


Regular Article

Types of co-occurring patterns of mental health among the disaster victims in South Korea

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Abstract

This study examined co-occurring patterns of mental health among disaster victims using latent profile analysis and assessed the difference between sociodemographic factors and protective factors that affect group classification. The data of 2300 disaster victims from 2019 (4th wave) NDMI (National Disaster Management Research Institute) for Long-term Survey on the Change of Life of Disaster Victims were analyzed. The latent profile analysis revealed that three profiles; High comorbid symptom (HCS) (6.2%), Medium comorbid symptom (MCS) (22.6%), and Low symptom (LS) (71.2%). The factors that explain the difference in this divided profile group were the type of disaster, hurt, income, age, elapsed years, resilience, and community resilience in the multinomial logistic regression. When individual resilience and community resilience are high, more effective in making people belong to the low comorbid symptom group. Therefore, there is a need for a strategy that promotes synergy between the two relationships while maintaining a dual focus point of view that fosters resilience at the individual and community level together.

Keywords: co-occurring pattern; disaster victim; latent profile analysis; mental health

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Introduction

Disaster refers to a natural phenomenon or social accident that significantly damages the lives, bodies, and property of the people. South Korea is encountering many disasters yearly. According to the Ministry of Interior and Safety (2020), the damage caused by natural disasters such as heavy rain, typhoons, heavy snow, and heat waves is gradually increasing in South Korea. In particular, the damage with 72 deaths and worth 1.32 trillion won in property was reported to occur due to a total of 27 times of disasters in 2020. In recent years, not to mention infectious diseases such as COVID-19, social disasters including maritime accidents such as Sewol ferry disaster,¹ and large-scale fires in logistics warehouses are also soared noticeably. In particular, on Halloween Day this year, more than 150 people were crushed to death as many people flocked to narrow alley.²

These natural and social disasters cause life-threatening and property damage to individuals, while also providing a root cause of Post-Traumatic Stress Disorder (PTSD) (Norris et al., 2002). PTSD refers to the cases that continue the characteristics of

intrusion, avoidance, negative cognition and mood, and hyperarousal for more than one month in case of experiencing traumatic events directly or indirectly (American Psychiatric Association, 2013). According to theory of shattered assumptions, the assumption that the society would be safe is destroyed through an unfortunate traumatic event, accompanied by painful symptoms such as PTSD (Janoff-Bulman, 1985). It is reported that the average prevalence of PTSD among Korean adults is less than 2%, which indicates lower statistics than those of the United States or Canada (Hong et al., 2020). However, 38% of Korean adults who experienced the disasters were reported to fall into the PTSD high-risk group (Kim et al., 2018), and 12.8% of all Koreans to the PTSD risk group as the recent rapid increase in stress caused by COVID-19 (Ministry of Health and Welfare, 2022). In addition, the investigations revealed an increase of 45.4% in the number of PTSD patients during the last 5 years (National Health Insurance Service, 2020).

Moreover, the problem is the fact that PTSD is accompanied by depression, anxiety, adaptation disorders, etc (Parker et al., 2016). According to a recent empirical survey of people in the entire United States, depression, anxiety, and PTSD exhibited an upward direction simultaneously during the COVID-19 global pandemic (Liu et al., 2020). A domestic study in South Korea also revealed that 37.4% of the PTSD risk group fell into the risk group for depression or anxiety, or both depression and anxiety (Sim, 2019). Social adaptation is also known to be closely associated with PTSD (Hassija et al., 2015), and a study by Carmassi et al. (2016) reported that the higher the level of PTSD shows, the more likely it is to accompany at least one social maladjustment behavior. As

¹The New York Times (2014.4.16). Students Among Hundreds Missing After South Korean Ferry Sinks. (<https://www.nytimes.com/2014/04/17/world/asia/south-korean-ferry-accident.html>)

²BBC News (2022.10.31). Itaewon crowd crush: Horror as more than 150 die in Seoul district. (<https://www.bbc.com/news/world-asia-63443044>)

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such, it is not easy to recover over one-third from symptoms of PTSD even after several years once it is accompanied by other psychiatric diseases (Kessler et al., 1995). PTSD patients with other psychiatric symptoms like depression, in particular, were revealed to have 17.9 times higher risk of committing extreme attempts such as suicide than simple PTSD patients (Kim & Jhone, 2021).

