



Relationship between Depression and Stress-Coping Strategies in Public Enterprise Workers Whose Workplaces Were Relocated to a New Environment

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Background: In this study, the relationship between depression and stress-coping strategies among public enterprise workers whose workplaces were relocated to a newly-built innovation city was investigated.

Methods: This study included a total of 922 public enterprise workers living in Naju Innovation City. Along with their sociodemographic data, each subject was assessed concerning depression, occupational stress, and stress-coping strategies using the Center for Epidemiologic Studies Depression Scale (CES-D), Korean Occupational Stress Scale (KOSS), and stress-coping scale (SCS), respectively. Logistic regression was performed to investigate the impact of the relevant factors on depressive symptoms.

Results: The overall prevalence of depressive symptoms was 14%. Some sociodemographic variables, the total scores of the KOSS, and four subscales of the SCS revealed significant differences between the depressed and normal groups. Multivariate regression analysis revealed that the KOSS (odds ratio [OR], 1.17; $p < 0.001$) and SCS, such as problem-solving-focused (OR, 0.75; $p < 0.001$), emotion-focused (OR, 1.15; $p < 0.05$), and wishful-thinking-focused (OR, 1.10; $p < 0.05$), were significantly associated with depression.

Conclusion: The results indicated that depressive symptoms were highly prevalent among workers whose workplaces were relocated. In addition, these symptoms were found to be related with occupational stress and stress-coping strategies. Our findings also suggest that promoting healthy stress-coping strategies and reducing occupational stress may help in preventing the occurrence of depression and managing depressed workers.

Keywords Depressive symptoms; Workers; Occupational stress; Coping skills

INTRODUCTION

In Korea, the “Special Act on Balanced National Development” was implemented to ensure equal development between regions. A total of 10 innovation cities have been created nationwide since 2013, and public institutions concentrated in the metropolitan area are

being dispersed and relocated to each region [1]. As a result, large numbers of employees in the target public enterprises are being transferred from metropolitan areas to rural areas in a short period of time. There are approximately 32,000 employees (based on the head office quota) from 175 public enterprises that are relocating to rural areas, and 4,618 are from institutions relocating

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to Gwangju and Jeonnam Join Innovation City (Naju Innovation City) [1]. Relocation to a newly built place of work can lead to high psychological anxiety from adapting to a new environment, the loss of personal ties formed in the previous location, and significant time needed to form new relationships, which may further increase people's psychological pain [2]. In a study conducted on workers who were relocated during the development of innovation cities, depression was high, and those who were depressed showed higher job stress and anxiety than non-depressed workers [3].

Depression has a higher socioeconomic burden than other major physical diseases [4]. In particular, depression in workers leads to decreased work efficiency, loss of self-esteem, and decreased quality of life, which cause complex and serious damage to businesses and indirect social costs including decreased corporate productivity [5]. In a 2002 Canadian community health survey, 3.7% of workers between the age of 25 and 64 had experienced depression in the past year, and the prevalence of depression was higher in women (5.1%) than in men (2.6%) [6]. According to the US National Comorbidity Study, 6.4% of workers satisfied the criteria of depression in the past year, suggesting that depression was common in workers [7]. In Korea, 7.4% of office workers have been diagnosed with depression by medical professionals at least once in their lifetime [8], which is the same as the lifetime prevalence of depression in the total Korean population (7.4%; major depressive disorder: 6.7%, dysthymia: 0.7%) [9]. According to the World Health Organization (WHO), depression accounts for 4.3% of the global disease burden. By 2030, it is predicted that depression will be the leading disease burden in developed countries [10]. Therefore, it is essential to identify and treat the causative factors of depression in workers as part of strategies for the prevention of depression.

