



Subgroups of depressive symptoms in Korean police officers: A latent class analysis

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ABSTRACT

The prevalence of depressive symptoms is common among police officers; however, studies that identify the patterns of depressive symptoms in police officers and occupational characteristics related to the specific subgroups of depressive symptoms are scarce. A total of 493 police officers in South Korea participated in this descriptive cross-sectional study between October and December 2019. Depressive symptoms were measured using the Patient Health Questionnaire-9. Latent class analysis was used to identify the subgroups of depressive symptoms. To identify the characteristics and predictors of the subgroup, χ^2 tests, analysis of variance, and multinomial logistic regression analysis were performed. Four latent classes of depressive symptoms were identified: “at-risk” (10.8%), “anhedonic” (21.5%), “somatic” (17.2%), and “minimal” (50.5%). Compared to the minimal group, drinking behaviors were higher in the at-risk group (odds ratio [OR] = 1.10, 95% confidence interval [CI] [1.03, 1.11]), and working hours were greater in the somatic group (OR = 1.01, 95% CI [1.00, 1.02]). Additionally, sleep quality (OR = 1.35, 95% CI [0.82, 2.22]) and fatigue (OR = 1.02, 95% CI [1.00, 1.04]) were found to be related in the anhedonic group. This study identified the heterogeneity of depressive symptoms among police officers. It is necessary to accurately identify the factors associated with the depression subgroups of police officers to develop support strategies and prevent an increase in their depression severity. The association between risk factors such as working hours and drinking behaviors might inform strategies to reduce depression in police officers.

1. Introduction

Approximately 5.0% of adults worldwide, that is, more than 0.3 billion people, suffer from depression that results in various negative emotional, cognitive, physical, and behavioral conditions (Smith, 2014). Notably, depression accounts for 10.3% of the total burden of diseases measured via years lost to disability (Smith, 2014). Depression is a heterogeneous phenomenon with a wide spectrum of symptoms experienced by each individual from a simple feeling of sadness or depressed mood to a continuous feeling of loss and guilt beyond helplessness, which may lead to suicidal ideation (Ulbricht et al., 2018). A significant number of suicides has been reported among police officers (Violanti et al., 2017), which implies that depression cannot be overlooked with respect to the protection of health rights. Mental health problems such as depression are generally more difficult to detect than physical health problems. Furthermore, in a study on treatment of adult depression in the United States, two-thirds of the adults with depression did not

receive depression treatment (Olson et al., 2016). This situation is even more complicated when it comes to police officers, a particularly vulnerable population for the development of depression and post-traumatic stress disorder (PTSD), who are more reluctant than the general population to seek psychological help (Karaffa and Koch, 2016; White et al., 2016).

Depression of police officers who encounter traumatic events have been reported to increase (Allison et al., 2020), which is also closely related to drinking behaviors when coping with traumatic experiences (Ralevski et al., 2016). Furthermore, depression in police officers is closely related to poor sleep quality and development of physical illnesses (Garbarino et al., 2019), and it is also involved in mental health problems such as anxiety and PTSD. Compared to those without a past traumatic experience, police officers with a traumatic experience show approximately a two-fold and six-fold higher level of depression or anxiety and PTSD, respectively (Stevellink et al., 2020). The COVID-19 pandemic has brought about a trend of accelerated increase in alcohol

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abuse with anxiety and depression, while the drinking behaviors induced by anxiety and depression further increase the public health risk (Hyun et al., 2021). In a previous study, 25% of police officers showed problematic drinking, while 22% had PTSD and 16% met the diagnostic criteria for major depressive disorder (Ménard et al., 2016), implying the need for greater interest in the mental health of police officers.

Latent class analysis (LCA) is a statistical technique that identifies hidden groups according to participant characteristics. As individual cases are classified as empirically-derived typologies, a given phenomenon can be understood as person-centered (Nylund-Gibson and Choi, 2018). Unlike the traditional variable-centered approach, LCA, a clustering approach, can be used to identify subgroups and heterogeneous characteristics of depressive symptoms in police officers. According to a systematic review of studies using LCA to identify the subgroups of depressive symptoms (Ulbricht et al., 2018), two to seven subgroups have been defined. However, no study appears to have explored the structural patterns of depressive symptoms or the factors that affect such patterns in police officers, a known high-risk group for mental health problems.

This study aimed to increase understanding of the characteristics of police officers that are associated with depressive symptoms. To this end, LCA was used to identify the subtypes of depressive symptoms that police officers experience. Another aim was to identify the factors associated with subgroups that can inform preventative and support strategies. Thus, the results of this study would provide primary information for mental health interventions by considering the factors that affect the different subtypes.