Domestic studies on PTSD are not sufficient despite the high expression rate and risk of PTSD comorbidity. By examining the existing studies associated with PTSD, the summary can be reached with several characteristics and limitations as follows. First, empirical studies on PTSD have been actively conducted in relatively recent days. It is, in fact, reasonable to say that the people in South Korea became interested in PTSD nationwide since the Sewol ferry disaster in 2014 (Shim, 2017). In that accident, there were a total of 304 deaths, mostly high school students who were on a school trip. The entire nation was fallen into great shock and grief due to the breaking news in a row every day. This was high time that the term PTSD began to be imprinted on the minds of entire people and the studies on PTSD were actively started in the academic circle as well.

Nevertheless, it is a fact that studies on PTSD comorbidity are also still insufficient due to the posterior interest in PTSD. In the previous domestic studies associated with PTSD, depression accounted for the most variable regarding PTSD comorbidity (Kim & Jhone, 2021; Lee, 2022). However, overseas studies have already reported that PTSD is simultaneously causing not only depression but also various mental disorders such as anxiety and social maladjustment (Brady et al., 2000). In taking into consideration this, an empirical investigation is needed by expanding the variables associated with PTSD in domestic studies.

Second, the research participant and areas for studies are limited. Existing studies mostly targeted the occupational groups that are likely to experience PTSD, such as police officers, firefighters, soldiers, and North Korean refugees (Chung et al., 2002; Kim & Jhone, 2021; Lee, 2012), or focused on the areas where disasters occurred (Ji & Hwang, 2008; Park, 2015). However, it is necessary to consider that PTSD can be expressed not only from the large events that meet the diagnostic criteria of DSM but also through traumatic events experienced in daily life (Kim et al., 2018). In other words, PTSD should be viewed as an experience of traumatic events that can occur to anyone throughout their lifetime, not just as a specific event that occurred to individuals. In that perspective, it is necessary to accumulate empirical data on PTSD in the entire people through nationwide surveys.

This study intends to investigate how PTSD is combined with the factors involved such as depression, anxiety, and social maladjustment by supplementing the limitations of the above previous studies through nationwide surveys. Recent studies show that studies on PTSD comorbidity have been conducted via a person-oriented approach (Lenferink et al., 2017; Zhen & Zhou, 2022). The person-oriented approach assumes individual heterogeneity as in real, unlike a variable-oriented approach. This approach focuses on classifying individuals who have invisible differences into similar groups (Bergman & Magnusson, 1997). This methodology seems to be effective in grouping individuals with similar characteristics when considering that there actually exist invisible individual differences in PTSD of patients who have experienced disasters. In addition, exploration is also available to factors that have an influence on the group classification through regression analysis. Despite these advantages, no agreement has ever been

reached on categorization because domestic previous studies on PTSD have rarely been conducted through a person-oriented approach.

In examining the recent studies that were analyzed via a person-oriented approach, a study by Lenferink et al. (2017), which targeted the bereaved families of the disaster, revealed three groups in the analysis results for the comorbidity in PTSD, grief, and depression. In addition, similar levels of PTSD and depression were shown in each group. A study after the COVID-19 pandemic also exhibited similar levels of PTSD and depression within the same group classified (Zhen & Zhou, 2022). A domestic study also reported that the levels of PTSD, depression and anxiety increase simultaneously as the number of co-existence diseases increases (Sim, 2019). This study also intends to analyze PTSD comorbidity through a latent profile analysis (LPA), which is a type of person-oriented analysis.

Meanwhile, it is necessary to note the logic that PTSD is not a symptom that appears to everyone who experienced disasters but something that individuals can control (Agaibi & Wilson, 2005). Resilience is known as an important mechanism that individuals who experienced disasters are able to overcome PTSD, although it appears as various mechanisms depending on the context and culture (Ungar, 2013). Resilience, in particular, acted as an important protective factor even in the comorbidity of PTSD, depression, and anxiety (Sim, 2019). In recent days, it has been revealed that community resilience is playing an important role in alleviating PTSD other than resilience at the individual level (Kim & Oh, 2020).