Previous studies showed differences in the severity of depression among workers according to socioeconomic characteristics such as sex, age, education level, and income level [11-13], and reported that health influencing behaviors including smoking, diet, and drinking were important determinants on depression [11,14]. Therefore, to systematically identify factors affecting depression in workers relocating to new workplaces, this study analyzed how sociodemographic factors affect depression and investigated the relationships between job stress, coping with stress, and depressive symptoms. In Korea,

many studies have assessed the prevalence and conditions of depressive disorder in the general population [7,11,15], and several studies have evaluated the quality of life and depression of residents whose living environment has changed due to national policies [16]. However, there is a lack of studies on depression in workers after the relocation of public institutions by law. Therefore, the purpose of this study was to identify the prevalence and related factors of depression in public enterprise workers whose workplaces were relocated to the newly built Naju Innovation City and to provide basic data on depression and stress management among said workers.

MATERIALS AND METHODS

1. Subjects

This study was conducted on workers in Naju Innovation City from April to May 2019. Samples were extracted using a proportional allocation method, and a questionnaire was conducted through individual interviews by professional investigators with employees who agreed to participate in the study. The participants were given an explanation about the purpose of the survey, and directions were provided to help the participants answer the survey questionnaires, which included several self-report screening instruments.

A total of 982 questionnaires were collected, and data were extracted from 922 questionnaires for the final analysis, after excluding 60 that were not completed. This study was approved by the Institutional Review Board of Naju National Hospital (approval number: NNH-HR-2020-9).

2. Design and assessment

1) Sociodemographic characteristics

Sociodemographic characteristics such as sex, age, length of employment, marital status, living with family, alcohol use, satisfaction with residential life, and overall satisfaction with life in Naju Innovation City were evaluated. Marital status was divided into married and unmarried (single, divorced, and separated). For investigation of whether living with family, participants were divided into groups living and not living with their families (weekend couple, single). Alcohol use was assessed using the first item of the Korean version of the

Alcohol Use Disorders Identification Test (AUDIT-K) to divide the participants into groups of alcohol consumers and non-consumers (Table 1).

2) The Center for Epidemiologic Studies Depression Scale (CES-D)

Depressive symptoms were evaluated using the CES-D, which was originally developed by the American Institute of Mental Health [17]. The CES-D evaluates the frequency and severity of six typical symptoms of depression in the past week: depressed mood, guilt or

worthlessness, hopelessness, psychomotor retardation, loss of appetite, and sleep disorder. The scale emphasizes the emotional and psychological aspects of depression [17]. The Korean version of the CES-D consists of 28 items, which are evaluated on a 4-point Likert scale, with the total score ranging from 0 to 84 points. A higher score indicates a higher likelihood of depression [18]. As previous studies described, the total score of 21 was used as the cut-off with a sensitivity of 95.7% and specificity of 69.5%, which was useful for screening significant depressive symptoms in the general population.

Table 1. General characteristics between depressed and normal public enterprise workers whose workplace was relocated to Naju Innovation City

Variable	Depressed (n=131)	Normal (n=791)	χ^2	p-value
Sex			5.22	<0.05
Male	74 (56.5)	528 (66.8)		
Female	57 (43.5)	263 (33.2)		
Age (y)			3.59	0.465
20-29	37 (28.2)	192 (24.3)		
30-39	53 (40.5)	285 (36.1)		
40-49	27 (20.6)	209 (26.4)		
50-59	11 (8.4)	88 (11.1)		
≥60	3 (2.3)	17 (2.1)		
Length of employment (y)			5.20	0.392
<1	7 (5.3)	44 (5.6)		
1-5	78 (59.6)	432 (54.6)		
6-10	21 (16.0)	101 (12.8)		
11-15	6 (4.6)	76 (9.6)		
16-20	8 (6.1)	61 (7.7)		
>20	11 (8.4)	77 (9.7)		
Marital status			6.35	<0.05
Married	56 (42.7)	432 (54.6)		
Unmarried	75 (57.3)	359 (45.4)		
Living with family			6.20	<0.05
Yes	30 (22.9)	268 (33.9)		
No	101 (77.1)	523 (66.1)		
Alcohol use			0.03	0.872
Yes	112 (85.5)	672 (85.0)		
No	19 (14.5)	119 (15.0)		
Satisfaction with residential life			16.60	<0.001
Satisfied	43 (32.8)	411 (52.0)		
Usually satisfied	53 (40.5)	236 (29.8)		
Dissatisfied	35 (26.7)	144 (18.2)		
Overall satisfaction			21.27	<0.001
Satisfied	24 (18.3)	281 (35.5)		
Usually satisfied	57 (43.5)	332 (42.0)		
Dissatisfied	50 (38.2)	178 (22.5)		

Values are presented as number (%).