2. Materials and methods

2.1. Research participants

The participants were 493 police officers who participated in this survey. Police officers enrolled in the job training course of an educational institution affiliated with the National Police Agency and located in Asan, Chungcheongnam-do, were recruited for this study. The sample size was adequate considering the results of a previous study, which reported that a sample size of 300 or more was desirable for LCA (Nylund-Gibson and Choi, 2018). The inclusion criteria were current police officers aged 20–59 years who are proficient in Korean and able to answer self-administered questionnaires. Those police officers with a career length below 12 months or whose duties were administrative work only were excluded.

2.2. Variables

2.2.1. Depressive symptoms

Depressive symptoms were measured using the Korean version of the Patient Health Questionnaire-9 (PHQ-9) validated by Han et al. (2008). The tool consists of nine items on depressive symptoms, and respondents are asked to rate the extent to which they experienced each symptom in the past two weeks. Each item is rated on a 4-point Likert scale scored 0–3; total scores range from 0 to 27. Based on Han et al.'s (2008) study, a score ≥ 5 indicates the possibility of a depressive disorder. A cutoff score ≥ 10 has been recommended for diagnosing major depressive disorder (Kroenke et al., 2001).

2.2.2. Drinking behaviors

Drinking behaviors were measured using the Alcohol Use Disorder Identification Test (AUDIT) developed by the World Health Organization (Babor et al., 2001). The tool consists of three domains: three questions on hazardous alcohol use, three questions on alcohol dependency symptoms, and four questions on harmful alcohol use. Each question is rated on a 5-point Likert scale scored 0–4; total scores range from 0 to 40. A score of 8 or more indicates hazardous drinking behaviors (Babor et al., 2001).

2.2.3. Fatigue

Fatigue was measured using the Multidimensional Fatigue Scale (MFS) developed by Chang et al. (2005a). The tool consists of 19 questions: eight on general fatigue, six on daily activity impairment, and five on situational fatigue. Each question is rated on a 7-point Likert scale with a total score of 133.

2.2.4. Occupational stress

Occupational stress was measured using the Korean Occupational Stress Scale (KOSS) developed by Chang et al. (2005b). The short form of the tool consists of 24 questions and seven domains including job demand, insufficient job control, interpersonal conflict, job security, organizational system, lack of reward, and occupational climate. Each question is rated on a 4-point Likert scale, and each domain is converted based on 100 and compared with the reference.

2.2.5. Subjective sleep quality

Subjective sleep quality was measured using a single question evaluating one's quality of sleep in the past one month, which was rated on a 4-point Likert scale (0 = "very good," 1 = "fairly good," 2 = "fairly poor," 3 = "very poor"). Higher scores indicate poorer sleep quality.

2.3. Data collection and ethical considerations

Before data collection, this study protocol was approved by the Institutional Review Board of C University (IRB No. 1041566-201909-HR-009-01). Between October and December 2019, a notice was posted about the survey as part of on-the-job-training at the Police Human Resources Development Institute, and the questionnaire was distributed to and retrieved from the police officers who voluntarily agreed to participate. A leaflet containing an explanation of this study purpose, methods, risks, and privacy protection was provided. Officers who volunteered to participate in this study signed an informed consent form. With the exclusion of 39 (7.3%) incomplete questionnaires out of a total of 532, data from 493 (92.7%) participants were used in the analysis.

2.4. Statistical analysis

The optimal number of latent classes to which each participant belongs was determined by calculating the probability values for dichotomous indicators of depressive symptoms. Responses to items that were scored 0 indicated absence of symptoms, whereas responses to items that were scored 1, 2 or 3 indicated presence of symptoms. The dichotomization was performed because participants showed a positively skewed distribution toward 0 on the PHQ items (Singham et al., 2022). The fitness index of the LCA was estimated according to the Akaike information criterion (AIC), Bayesian information criterion (BIC), sample size-adjusted BIC (SABIC), and entropy values. The smaller the AIC, BIC, and SABIC values, the better the fit, and the closer the entropy value is to 1, the better the classification (Nylund-Gibson and Choi, 2018). Optimal model verification was used to determine the number of groups using the Vuong-Lo-Mendell-Rubin adjusted likelihood ratio test (VLMR-LRT) and bootstrap likelihood ratio test. When the null hypothesis was rejected with a nonsignificant p -value for the k class, the $k-1$ class was selected (Nylund-Gibson and Choi, 2018). In line with common practice, each identified class needed to include at least 5% of the original sample to be considered to have potential utility (Yuan et al., 2020). The identified classes would be the dependent variables in the multinomial logistic regression models. The characteristics according to the latent class were analyzed using the χ^2 test, independent t -test, and analysis of variance, with Scheffe's test as the post-hoc test. The associated factors of depressive symptoms according to the latent class were verified using multinomial logistic regression analysis. For all statistical analyses, the level of significance was considered at $p < .05$. M-plus version 8.3 was used for the LCA and IBM SPSS Statistics 23.0 was used for all other analyses.