This study intends to investigate the potential groups for PTSD, depression, anxiety, and social maladjustment of the people in South Korea who have experienced disasters, and beyond that, to examine the factors affecting the classification of groups. Based on this, empirical and academic data on PTSD comorbidity will be accumulated, and furthermore, differentiated intervention methods will be discussed by the group types. Specific research questions are as follows.

Research Question 1: How are PTSD, depression, anxiety, and social maladjustment of people in South Korea classified?

Research Question 2: What is the difference between socio-demographic factors and protective factors that affect group classification?

Methods

Participants and procedure

The 2019 (4th wave) NDMI (National Disaster Management Research Institute) for Long-term Survey on the Change of Life of Disaster Victims data was used in this study. Since 2016, NDMI has been conducting a panel survey in Korea on natural and social disaster victims to identify the challenges and changes to their lives after the disasters. The survey panel samples were extracted using a systematic extraction process taking into account of the type of disaster, gender, age, region and etc. In the 2019 4th wave data, 2300 participants who signed an informed consent form were surveyed. Disasters in this study were divided into natural disasters and social disasters. The natural disaster experience of disaster victims was 86.5% (typhoon: 28.8%, heavy rain: 26.4%, earthquake: 31.3%), and social disaster damage (only disasters caused by fire) was 13.5%.

Table 1. Goodness-of-fit statistics for class solutions

Profile	Log likelihood	AIC	BIC	SABIC	Entropy	LMR LRT	<i>p</i>
1	−8895.48	17,806.97	17,852.89	17,827.48	1.00		
2	−6869.75	13,765.51	13,840.14	13,798.83	0.94	4051.46	0.01
3	−6067.27	12,170.53	12,273.87	12,216.68	0.93	1604.97	0.01
4	−5785.86	11,617.72	11,749.75	11,676.68	0.93	562.87	0.01
5	−5857.00	11,770.00	11,930.74	11,841.78	0.66	−142.13	0.66
6	−5552.25	11,170.49	11,359.93	11,255.09	0.71	609.33	0.01

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample Size Adjusted BIC; LMR-LRT = Vuong-Lo-Mendell-Rubin Likelihood Ratio Test.

Measures

PTSD was assessed by the Impact of Event Scale-Revised Korean version (IES-R-K) (Eun et al., 2005). This scale has 22 items and 3 sub-factors (avoidance, hyperarousal, and intrusion symptoms) (e.g., “I tried not to talk about it”, “Any reminder brought back feelings about it”, “I felt watchful or on-guard”). The response category was analyzed with a 5-point Likert scale (1 = not at all to 5 = extremely). In this study, Cronbach’s α of IES-R is .98.

Depression was measured by the Korean version of the Patient Health Questionnaire-9 (PHQ-9) (An et al., 2013). The PHQ-9 was rated on a 4-point-Likert scale (1 = not at all to 4 = nearly every day) (e.g., “Little interest or pleasure in doing things?”, “Feeling tired or having little energy?”, “Poor appetite or overeating?”). This scale asks about the degree of depression of respondents in the past two weeks. In this study, Cronbach’s α of PHQ-9 is .92.

Anxiety was assessed by the Korean version of the Generalized Anxiety Disorder-7 (GAD-7) (Spitzer et al., 2006). The GAD-7 comprises 7 items and rates on a 4-point-Likert scale (1 = not at all to 4 = nearly every day) in the last two weeks (e.g., “Feeling nervous, anxious or on edge?”, “Being so restless that it is hard to sit still?”, “Feeling afraid as if something awful might happen?”). Cronbach’s α of Anxiety is .93.

Work and Social maladjustment were measured by the Work and Social Adjustment Scale (WSAS) (Mundt et al., 2002). WSAS comprises 5 items for the effects of disaster on housework, social activity, personal activity, building and maintaining relationships, and work ability. It was rated on a 5-point-Likert scale (1 = not at all to 5 = very much) (e.g., “Because of the way I feel, my ability to work is impaired”, “Because of the way I feel, my social leisure activities involving other people (such as parties, outings, visits, dating, home entertainment, cinema) are impaired”, “Because of the way I feel, my ability to form and maintain close relationships with others, including those I live with is impaired”). Cronbach’s α of WSAS is .97.