Participants having scores more than 21 were classified as the depressive symptom group [18].

3) Korean Occupational Stress Scale (KOSS)

The KOSS was used to measure the occupational stress of the participants [19]. The tool consists of eight domains: physical environment, job demands, insufficient job control, interpersonal conflict, job insecurity, organizational system, lack of reward, and occupational climate, with a total of 43 items. Each item is evaluated on a 4-point Likert scale ranging from “strongly disagree” to “strongly agree.” Each domain’s score is converted into a score out of 100 points, and the sum of all scores is used to assess occupational stress. In this study, a score higher than the median value of the enterprise or higher than the reference value of worker occupational stress suggested by the Korea Occupational Safety and Health Agency (KOSHA CODE H-42-2006) indicated that the participant was exposed to relatively more factors of occupational stress compared to the normal group [20].

4) Stress-coping scale

The stress-coping scale developed by Lazarus and Folkman consists of 68 items [21] and is used to evaluate stress-coping in daily life. The tool was adapted, revised, and supplemented by Lee and Kim [19] to consist of 62 items under 4 factors: problem-solving-focused stress-coping, seeking social support, wishful thinking, and emotion-focused stress-coping. Each item is evaluated on a 4-point Likert scale ranging from “not at all” to “very much.” In a study on the relationship between A and B personality types, self-identity, and coping with stress [22], a total of 24 items with 6 items from each of the 4 factors were selected. Problem-solving-focused stress-coping and seeking social support were conceptualized as active coping, and wishful thinking and emotion-focused stress-coping were conceptualized as passive coping. A higher score for active coping suggested that the participants relied more on active coping, and a higher score for passive coping indicated that the participants used more passive coping for stress-coping. The Cronbach’s α value of previous study was 0.81 [22]. The Cronbach’s α in this study was 0.82, and the individual Cronbach’s α for problem-solving-focused stress-coping, seeking social support, wishful thinking, and emotion-focused stress-coping were 0.75, 0.74, 0.62, and 0.73, respectively.

3. Statistical analysis

Using a cut-off score of 21 on the CES-D, participants were divided into those with and without depressive symptoms which labelled as depression and normal group, respectively. To identify factors affecting depression, differences in sociodemographic characteristics and scale scores according to depression were assessed using the chi-square test and independent t-test. A multivariate logistic regression analysis was conducted using variables that had significant relationships with depressive symptoms in the univariate analysis. The collected data were statistically analyzed using IBM SPSS Statistics for windows, version 21.0 (IBM Corp., Armonk, NY, USA) and a p-value <0.05 was considered statistically significant.

RESULTS

1. Prevalence of depression and related sociodemographic characteristics

A total of 131 participants (14% of the total participants) were included in the depression group. Seventy-four male (12.3%) and fifty-seven female (17.8%) were in the depression group, showing that the prevalence of depression was significantly higher in female ($\chi^2=5.22$, $p<0.05$). The prevalence of depressive symptoms was 11.5% in married participants and 17.3% in unmarried participants, a significant difference ($\chi^2=6.35$, $p<0.05$). The prevalence of depressive symptoms was 10.1% in participants who were living with family and 16.2% in those who did not live with family, also a significant difference ($\chi^2=6.20$, $p<0.05$). Also, significant differences were found on the variables such as the satisfaction with residential life ($\chi^2=16.60$, $p<0.001$) and the satisfaction with their overall life in Naju Innovation City ($\chi^2=21.27$, $p<0.001$). There were no significant differences according to age, length of employment, and alcohol use (Table 1).

