
Gender	Male	10 (8.4)
	Female	109 (91.6)
Age (yr)	≤ 30	34 (28.6)
	40~49	41 (34.5)
	≤ 50	44 (37.0)
		44.8 ± 9.04
Marital status	Married	97 (81.5)
	Single	22 (18.5)
Location of public health center	City, District	64 (53.8)
	County	55 (46.2)
Work period(yr)	0.5~5	35 (29.4)
	> 5	84 (70.6)
		9.98 ± 8.53
Position	Nurse	64 (53.8)
	Non-nurse	55 (46.2)
Experiences of abrupt task	Yes	59 (49.6)
	No	60 (50.4)
Time of notification about abrupt task (n = 59)	0~1 day ago	20 (33.8)
	A few days ago	39 (66.2)
Requirements to prepare for future disasters†	Sufficient reward	68 (57.1)
	Employment of flexible workforce	64 (53.8)
	Construction of organizational support system	57 (47.9)
	Sufficient cooperation	41 (34.5)
	Education of disaster preparedness	36 (30.3)
	Flexible working system	35 (29.4)
	Proper budget	15 (12.6)
Satisfaction with compensation related to COVID-19	Very dissatisfied	37 (31.1)
	Dissatisfied	55 (46.2)
	Moderate	27 (22.7)
	Satisfied	0 (0.0)
	Very satisfied	0 (0.0)
Satisfaction with work assignment related to COVID-19	Very dissatisfied	19 (16.0)
	Dissatisfied	56 (47.1)
	Moderate	43 (36.4)
	Satisfied	1 (0.5)
	Very satisfied	0 (0.0)
Satisfaction with working support system related to COVID-19	Very dissatisfied	20 (16.8)
	Dissatisfied	54 (45.4)
	Moderate	42 (35.3)
	Satisfied	3 (2.5)
	Very satisfied	0 (0.0)
Satisfaction with current job	Very dissatisfied	3 (2.5)
	Dissatisfied	17 (4.3)
	Moderate	67 (56.3)
	Satisfied	30 (25.2)
	Very satisfied	2 (1.7)

†Multiple choice.

3.24 ± 1.12 points, the mean score for resilience was 4.35 ± 0.71 points, the mean score for career development opportunities was 1.88 ± 0.67 points, the mean score for person-job fit was 3.36 ± 0.70 points, and the mean score for work engagement was 3.24 ± 0.62 points (Table 2).

3. Differences in work engagement according to the general characteristics and work-related characteristics regarding COVID-19 response tasks

Among the general characteristics and work-related characteristics regarding COVID-19 response tasks of the participants, age ($F = 5.45$, $p = .002$), marital status ($t = 2.94$, $p = .004$), location of the public health center ($t = 2.12$, $p = .036$), and satisfaction with work assignment related to COVID-19 ($F = 5.33$, $p = .006$) had a significant effect on work engagement (Table 3). As a result of post-hoc analysis, the level of work engagement was higher in the 40-49 age group and the ≥ 50 age group than the ≤ 30 age group, and the married group showed a higher level of work engagement than the unmarried group. Also, the level of work engagement was higher in the group working at public health centers in a city or district than the group working at public health centers in counties. Additionally, the level of work engagement was higher in the group satisfied with work assignment related to COVID-19 than the group dissatisfied with it.

4. Correlations between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement

Work engagement was negatively correlated with job stress ($r = -.40$, $p < .001$) and burnout ($r = -.38$, $p < .001$), but it was positively correlated with resilience ($r = .52$, $p < .001$), career development opportunity ($r = .48$, $p < .001$), and person-job fit ($r = .74$, $p < .001$) (Table 4).

5. Factors affecting work engagement among the participants

In the multiple regression analysis, age, among the general characteristics, marital status, workplace, and satisfaction with work division, which were found to have a significant effect on work engagement, were converted into dummy variables and included as control variables. After controlling for these variables, multiple regression analysis was conducted job stress, burnout, resilience, career development opportunities, and person-job fit, which showed a significant correlation with work engagement. To check the basic assumptions of the regression model, the test for multicollinearity between independent variables was performed.