Individual resilience was assessed by the Brief Resilience Scale (BRS) (Smith et al., 2008). BRS consists of 6 items and rates on a 5-point-Likert scale (1 = not at all to 5 strongly agree) (e.g., “I tend to bounce back quickly after hard times”, “It does not take me long to recover from a stressful event”, “I usually come through difficult times with little trouble”). Cronbach’s α of individual resilience is .79.

Community resilience was measured by the Conjoint Community Resiliency Assessment Measure-10 (CCRAM) (Leykin et al., 2013). It consists of 10 items and 5 domains (leadership, collective efficacy, preparedness, place attachment, and social trust) (e.g., “I feel a sense of belonging to my town”, “The relations between the various groups in my town are good”, “The

municipal authority (regional council) of my town functions well”). CCRAM is rated on a 5-point Likert scale (1 = disagree to 5 = very strongly agree). Cronbach’s α of community resilience is .93.

Data analysis

First, LPA was employed. The optimal number of latent profiles was identified based on a variety of model fit indices, including log-likelihood, Akaike’s Information Criterion (AIC), Bayesian Information Criterion (BIC), Sample-Size Adjusted Bayesian Information Criterion (SABIC), Entropy, and Lo-Mendell-Rubin likelihood ratio test (LMR). In general, lower values of log-likelihood, AIC, BIC, and SABIC as well as higher values of Entropy indicate a better fit. Also, when it is statistically significant in the LMR test, it indicates that *k* profile model is a more concise solution than *k*-1 profile (Nylund et al., 2007).

Diverse mental health symptoms were used for profile classification, such as 1) PTSD, 2) Depression, 3) Anxiety, and 4) Work and Social Adjustment (WSA). Second, using the chi-squared test and analysis of variance (ANOVA), we explored the demographics and major factors for each profile. Lastly, multinomial regression analysis was conducted to determine the predictors that distinguish among profiles. All statistical analyses were performed using R statistical software (version 4.1.2; R Core Team, 2021).

Results

Latent profile analysis

Table 1 summarizes the results of the goodness-of-fit statistics for profile classification. It shows that the values of log-likelihood, AIC, BIC, and SABIC consistently decreased and statistically significant results in the LMR test to profile 4. Entropy also showed the highest value from profile 2 to profile 4. Profile 4 showed the best indices when considering various indices, but it was difficult to see a meaningful classification because there was a profile that showed less than 5% of the total group. Therefore, as an alternative, profile 3 was selected as the optimal solution.

Figure 1 presents the features of each profile of co-occurring patterns of mental health among disaster victims. Profile 1, with overall high mental health scores, was named the “High comorbid symptom” (HCS) (6.2% of the sample); Profile 2, with moderate mental health scores, was labeled the “Medium comorbid symptom” (MCS) (22.6% of the sample); and Profile 3, with low mental health scores, was named the “Low symptom” (LS) (71.2% of the sample).