3. Results

3.1. Frequency distributions of depressive symptoms

The distribution of the experience of depressive symptoms in the participants is shown in Fig. 1. Among the depressive symptoms reported to have been experienced for several days, “feeling tired” showed the highest frequency at 52.1%, followed by “little interest” (45.7%).

3.2. LCA of depressive symptoms

After comprehensively examining the classification criteria, the most optimal model of depressive symptoms was determined when the number of potential subgroups was four (Table 1). Although the AIC decreased as the number of subgroups increased, the BIC was lowest when the number of subgroups was 3, and the SABIC was lowest when the number of subgroups was 4. Entropy values of 0.8 or higher for each subgroup were appropriately classified. The p-value of the VLMR-LRT was nonsignificant when the number of latent classes was five and the smallest subgroup size was less than 5% of the total sample. For the four latent classes that were determined, probability values were obtained per case across nine depressive symptoms. Based on the average probability of each latent class, each subgroup of depressive symptoms was named (Fig. 2). First, subgroup 1 (class 1) was named “at-risk” as it accounted for 10.8% of all samples with a high probability of 0.87 to 1.00, except for “suicidal ideation” (0.56). Next, subgroup 2 (class 2) was named “anhedonic” as it accounted for 21.5% of all samples with a high probability of “little interest” (1.00) and “feeling tired” (0.94). Subgroup 3 (class 3) was named “somatic” as it accounted for 17.2% of all samples with a notably high probability of “feeling tired” (0.89). Subgroup 4 (class 4) was named “minimal” as it accounted for 50.5% of all samples with a low probability of symptoms (less than 0.10) except for “little interest” (0.17).

3.3. Comparison of specific characteristics of depressive symptoms

The specific characteristics of each latent class are presented in Table 2. For fatigue, significant differences were found across the subgroups with the following scores: 65.11 ± 19.04 in the minimal subgroup, 78.34 ± 16.97 in the anhedonic subgroup, 86.95 ± 17.49 in the somatic subgroup, and 90.69 ± 17.85 in the at-risk subgroup ($F = 48.67, p < .001$). The score for sleep quality of the at-risk subgroup (1.49 ± 0.67) was significantly higher than that of the minimal subgroup (1.02 ± 0.62) ($F = 10.05, p < .001$). For working hours, significant differences were found across the subgroups as follows: 209.98 ± 37.51 in the

minimal subgroup, 211.97 ± 35.93 in the anhedonic subgroup, 223.20 ± 43.09 in the somatic subgroup, and 229.29 ± 60.29 in the at-risk subgroup ($F = 2.78, p = .041$). Lastly, for occupational stress, the anhedonic subgroup had the highest score (56.16 ± 6.14), while the minimal subgroup was had the lowest score (53.75 ± 5.90) ($F = 4.60, p = .003$).

3.4. Factors affecting each subgroup of depressive symptoms

The results of the multinomial regression analysis to identify the factors affecting each subgroup of depressive symptoms are presented in Table 3. Gender, age, shift work, drinking behaviors, fatigue, sleep quality, work experience, working hours, and occupational stress were included as the independent variables, and the minimal group was used as a reference. Compared to the minimal subgroup, the affecting factor in the at-risk subgroup was drinking behaviors with a 1.10-fold increase in odds ratio (OR) (95% confidence interval [CI] [1.03, 1.18], $p = .007$). Compared to the minimal subgroup, the affecting factor in the somatic subgroup was working hours (OR: 1.01, 95% CI [1.00, 1.02], $p = .048$). Compared to the minimal subgroup, the affecting factor in the anhedonic subgroup was sleep quality, with a 1.49-fold increase in OR (95% CI [1.04, 2.16], $p = .031$). Fatigue was another affecting factor in the anhedonic subgroup (OR: 1.02, 95% CI [1.00, 1.04], $p = .035$).