2. Comparison of psychosocial variables between the depression and normal groups

The mean score of the CES-D in the depression group was 28.89 ± 7.48 , which was significantly higher compared to 8.01 ± 5.08 in the normal group ($t=-30.81$, $p<0.001$). The mean score of the KOSS in the depression

group was 49.87 ± 9.71 , which was significantly higher than the 38.48 ± 8.49 in the normal group ($t = -13.93$, $p < 0.001$). Compared to the normal group, the depression group had a lower problem-solving-focused stress-coping score ($t = 8.84$, $p < 0.001$) and lower seeking social support score ($t = 4.34$, $p < 0.001$). Additionally, compared to the normal group, the depression group had higher scores for emotion-focused stress-coping ($t = -3.47$, $p < 0.05$) and wishful thinking ($t = -2.21$, $p < 0.05$) (Table 2).

3. Factors affecting depressive symptoms

To find factors affecting the depressive symptoms of workers whose workplaces were relocated to an innovation city, a multivariate logistic regression analysis was conducted using variables that were significant in the simple analysis as independent variables. The depression and normal groups divided based on CES-D score were set as the dependent variables. As a result, a high total score on the KOSS increased the likelihood of developing depressive symptoms by 1.17 times (95% confidence interval [CI], 1.13-1.21; $p < 0.001$). Problem-solving-focused stress-coping, which is an active coping strategy, acted as a protective factor that lowered the likelihood of developing depression by 0.75 times (95% CI, 0.67-0.84; $p < 0.001$). In contrast, passive coping strategies such as emotion-focused stress-coping increased the likelihood of depressive symptoms by 1.15 times (95% CI, 1.04-1.28; $p < 0.05$). Additionally, wishful thinking was another risk factor that increased the likelihood of depressive symptoms by 1.10 times (95% CI, 1.00-1.20; $p < 0.05$). Sex, marital status, living with family, satisfaction with residential life, and overall satisfaction with life in Naju Innovation City did not have significant effects on de-

pressive symptoms (Table 3).

DISCUSSION

This study was conducted to assess the prevalence of depression and analyze psychosocial factors in public enterprise workers who relocated to Naju Innovation City.

The prevalence of depression in workers was 14%. In a previous study of 998 employees who underwent general checkups at the Corporate Mental Health Research Center at Kangbuk Samsung Hospital (Seoul, Korea), the prevalence of depression was 6.2% [23]. In another study of 194,226 participants that conducted general checkups at the Comprehensive Medical Examination Center (Seoul, Suwon), the prevalence of depression was 5.7% [23]. In both studies, the prevalence was lower than that observed in our study. In another study conducted in 2015, approximately 7.4% of 1,000 Korean office workers had been diagnosed with depression by a medical professional at least once in their lifetime [8], which was lower than that observed in our study. Although that study was conducted on office workers as in our study, the Impact of Depression at Work Audit was used as the diagnostic tool compared to the CES-D in this study [8]. In other countries, the prevalence of depressive symptoms in workers was 3.7% to 6.4% [6,7], which was lower than that in our study. Overall, the prevalence of depression in office workers in our study was higher than that in previous studies. The relocation of a workplace causes changes in job characteristics and interpersonal relationships. Adapting to a new environment may lead to increased stress, which may cause more depres-

Table 2. Comparisons of mental health-related conditions among subjects with and without depression in public enterprise workers whose workplace was relocated to Naju Innovation City

Variable	Depressed (n=131)	Normal (n=791)	t	p-value
CES-D, score	28.89±7.48	8.01±5.08	-30.81	<0.001
KOSS, score	49.87±9.71	38.48±8.49	-13.93	<0.001
Stress-coping ^a				
Problem solving	14.58±2.82	16.99±2.90	8.84	<0.001
Social support	14.59±2.98	15.87±3.15	4.34	<0.001
Emotion focused	12.98±2.78	12.16±2.49	-3.47	<0.05
Wishful thinking	15.18±3.44	14.53±3.07	-2.21	<0.05

Values are presented as mean±standard deviation.

CES-D, Center for Epidemiologic Studies Depression Scale; KOSS, Korean Occupational Stress Scale.

^aStress-coping scale (SCS) was used which revised by Park [19] based upon the work of Lazarus and Folkman [21].