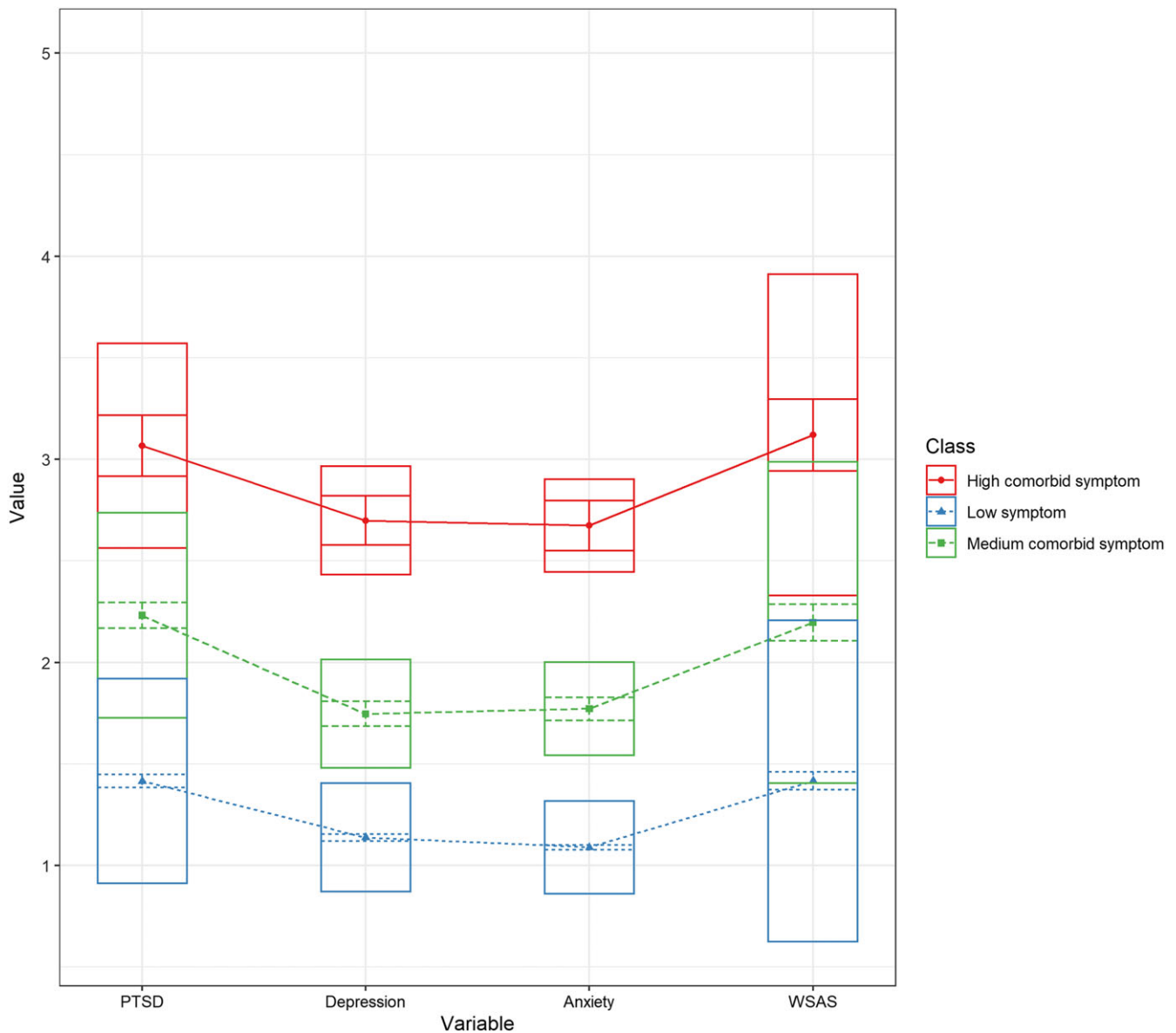


Figure 1. Co-occurring patterns of mental health in the three-class latent profile model. Note. PTSD = Posttraumatic Stress Disorder; WSA = Work and Social Adjustment.

Predictors of class membership

Table 2 shows the sociodemographic variables for disaster victims in each of the three profiles. The chi-squared test and one-way ANOVA revealed significant differences between the profiles in terms of gender, type of disaster, hurt, education, income, age, and elapsed years in sociodemographics. A multinomial logistic regression analysis was used to include the variables. The proportion of females was higher in the group with a higher degree of mental health. HCS with a high level of mental health had a relatively high rate of social disaster (40.6%) compared to other profiles. The difference between the profiles was not verified in life threat. The hurt experience was higher in the HCS profile (12.6%). In education, the group with a lower degree of mental health showed a higher percentage of education level. The age of the group with a high degree of mental health was higher, and the elapsed time of disaster events was shorter.

The age ($M = 55.5$, $SD = 17.4$) of LS was lower, and the elapsed years from the event ($M = 4.3$, $SD = 1.7$) of LS were longer than that of other profiles. All of the mental disorders used for profile classification showed the highest in HCS. Individual resilience ($M = 3.4$, $SD = 0.6$) and community resilience ($M = 3.3$, $SD = 0.6$), which are considered protective factors, were highest in LS.