4. Discussion

This study investigated the subgroups of depressive symptoms in police officers in South Korea and identified the factors affecting each subgroup, to provide primary information for developing interventions for occupational health across the subgroups of depressive symptoms.

The LCA of the nine depressive symptoms reported by the participants showed that there were four subgroups of depressive symptoms: at-risk (class 1), anhedonic (class 2), somatic (class 3), and minimal (class 4). These results differ from previous studies where the four subgroups were identified as non-depressed, psychosomatic, cognitive-emotional, and severely-depressed in a nationally representative United States sample (Carragher et al., 2009), and where the four subgroups were reported as mild, moderate without anxiety, moderate with anxiety, and severe in a nationally representative Netherlands sample (Have et al., 2016). The discrepancy reflects how specific depressive symptoms are more prominent than others depending on the instrument used in this study, the time of data collection, and cultural differences in the samples (Ulbricht et al., 2018). Nevertheless, it is necessary to consider the characteristics of the depressive symptoms in each subgroup to increase the effectiveness of an intervention to address

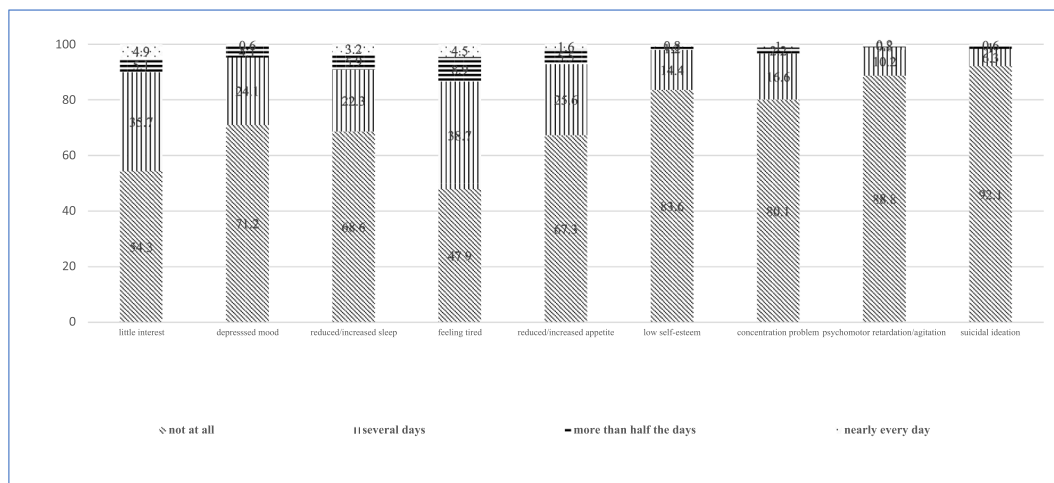


Fig. 1. Frequency distributions of depressive symptoms in Korean police officers, 2019.

Table 1
Model Fit Indices of the Latent Class Analysis Solutions in a sample of Korean Police Officers.

Model	AIC	BIC	Adjusted BIC	Entropy	Log Likelihood	VLMR-LRT p-value	BLRT p-value	% in each class
1 class	4762.14	4799.95		–		–	–	
2 classes	3641.96	3721.77	3661.47	0.87	–2372.07	<.001	<.001	40.9, 49.1
3 classes	3403.69	3525.50	3433.46	0.88	–1801.98	.0021	<.001	36.9, 50.7, 12.4
4 classes	3376.27	3540.09	3416.31	0.83	–1672.85	.0178	<.001	10.8, 21.5, 17.2, 50.5
5 classes	3371.48	3577.31	3421.78	0.87	–1649.14	.4818	.0714	11.4, 22.5, 1.8, 51.1, 13.2

AIC, Akaike’s information criterion; BIC, Bayesian information criterion; VLMR-LRT, Vuong-Lo-Mendel-Rubin likelihood ratio test; BLRT, bootstrapped likelihood ratio test.

p-value is for the k versus k-1 class solution.