Table 3. Logistic regression analysis for the factors affecting depressive symptoms

Variable	B	SE	Wals	p-value	OR (95% CI)
KOSS	0.15	0.02	77.03	<0.001	1.17 (1.13–1.21)
Stress-coping					
Problem solving	–0.29	0.06	27.02	<0.001	0.75 (0.67–0.84)
Social support	0.06	0.05	1.39	0.238	1.06 (0.96–1.17)
Emotion focused	0.14	0.05	7.14	<0.05	1.15 (1.04–1.28)
Wishful thinking	0.09	0.05	3.91	<0.05	1.10 (1.00–1.20)
Sex					
Female	–0.02	0.25	0.01	0.945	0.98 (0.61–1.59)
Marital status					
Unmarried	0.11	0.29	0.13	0.714	1.11 (0.63–1.95)
Living with family					
No	0.58	0.33	3.06	0.080	1.79 (0.93–3.43)
Satisfaction with residential life					
Satisfied	–0.36	0.38	0.90	0.343	0.70 (0.33–1.47)
Usually satisfied	0.15	0.37	0.16	0.692	1.16 (0.56–2.39)
Dissatisfied			3.59	0.166	
Overall satisfaction					
Satisfied	0.23	0.40	0.34	0.558	1.26 (0.58–2.74)
Usually satisfied	0.36	0.33	1.18	0.277	1.43 (0.75–2.74)
Dissatisfied			1.21	0.546	

B, unstandardized beta coefficients; SE, standard error; OR, odds ratio; CI, confidence interval; KOSS, Korean Occupational Stress Scale. OR was calculated using a logistic regression analysis.

sive symptoms [3]. Previous studies have consistently reported depressive symptoms in immigrant workers and immigrants. In a study of 3,113 Mexican immigrants in the USA, 13.3% had a score of 16 or higher for CES-D depressive symptoms [24]. In another study, 61.3% of 299 Moroccan and 33.3% of 304 Turkish immigrant workers in the Netherlands had severe depressive symptoms with a CES-D score higher than 16 points [25]. In Korea, approximately 29% of 64 North Korean defectors had depressive symptoms with a CES-D score of 21 points or higher [26]. Our findings are in agree with those of previous studies, suggesting that the severity of depression varies according to the relocation of workplaces and residences.

We observed that occupational stress increased the risk of depression even after correcting for the effects of other factors through multivariate analysis. This was consistent with the findings of previous studies in which occupational stress factors were related to depression in various groups of workers [27]. Individuals unsuitable for the work environment suffer from severe occupational stress, which causes negative emotions such as depression and anxiety [28]. In contrast, another study

reported that depression has negative effects on occupational stress [29]. Future prospective studies must investigate the causal relationship between depression and occupational stress. According to a study conducted on public enterprise workers who relocated to Naju Innovation City in 2017, factors related to depressive symptoms were the variables such as dissatisfaction with overall life in the Innovation City, no alcohol use, unmarried marital status, and high scores on state anxiety [3]. While the stresses caused by environmental factors were highly influenced to depression in the early stage of relocation [3], the occupational stress might have impact on depression in this study. Therefore, adequate management of occupational stress is important in preventing depression.

The early concepts of occupational stress-induced depression focused on the physical environment and physical safety of workers during work [30]. However, psychological health promotion programs focused on the behavior and lifestyle of workers can greatly contribute to reducing occupational stress and preventing depression [30,31]. In the stress-vulnerability model, stress can trigger potential vulnerability factors, causing depres-

sion; however, adequate coping methods for stress can help individuals maintain an adaptive state [32]. This suggests that although stress, an environmental factor, can directly cause psychological maladaptation, an individual's intrinsic factors play an important role in coping with stress. In a previous study on the mediating effects of stress-coping, problem-solving-focused stress-coping and emotion-focused stress-coping played a mediating role between stress and depressive symptoms [32]. Furthermore, stress affected depression and suicidal thoughts through passive coping [33].