Table 2. Degrees of Job stress, Burnout, Resilience, Career Development Opportunity, Person-Job Fit, Work Engagement (*N*=119)

JD-R model concept	Variables	Categories	Range	Mean ± SD
Job demands	Job stress	Job demand	1~4	2.65 ± 0.56
		Insufficient job control		2.47 ± 0.31
		Interpersonal conflict		2.27 ± 0.58
		Organizational system		2.40 ± 0.50
		Lack of reward		2.49 ± 0.53
		Total		2.46 ± 0.30
Strain	Burnout	Physical exhaustion	1~7	3.80 ± 1.22
		Emotional exhaustion		2.93 ± 1.32
		Mental exhaustion		3.06 ± 1.20
		Total		3.24 ± 1.12
Job resources	Resilience		1~6	4.35 ± 0.71
	Career development opportunity		0~4	1.88 ± 0.67
	Person-job fit		1~5	3.36 ± 0.70
Motivation	Work engagement	Vigor	1~5	3.25 ± 0.67
		Dedication		3.42 ± 0.72
		Absortion		3.10 ± 0.68
		Total		3.24 ± 0.62

The tolerance values were all greater than 0.1, ranging from .398 to .675, and the Variance Inflation Factor (VIF) values were less than 10, ranging 1.416 to 2.473, indicating that there was no multicollinearity problem. The Durbin-Watson statistic was 1.70, which is close to 2, so it was confirmed that there was no autocorrelation in the residuals. The results of regression analysis showed that the regression model was statistically significant ($F = 17.83$, $p < .001$). Among the control variables, age was identified as an influencing factor for work engagement among the participants. Among the independent variables, the factor that had the greatest impact on work engagement was personal-job fit ($\beta = 0.49$, $p < .001$), followed by career development opportunities ($\beta = 0.16$, $p = .035$). These variables explained 61% of the total variance (Table 5).

Discussion

Based on the JD-R model and previous studies, this study aimed to investigate the relationships between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement, and identify factors affecting work engagement among healthcare workers at public health centers during the COVID-19. It is expected to contribute to the response to future emerging infectious disease outbreaks. In this study, 49.6% of the participants had the experience of unexpected abrupt tasks due to COVID-19 response tasks, and regarding the time of receiving notification about such abrupt tasks, 33.8% were notified on the day of task assignment or the day before, and 66.2% were informed a few days ago. During the COVID-19 period, public health centers were required to handle heavy job demands due to a sudden surge in workloads due to frequently changing infection control policies and urgently issued emergency orders [21]. It has been shown that unexpected abrupt tasks cause job stress due to its unpredictable nature and low control over one's work, and consequently, they greatly interfere with work as well as household and social activities, resulting in depression and decreased quality of life among workers [22]. Therefore, there is a need to consider appropriate strategies against abrupt tasks and their negative impact. In this study, the proportion of people dissatisfied with work assignment related to COVID-19 was 63.1%, and the proportion of people dissatisfied with the working support system was 62.2%. These results may be attributed to the fact that infection control measures taken in response to COVID-19 resulted in workload surges for the workers of public health centers, COVID-19 response tasks were not properly divided but concentrated in particular job positions [21], and the support system was also insufficient, leading to increased confusion. Therefore, it is necessary to prepare systems for appropriately responding to infectious disease outbreaks, such as adequate staffing for essential areas and an infectious disease response system, and these strategies require close cooperation with related government agencies.

Table 3. Differences in Work Engagement according to General Characteristics, Job Characteristics Experience related to COVID-19 (*N*=119)

Characteristics	Categories	Work engagement	
		Mean ± SD	t/F (*p*)
Gender	Male	2.91 ± 0.91	2.65 (.082)
	Female	3.27 ± 0.58	
†Age (yr)	≤ 30[a]	2.90 ± 0.60	10.51 (< .001)
	40~49[b]	3.25 ± 0.61	a < b
	≥ 50[b]	3.49 ± 0.50	
Marital status	Married	3.32 ± 0.32	2.94 (.004)
	Single	2.91 ± 0.55	
Location of public health center	City, District	3.34 ± .0.64	2.12 (.036)
	County	3.11 ± 0.57	
Work period(yr)	0.5~5	2.97 ± 0.64	0.53 (.464)
	> 5	3.35 ± 0.57	
Position	Nurse	3.27 ± 0.65	0.85 (.358)
	None-nurse	3.20 ± 0.57	
Experiences of abrupt task	Yes	3.13 ± 0.61	-1.97 (.052)
	No	3.35 ± 0.60	
Time of notification about abrupt task (n = 59)	0~1 day ago	2.82 ± 0.70	3.48 (.067)
	A few days ago	3.27 ± 0.52	
Satisfaction with compensation related to COVID-19	Very dissatisfied	3.32 ± 0.75	0.46 (.631)
	Dissatisfied	3.21 ± 0.56	
	Neutral & Satisfied	3.20 ± 0.62	
†Satisfaction with work assignment related to COVID-19	Very dissatisfied[a]	2.83 ± 0.83	5.33 (.006)
	Dissatisfied[b]	3.28 ± 0.53	a < b
	Neutral & Satisfied[b]	3.34 ± 0.52	
Satisfaction with working support system related to COVID-19	Very dissatisfied	3.09 ± 0.97	1.18 (.311)
	Dissatisfied	3.23 ± 0.52	
	Neutral & Satisfied	3.33 ± 0.52	
Satisfaction with Current job	Very dissatisfied	2.55 ± 1.14	2.49 (.086)
	Dissatisfied	3.13 ± 0.80	
	Neutral & Satisfied	3.28 ± 0.62	