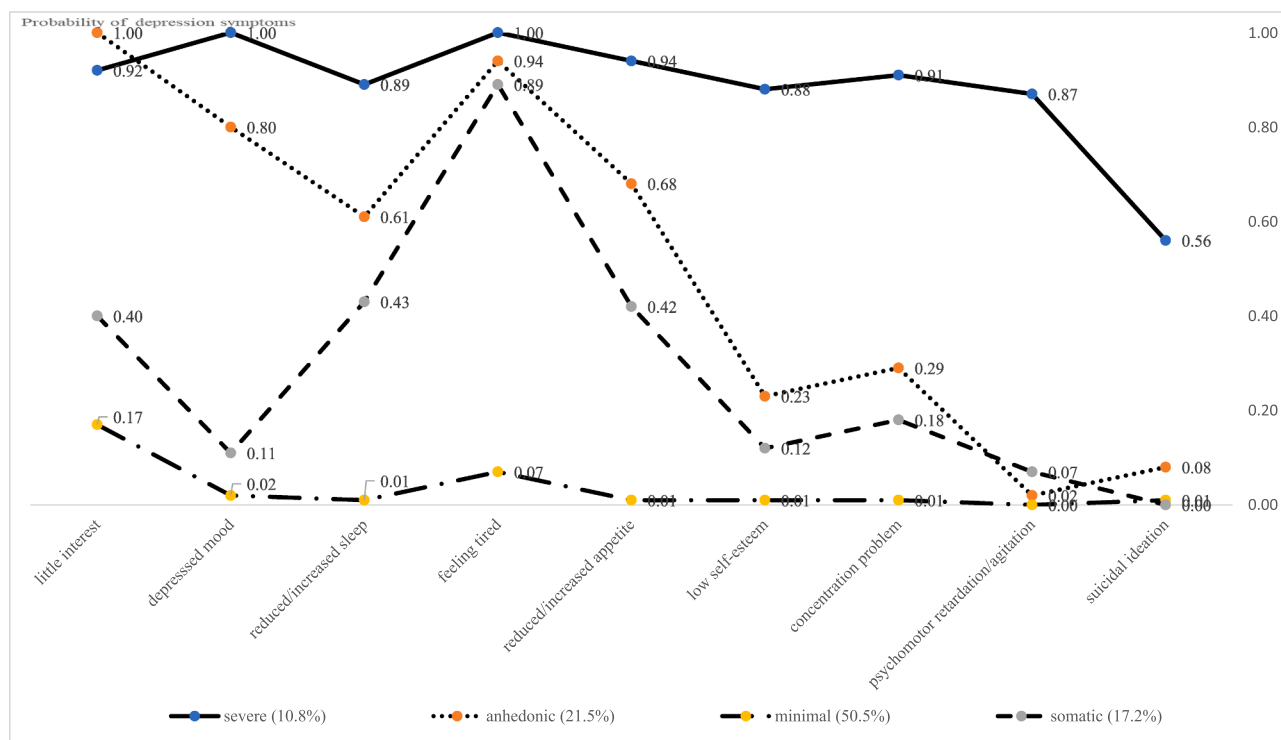


Fig. 2. Depressive symptoms subgroups of Korean police officers by latent class analysis, 2019.

depression in police officers.

Approximately half (50.5%) of the participants who reported minimal depressive symptoms belonged to the minimal subgroup, which was used as a reference for the comparison across subgroups. Compared to the minimal subgroup, class 1 with high probability values for most depressive symptoms, except suicidal ideation, was the at-risk subgroup. This group showed a score of at least 5 on the PHQ-9, which indicated the possibility of a depressive disorder. The scores for sleep quality, working hours, and fatigue were lower by 0.5 points, longer by 20 h, and higher by 25 points, respectively, in the at-risk subgroup compared to the minimal subgroup. The factor affecting this group was the drinking behavior in which alcohol use is increased when coping with hyperarousal and repeated re-experiencing after a traumatic event (Ménard et al., 2016); moreover, drinking behaviors due to depression is a risk factor for increasing work safety problems (Agrawal and Singh, 2020). Therefore, careful assessment is required to verify the association of depression with drinking behaviors in police officers. The findings indicated a need for greater efforts to prioritize the health problems in police officers and provide suitable interventions that will be beneficial to them.

Compared to the minimal subgroup, the anhedonic group (class 2) showed a score of 3.5 on the PHQ-9 and had the highest score for occupational stress at 56.2. Fatigue was shown to be the affecting factor

of this group. Fatigue is an objective feeling of weariness that marks the onset of a disease as it induces psychological, physical, and immunological changes (Fekedulegn et al., 2017). Fatigue is thus deeply associated with occupational stress such as handling civil complaints or excessive workload (Chang et al., 2005a; Fekedulegn et al., 2017; Han et al., 2018). Sleep deprivation indicates a higher level of perceived stress, and factors such as shift work can lead to chronic fatigue, which can significantly impact the level of depression (Gershon et al., 2009; Ma et al., 2019; Sherwood et al., 2019; Violanti et al., 2017). The prolonged stress due to emotional labor could cause anhedonia or burnout, a state of physical and psychological depletion with a cynical attitude towards work performance. The efficiency of work performance is reduced in addition to potential injury during work due to fatigue (Agrawal and Singh, 2020). Notably, the factors that affect the levels of fatigue and burnout should be more accurately determined through a longitudinal study in the future, and efforts should be made to prevent the progression of anhedonic depression and chronic fatigue syndrome to major depressive disorder.