In our study, we observed that problem-solving-focused stress-coping, which is an active coping strategy, lowered the risk of depressive symptoms acting as a protective factor, while passive stress-coping strategies increased the risk. We confirmed a negative relationship between problem-solving-focused stress-coping and depression, and our findings are partly consistent with those of previous studies [34] in which more active coping strategies led to greater psychological well-being. Problem-solving-focused stress-coping is an active and positive coping method in which the individual confronts difficulties during adaptation processes and seeks out resources with the determination to solve the problem [34]. Therefore, problem-solving-focused stress-coping may have contributed to the management of stress caused by involuntary relocation, thereby lowering depressive symptoms.

Emotion-focused stress-coping and wishful thinking, which are passive coping methods, were positively related with depressive symptoms, suggesting that passive stress-coping strategies are ineffective and lead to negative results. Passive stress-coping consists of strategies to avoid thinking about or experiencing stressful situations [35]. These strategies may help to temporarily reduce negative emotions; however, in the long term, these may not be effective in the management of emotions and cause psychological difficulties [35]. Therefore, it would be helpful to check the coping methods related to the maladaptive emotional reactions experienced by relocated public enterprise workers and to train them to use more effective active coping strategies to reduce depression and promote their psychological well-being.

Lazarus and Folkman [21] reported that problem-solving-focused stress-coping is often used when people perceive that stress can be changed, while emotion-focused stress-coping is used when they perceive that it cannot be changed. In a study investigating the moderat-

ing effects of problem-solving-focused stress-coping on the relationship between stress and depression [36], in low-stress situations, increased problem-solving-focused stress-coping lowered depression. When the stress level was increased, the decrease in depression was relatively small, such that problem-solving-focused stress-coping had counter-buffering effects. As such, stress-coping strategies may have different effects depending on the stress level or situation. Here, different levels of stress were not analyzed. Future studies must assess the relationship between depression and stress-coping according to the level of stress.

Several limitations must be considered in the interpretation of our research findings. First, questionnaire-based data were used in this study, and the results depended on the self-reports of the participants. The mental health professionals were not actively engaged in the diagnostic interview with participants in this study, so the prevalence of depression may not be accurately interpreted. Second, this study was only conducted on public enterprise workers who relocated to an innovation city. Thus, the findings cannot be generalized. Future studies must assess different workers in various occupations for a comprehensive understanding. Third, as this was a cross-sectional study, the causal relationship between related factors and depressive symptoms cannot be accurately explained. In particular, there was no questionnaire data that could be used to identify the specific causal relationships such as the length of employment in the innovation city and voluntary relocation. In the future, systematic prospective studies must be conducted to identify causality.

However, this study is meaningful as it investigated the prevalence of depression in public enterprise workers who relocated to Naju Innovation City and showed the impact of job stress and stress-coping strategies on depression. Previous studies investigated the prevalence of depression in the general population and workers within the scope of daily life [5,12]. However, only a limited number of studies systematically examined the problems that may arise when public enterprises located in metropolitan areas are moved to the 10 innovation cities nationwide in accordance with the "Special Act on Balanced National Development" for balanced development among regions, as in this study [1]. In future studies, it may be clinically important to systematically investigate the psychiatric problems that may be observed in workers who relocated to a new environment. Additionally,

our findings may be actively utilized in Employee Assistance Program (EAP) for workers whose workplaces were relocated.

CONCLUSION

This study investigated the relationships between depressive symptoms and occupational stress, and stress-coping strategies in public enterprise workers who relocated to Naju Innovation City. The prevalence of depression in workers assessed using the CES-D was 14%, and this was higher than that of the general population. Variables such as sex, marital status, living with family, the satisfaction with residential life, and the overall satisfaction with life in Naju Innovation City revealed significant differences between the depression and normal groups. Occupational stress was higher in the depressed than in the normal group. Additionally, compared to the normal group, the depression group used less active stress-coping strategies and more passive stress-coping strategies. A high total score on the KOSS was also a factor affecting to depressive symptoms.

These results suggest that the prevalence of depressive symptoms is high in public enterprise workers who relocated to Naju Innovation City and depressive symptoms are related to occupational stress and stress-coping strategies. The findings of this study may be used as basic data to implement EAP.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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