†Scheffé test

Table 4. Correlation among Job stress, Burnout, Resilience, Career Development Opportunity, Person-Job Fit and Work Engagement (*N*=119)

Variables	1	2	3	4	5	6	7	8	9
	r (*p*)								
1. Job stress	1								
2. Physical exhaustion	.29 (.001)	1							
3. Emotional exhaustion	.31 (< .001)	.73 (< .001)	1						
4. Mental exhaustion	.39 (< .001)	.62 (< .001)	.81 (< .001)	1					
5. Burnout	.37 (< .001)	.85 (< .001)	.94 (< .001)	.91 (< .001)	1				
6. Resilience	-.28 (< .001)	-.32 (< .001)	-.46 (< .001)	-.43 (< .001)	-.45 (< .001)	1			
7. Career development opportunity	-.36 (< .001)	-.22 (.016)	-.25 (.006)	-.30 (.001)	-.29 (.001)	.31 (.001)	1		
8. Person-job fit	-.39 (< .001)	-.28 (.002)	-.33 (< .001)	-.45 (< .001)	-.40 (< .001)	.52 (< .001)	.48 (< .001)	1	
9. Work engagement	-.40 (< .001)	-.33 (< .001)	-.31 (.001)	-.38 (< .001)	-.38 (< .001)	.52 (< .001)	.48 (< .001)	.74 (< .001)	1

Table 5. Factors influencing of Work Engagement (*N*=119)

Variables	B	SE	β	t	*p*
Age (ref. = over 50)					
≤ 30	-0.29	0.11	-0.22	-2.50	.014
40~49	-0.19	0.08	-0.15	-2.28	.024
Marital status (ref. = single)	0.01	0.13	0.01	0.02	.893
Location of public health center (ref. = city)	-0.02	0.07	-0.02	-0.40	.583
Satisfaction with work assignment related to COVID-19 (ref. very dissatisfied)					
Dissatisfied	0.17	0.1	0.14	1.96	.108
Neutral & satisfied	0.18	0.11	0.15	1.80	.105
Job stress	-0.16	0.14	-0.08	-1.11	.588
Burnout	-0.01	0.04	-0.01	0.13	.983
Resilience	0.12	0.07	0.13	1.81	.073
Career development opportunities	0.16	0.06	0.16	2.19	.035
Person-job fit	0.43	0.07	0.49	6.03	< .001
Adj-R^2			.61		
R^2			.65		
F (*p*)			17.83 (< .001)		

The mean score for work engagement was found to be 3.24 points (range: 1 to 7 points). There are no previous studies to investigate work engagement among the workers of public health centers, work engagement in this study was slightly higher, compared to 3.06-3.17 points reported in previous studies of hospital nurses [23]. The results of this study seem to show that COVID-19 response workers at public health centers showed a relatively higher level of work engagement through personal sacrifice and passion with a sense of mission to prevent the spread of COVID-19 infections to the local communities in the context of the COVID-19 as a national disaster [2,21]. It is thought that follow-up research is needed to determine whether a high level of work engagement among public health center workers can be attributed to the special situation of COVID-19.

The mean score for job stress was 2.46 points (range: 1 to 4 points), which is a similar level to 2.47 points in a previous study among clinical nurses during the COVID-19 [24]. Among the sub-domains of job stress, job demands had the highest mean score at 2.65 points. In this regard, a previous study reported that response workers experienced a severe shortage of workforce due to the spread of COVID-19 and various changes related to COVID-19 [21], and unexpected abrupt tasks due to insufficient staffing levels as a result of the frequently changing COVID-19 situation are also presumed to have contributed to increased job stress. The mean score of burnout was found to be at a risk level with a mean score of 3.24 (range: 1 to 7 points). Since the first confirmed case of COVID-19 in Korea was detected in January 2020, Korea suffered five times of COVID-19 pandemics and many healthcare workers showed a high level of burnout as a result of emotional exhaustion and chronic fatigue [24-26]. Among the sub-domains of burnout, physical exhaustion showed the highest mean score of 3.80 points, and it is thought that the participants showed a serious level of physical exhaustion due to heavy workloads and insufficient rest. The negative consequences of job stress and burnout have been found to have a negative impact not only on the individual but also on organizational performance [27], so there is a need to pay attention to and improve job stress and burnout among healthcare workers of public health centers.