Compared to the minimal subgroup, the somatic subgroup (class 3) showed a score of 3.7 on the PHQ-9 and a score of 86.95 on the MFS, which were higher than the scores of the minimal and anhedonic subgroups. While the reason for visiting a primary health clinic is physical symptoms, those induced by depression are often unrecognized

Table 2
Subgroup specific characteristics of Korean Police Officers, 2019 (N = 493).

Item	Class 1	Class 2	Class 3	Class 4	Total	χ^2/F	p
	(at-risk) n (%) or M \pm SD	(anhedonic) n (%) or M \pm SD	(somatic) n (%) or M \pm SD	(minimal) n (%) or M \pm SD			
Gender	53(10.8)	106(21.5)	85(17.2)	249(50.5)	493(100.0)		
Male	45(84.9)	87(82.1)	68(80.0)	229(92.0)	430(87.2)	11.61	0.009
Female	8(15.1)	19(17.9)	17(20.0)	20(8.0)	63(12.8)		
Age	42.38 \pm 10.75	43.02 \pm 8.69	44.25 \pm 10.39	45.00 \pm 10.82	44.17 \pm 10.33	1.52	0.209
\leq 39	22(41.5)	40(37.7)	32(37.6)	85(34.1)	179(36.3)	9.96	0.126
40-49	13(24.5)	39(36.8)	19(22.4)	65(26.1)	136(27.6)		
\geq 50	18(34.0)	27(25.5)	34(40.0)	99(39.8)	178(36.1)		
Drinking behaviors [†]	10.86 \pm 6.50	8.07 \pm 6.47	8.54 \pm 5.66	8.59 \pm 5.94	8.70 \pm 6.10	2.54	0.056
Hazardous alcohol use	7.24 \pm 2.80	5.70 \pm 3.56	6.26 \pm 3.40	6.31 \pm 3.49	6.27 \pm 3.44	2.35	0.072
AD symptoms	1.56 \pm 2.39	1.15 \pm 2.10	1.06 \pm 1.91	1.14 \pm 2.09	1.17 \pm 2.10	1.19	0.313
Harmful alcohol use	1.83 \pm 2.83	1.25 \pm 2.14	1.24 \pm 1.96	1.20 \pm 2.01	1.28 \pm 2.13	1.01	0.389
Fatigue (MFS)	90.69 \pm 17.85 ^{d)}	78.34 \pm 16.97 ^{b)}	86.95 \pm 17.49 ^{c)}	65.11 \pm 19.04	74.49 \pm 20.79	48.67	< .001
Sleep quality	1.49 \pm 0.67 ^{d)}	1.27 \pm 0.58 ^{c)}	1.17 \pm 0.70 ^{b)}	1.02 \pm 0.62 ^{a)}	1.15 \pm 0.65 ^{a)}	10.05	< .001
Depressive symptoms	4.93 \pm 0.67	3.51 \pm 3.93	3.65 \pm 4.10	2.45 \pm 3.51	3.15 \pm 3.95	7.19	< .001
Shift work						6.16	0.104
Yes	31(58.5)	57(53.8)	37(43.5)	109(43.8)	234(47.5)		
No	22(41.5)	49(46.2)	48(56.5)	140(56.2)	259(52.5)		
Work experience (years)	14.51 \pm 11.52	15.25 \pm 9.61	16.55 \pm 10.76	16.82 \pm 10.61	16.19 \pm 10.53	1.06	0.365
\leq 10	23(43.4)	38(35.8)	34(40.0)	83(33.3)	178(36.1)	16.17	0.013
Oct-20	11(20.8)	37(34.9)	13(15.3)	53(21.3)	114(23.1)		
\geq 20	19(35.8)	31(29.2)	38(44.7)	113(45.4)	201(40.8)		
Working hours (hour/month)	229.29 \pm 60.29	211.97 \pm 35.93	223.20 \pm 43.09	209.98 \pm 37.51	214.97 \pm 41.60	2.78	0.041
KOSS	55.46 \pm 7.27 ^{d)}	56.16 \pm 6.14 ^{c)}	55.46 \pm 6.03 ^{b)}	53.75 \pm 5.90 ^{a)}	54.76 \pm 6.20	4.6	0.003
Job demand	45.13 \pm 20.31 ^{d)}	44.18 \pm 15.61 ^{c)}	45.98 \pm 16.45 ^{b)}	40.46 \pm 16.04 ^{a)}	42.72 \pm 16.64	3.3	0.02
Insufficient job control	45.75 \pm 17.88	46.51 \pm 15.84	48.51 \pm 16.42	45.19 \pm 15.15	46.11 \pm 15.83	0.95	0.415
Interpersonal conflict	64.36 \pm 17.35	63.10 \pm 15.90	61.44 \pm 15.95	64.92 \pm 15.24	63.87 \pm 15.75	1.14	0.331
Job insecurity	23.58 \pm 19.73	28.46 \pm 22.30	21.37 \pm 18.65	25.74 \pm 21.51	25.34 \pm 21.09	1.94	0.123
Organizational system	49.69 \pm 18.63 ^{d)}	50.00 \pm 17.48 ^{c)}	47.65 \pm 19.19 ^{b)}	54.15 \pm 16.26 ^{a)}	51.64 \pm 17.47	3.76	0.011
Lack of reward	56.60 \pm 20.24	55.98 \pm 17.63	58.04 \pm 17.18	60.84 \pm 15.64	58.85 \pm 16.97	2.53	0.057
Occupational climate	37.34 \pm 20.51 ^{d)}	40.09 \pm 19.15 ^{c)}	38.43 \pm 20.21 ^{b)}	34.04 \pm 18.94 ^{a)}	46.47 \pm 19.49	2.85	0.037

M \pm SD, mean \pm standard deviation; AD, alcohol dependence; MFS, Multidimensional Fatigue Scale; KOSS, Korean Occupational Stress Scale.

a)b)c)d) Scheffe's test (mean with the other letter significantly different).

[†] Based on the Alcohol Use Disorder Identification Test.

Table 3
Multinomial logistic regression analysis for depression symptoms subgroup related variables in Korean Police Officers, 2019.

Variable	Model (reference: minimal subgroup)								
	at-risk			anhedonic			somatic		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Gender (male)	1.17	(0.27, 4.99)	.836	1.11	(0.41, 2.97)	.837	2.48	(0.65, 9.50)	.185
Age	0.98	(0.87, 1.11)	.793	0.98	(0.89, 1.08)	.705	1.03	(0.95, 1.12)	.484
Shift work (yes)	2.15	(0.88, 5.24)	.094	1.17	(0.60, 2.28)	.654	1.06	(0.54, 2.06)	.874
Drinking behaviors [†]	1.10	(1.03, 1.18)	.007	0.96	(0.91, 1.02)	.193	0.98	(0.92, 1.04)	.447
Fatigue (MFS)	1.01	(0.99, 1.04)	.318	1.02	(1.00, 1.04)	.035	1.00	(0.98, 1.01)	.625
Sleep quality	1.35	(0.82, 2.22)	.245	1.49	(1.04, 2.16)	.031	1.20	(0.84, 1.73)	.320
Work experience (years)	0.99	(0.88, 1.11)	.843	1.01	(0.93, 1.10)	.805	0.97	(0.92, 1.05)	.454
Working hours	1.01	(0.99, 1.02)	.158	1.00	(0.99, 1.01)	.572	1.01	(1.00, 1.02)	.048
Occupational stress (KOSS)	0.98	(0.91, 1.05)	.508	1.03	(0.98, 1.09)	.268	1.01	(1.00, 1.02)	.600
-2 log likelihood	673.67								
Chi-square (df)	46.48 (27)								
Nagelkerke R ²	.18								

OR, odds ratio; CI, confidence interval; MFS, Multidimensional Fatigue Scale; KOSS, Korean Occupational Stress Scale; df, degrees of freedom.

[†] Based on the Alcohol Use Disorder Identification Test.

(Kapfhammer, 2006). Notably, for police officers who are expected to be tenacious in fulfilling their duty, reporting physical problems rather than psychological problems is presumed to be more appropriate. As the frequent complaints of physical symptoms without a diagnosed physical disorder may be an indirect expression of depression, it is necessary to help police officers in the somatic subgroup to accurately recognize depressive symptoms and get access to the appropriate healthcare services.