The mean score for resilience was 4.35 points (range: 1 to 6 points). This score is higher than 3.76 points among clinical nurses during COVID-19 [28]. Resilience helps individuals to overcome adverse situations and adapt to changing environments, and help them to perform their jobs properly [29]. Especially in a disease outbreak involving various and rapidly changings such as the COVID-19, importance of resilience more emphasized for response workers [30], so it is necessary to continuously maintain a high level of resilience. In particular, mindfulness-based programs have been effective in promoting resilience in infectious disease outbreak. [31], organization-level efforts are needed to improve resilience among public health workers at public health centers during the recovery phase of the COVID-19 as a disaster.

The mean score for career development opportunities was 1.88 points (range: 0-4 points), and this is lower than 2.31 points of tertiary general hospital nurses [17]. These results are presumed to suggest that the workers of public health centers did not perceive that their COVID-19 response tasks were helpful for the growth and development of their careers. According to a previous study, career development opportunities as a job resource are a factor that stimulates personal growth and development, and contribute to carrying out job tasks by increasing work engagement [32]. In this respect, career development opportunities in an infectious disease outbreak situation are very important, and organization-level attention and effort are needed to promote this factor. To this end, expansion of various forms of career development opportunities, including rewards and promotions, work guidelines that distinguish between the work system for disaster periods and the one for ordinary times, and online job training on infectious diseases by the Health and Welfare Human Resources Institute can be employed as strategies to provide career growth opportunities for response workers of public health centers.

The mean score for person-job fit was 3.36 points (range: 1 to 5 points), which is relatively higher than 3.21 points of nursing public officials [10], and 3.07 points of general civil servants [33]. According to a previous study, individuals are likely to perceive a good person-job fit when they feel comfortable about the jobs they pursue and get motivated by them, when they learn specific skills needed for their tasks at work and use them to perform their tasks, and when they acquire or exert capabilities, and a good person-job fit contributes to performance improvement [10]. It has also been reported that when individuals deem their jobs suitable for themselves, their morale is increased due to their pride in their job, and this perception gives them motivation for work, and has a positive impact on work performance [10]. In view of these findings, it is suggested that public health centers should explore strategies to improve person-job fit. If the organizational system is reorganized by considering the characteristics of each department as well as the characteristics of individual workers to ensure appropriate staffing and efficient task assignment in the event of emerging infectious disease outbreaks, it can be a useful strategy to improve person-job fit among response workers at public health centers.

In this study, factors affecting work engagement among COVID-19 response workers of public health centers were identified as age, career development opportunity, and person-job fit, and the total explanatory power of these variables for work engagement was 65%. Person-job fit was found to be the factor that has the greatest impact on work engagement among COVID-19 response workers of public health centers. The results of this study is consistent with a meta-analysis study on factors affecting work engagement among the members of domestic companies, and the meta-analysis reported that person-job fit was found to be the most important factor among job resources [33,34]. Person-job fit refers to the degree of match between a person's degree of knowledge, skills, and abilities required for a given job and the job demands of a job [9], and it is widely known as a variable influencing positive job performance such as job satisfaction and work engagement in public health center nurses and clinical nurses [10]. In an infectious disease outbreak situation, if the characteristics and personality traits of response workers of public health centers are well suited to job duties that they are currently performing, this good person-job fit will positively affect COVID-19 response tasks, thereby leading to the increase of work engagement and improvement of organizational performance, and it will also have a positive impact on public health and safety. In this respect, it is important to improve person-job fit among healthcare workers of public health centers. In the COVID-19, the response workers of public health centers experienced more difficulties due to increased confusion resulting from unsatisfactory work assignment and unfamiliar tasks [21]. The directors and officials of public health centers should make effort to allocate tasks based on the assessment of person-job fit even at ordinary times to ensure that task assignment will appropriately reflect individuals' interests, understanding, behaviors, skills, and needs. As a strategy for efficient task assignment based on person-job fit, it is necessary to provide education focused on practice training that is helpful for the actual performance of job duties rather than education focused on theoretical knowledge. Since civil servants in public health centers are required to have the ability to develop and plan health projects and manage cases even in infectious disease outbreak situations, customized job training for each job position is required for them. On the other hand, professional personnel in public health centers should be provided with practical education programs that will be helpful in the field of nursing practice. Appropriate staffing is also expected to contribute to improving person-job fit among professionals working at public health centers.