Working hours was an affecting factor of depression among police officers in the somatic subgroup; thus, long hours of work can cause difficulties in mental health and work performance. For this group,

therefore, an assessment to identify the cause of the physical symptoms as an organic or psychological one is required, and interventions to improve mental health may be necessary for work-related depression. For example, working 52 h or more, as recognized by the Labor Standards Act of Korea, can be a contributing factor in depression (Jung and Kim, 2021). Furthermore, overwork is a known cause of death for police officers who died on duty while working for 56 h or more per week (Kim et al., 2019). Additionally, long work hours cause fatigue due to the insufficient recovery time available for the body, which is closely related to the occurrence of cardiovascular diseases (Han et al., 2018; Kim et al., 2019). As an increase in working hours reduces the time available for

rest and sleep and increases the risk of depression, administrative supervision is necessary while implementing health care for police officers.

Lastly, the mean score of depressive symptoms among the participants was 3.15 ± 3.95 , which was similar to 3.23 ± 3.79 in a study on 168 local police officers in other regions in South Korea (Sin, 2021). Considering that the prevalence of depression among 631 Australian police officers was 37.2%, which was higher than the prevalence of depression in the general population of Australia by 20% (Lawson et al., 2012), they were also expected to experience severe difficulties due to depression. In particular, Ménard et al. (2016) reported the rate of major depressive disorder was 16% in police officers in the United States, Canada, Australia, and New Zealand, while Stevelink et al. (2020) found depression was the most frequently reported mental health problem in police officers in the United Kingdom (9.8%). In Tanzania, 19.8% of police officers were depressed, with 30.2% of them reporting moderate to severe depression (Njiro et al., 2021). These results reflect the seriousness of their depression problems. Compared to Korean firefighters, police officers who had been exposed to frequent occupational stress and excessive workload displayed a severe problem with sleep and a high risk of PTSD (Kim et al., 2019). Compared to Korean public officers, the ratio of police officers with mood disorders was high (Han et al., 2018). In this study, the average PHQ-9 score was less than 5, and the distribution of depression with a PHQ-9 score of 10 or more was also low at only 6.9% compared to 9.8% in the United Kingdom (Stevelink et al., 2020). Nevertheless, in South Korea, there was an increased rate of psychiatric and suicide counseling among police officers and a 45% increase in the number of depressed police officers in the past five years (Press Release of Lee Parliament Office, 2021). As such, there is an urgent need to develop strategies for early diagnosis of depression and interventions for suicide-related problems in police officers in South Korea.

This study is significant because, first, it differs from previous studies in that LCA, a person-centered approach, was applied, which allowed for the classification of subgroups related to the depressive symptoms of police officers as well as the characterizations of each group. Second, drinking behaviors, sleep quality, working hours, and fatigue were identified as factors associated with depression in police officers, thereby providing basic information for developing interventions to address what is contributing to their mood as well as the depressive symptoms. It is hoped that preemptive policies with high practicality will be developed in the future to prevent the problem of depression in police officers.

4.1. Limitations of this study

There are several limitations to this study that deserve mentioning. The results should be interpreted with caution because the data were collected using convenience sampling, based on self-report questionnaires, and limited to the depressive symptoms experienced during a specific time period. Additionally, only one item was used to assess sleep quality, and the PHQ-9 scores were dichotomized because of the limited range of depressive symptoms in the sample. Lastly, generalizability of the results may be limited as they may not be representative of police officers in other locations.

5. Conclusions

Through the LCA of depressive symptoms in police officers, four subgroups were defined: at-risk (10.8%), anhedonic (21.5%), somatic (17.2%), and minimal (50.5%). The analysis verified the heterogeneity of depressive symptoms that can be classified into specific groups. The at-risk subgroup, in particular, showed the possibility of a depressive disorder. In this subgroup, drinking behavior was identified as a factor associated with depression, indicating the need for implementing interventions through careful assessments for verifying the associations between drinking behavior and problem drinking from the perspective

of mental health. For the anhedonic subgroup, sleep quality and fatigue were the factors associated with depression, indicating the need to prevent the progression of chronic fatigue or anhedonia to major depressive disorder. For the somatic subgroup, police officers should receive help in accurately recognizing the physical symptoms of feeling tired and reduced appetite as depressive symptoms and accessing appropriate healthcare services. In the future, regular assessments should be performed on depression in addition to occupational factors, such as shift work and long work hours, to provide early interventions for the problem of depression in police officers.

CRedit authorship contribution statement

Kyonghwa Kang: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Funding acquisition. **Hwal Lan Bang:** Validation, Data curation, Visualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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