In this study, second impact factor on work engagement was career development opportunities. These results are consistent with a previous study of nurses reporting that it is a significant variable positively affecting work engagement [17]. Career development opportunities, which are one component of job resources [6], represent an individual's assessment of the degree to which the organization and job duties are useful for the growth

and development of his or her career, and this factor can increase work engagement through individuals' perception that they can continuously develop and grow their capabilities at work through education and training [17,35]. Therefore, there is a need to consider establishing a system that can make people confident that their tasks in special situations such as an infectious disease outbreak will also be helpful for their career development. In particular, in the case of civil servants of public health centers, their promotion system usually requires a long period of time between promotions, so it may be difficult for them to recognize their work as a career development opportunity. In this regard, the introduction of a system such as the career development system for clinical nurses that is currently being implemented in domestic tertiary general hospitals may promote self-development of nursing personnel at public health centers, and thereby create career development opportunities.

In this study, among the general characteristics, age was found to be the only variable affecting work engagement. More specifically, among COVID-19 response workers of public health centers, the 30-49 age group showed a higher level of work engagement than the ≥50 age group. But almost studies of nurses reported that age was identified as a factor affecting work engagement, and the level of work engagement was found to increase with aging [29]. The results of this study are partially different from these findings. Generally, work engagement has been reported to increase with aging increased job flexibility and loyalty to the organization [29]. The different result from previous study is presumed to be due to the fact that the participants of this study included both civil servants and healthcare professionals, who can be divided into two groups in charge of different tasks. Thus, in a follow-up study, there is a need to examine the relationship between age and work engagement by distinguishing between civil servants and healthcare professionals in public health centers.

In short, based on the JD-R model, this study identified factors affecting work engagement among response workers at public health centers who experienced severe job stress and burnout due to unexpected abrupt tasks during COVID-19. It is a significant aspect that this is the first research attempt to examine the influences of resilience, career development opportunities, and person-job fit on work engagement during COVID-19, based on the JD-R model. However, it should be pointed out that this study has several limitations. First, because the participants of this study were workers of public health centers or branch offices of public health centers in 20 areas including cities, counties and districts in one province, it is difficult to generalize study findings to all public health centers in Korea. Second, because this study is a cross-sectional research, the present study could not clarify causal relationships between the factors influencing work engagement among COVID-19 response workers of public health centers. Third, the participants consisted of civil servants and professionals, and since these two groups are distinct from each other in terms of types of tasks, so there may be a limitation in the discussion of their work engagement.

Conclusions

Based on the JD-R model, this study attempted to examine the relationships between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement among COVID-19 response workers of public health centers, and identify factors influencing work engagement. As a result of multiple regression analysis, person-job fit, career development opportunities, and age were found to be significant influencing factors for work engagement, and the explanatory power of the variables was 61%. The results of this study suggest that for increase work engagement among healthcare workers of a future infectious disease outbreak, it is necessary to align tasks with individuals' characteristics in the process of work assignment, develop various strategies for providing career development opportunities even in infectious disease outbreak situations, and design work assignment by taking age into account.

Based on the results of this study, the following suggestions are presented. First, it was found that there were differences in the job demands for healthcare workers at public health centers among areas such as cities, counties, and districts depending on the situations of small-scale COVID-19 mass infections during the past three years. Therefore, in follow-up research, a replication study should be conducted by expanding the scope of research to public health centers including public health clinics in the cities, counties, and districts of different provinces. Second, although the JD-R model suggested that there are significant relationships between job stress, burnout, and work engagement, the results of this study did not show any significant association between them. Thus, a follow-up research should undertake a replication study to investigate relationships between the variables. Third, it is required to explore various strategies for increasing work engagement by distinguishing between civil servants and healthcare professionals at public health centers as two groups in charge of disparate tasks.

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Conflict of interest

Yeongmi Ha has been editorial board member of the Research in Community and Public Health Nursing. She was not involved in the review process of this manuscript. The authors declared no conflict of interest.

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Authors' contributions

Songran Park contributed to conceptualization, data curation, formal analysis, visualization, writing-original draft, review&editing, investigation, resources, software, and validation. Yeongmi Ha contributed to conceptualization, methodology, project administration, visualization, writing-original draft, review&editing, investigation, resources, software, supervision, and validation.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to privacy concerns, but select data are available from the corresponding author upon reasonable request.

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