Multinomial logistic regression analysis

Multinomial logistic regression analysis was used to determine the predictors that distinguish the groups (see Table 3). The reference group was the high comorbid symptom (HCS). Victims who experienced social disasters or suffered hurt from disaster events were more likely to belong to HIC with a higher level of mental health. Higher wages were more likely to be to groups (MCS and LS) with a lower level of mental health. Older people were more likely to

Table 2. Differences in socio-demographic and mental health related variables by profile

	HCS 143 (6.2%)	MCS 519 (22.6%)	LS 1638 (71.2%)	<i>p</i>	Post-hoc
Gender				<0.001	
Male	47 (32.9%)	185 (35.6%)	786 (48.0%)		
Female	96 (67.1%)	334 (64.4%)	852 (52.0%)		
Type of disaster				<0.001	
Natural	85 (59.4%)	435 (83.8%)	1470 (89.7%)		
Social	58 (40.6%)	84 (16.2%)	168 (10.3%)		
Life threat				0.135	
No	95 (66.4%)	297 (57.2%)	979 (59.8%)		
Yes	48 (33.6%)	222 (42.8%)	659 (40.2%)		
Hurt				<0.001	
No	125 (87.4%)	477 (91.9%)	1568 (95.7%)		
Yes	18 (12.6%)	42 (8.1%)	70 (4.3%)		
Education				<0.001	
>=high	137 (95.8%)	460 (88.6%)	1312 (80.1%)		
<=University	6 (4.2%)	59 (11.4%)	326 (19.9%)		
Income				<0.001	
>100	58 (40.6%)	118 (22.7%)	164 (10.0%)		
<=100 & >300	73 (51.0%)	276 (53.2%)	732 (44.7%)		
<=300 & >500	10 (7.0%)	103 (19.8%)	547 (33.4%)		
<=500	2 (1.4%)	22 (4.2%)	195 (11.9%)		
Age	65.9 ± 13.0	62.8 ± 15.1	55.5 ± 17.4	<0.001	HCS > LS, MCS > LS
Elapsed years	4.1 ± 1.3	4.0 ± 1.5	4.3 ± 1.7	<0.001	LS > MCS
PTSD	3.1 ± 0.7	2.2 ± 0.5	1.4 ± 0.5	<0.001	HCS > MCS > LS
Depression	2.7 ± 0.4	1.8 ± 0.4	1.1 ± 0.2	<0.001	HCS > MCS > LS
Anxiety	2.7 ± 0.4	1.8 ± 0.3	1.1 ± 0.2	<0.001	HCS > MCS > LS
WSA	3.1 ± 0.9	2.2 ± 0.9	1.4 ± 0.7	<0.001	HCS > MCS > LS
Individual resilience	2.6 ± 0.6	2.9 ± 0.5	3.4 ± 0.6	<0.001	LS > MCS > HCS
Community resilience	2.8 ± 0.6	3.0 ± 0.6	3.3 ± 0.6	<0.001	LS > MCS > HCS

Note. Values are frequency (percent) or mean (standard deviation); P values come from chi square test or ANOVA (Analysis of variance); PTSD = Posttraumatic Stress Disorder; WSA = Work and Social Adjustment; HCS = High comorbid symptom; MCS = Medium comorbid symptom; LS = Low symptom.

Table 3. Results of multinomial logistic regression

Ref. HCS		MCS			LS	
Predictors	Odds Ratios	CI	p	Odds Ratios	CI	p
Gender						
Male	Reference	–	–	Reference	–	–
Female	1.44	0.92–2.26	0.107	1.16	0.75–1.81	0.504
Type of disaster						
Natural	Reference	–	–	Reference	–	–
Social	0.26	0.15 – 0.45	<0.001	0.17	0.10– 0.30	<0.001
Life threat						
No	Reference	–	–	Reference	–	–
Yes	1.01	0.60 – 1.69	0.980	1.14	0.68– 1.90	0.620
Hurt						
No	Reference	–	–	Reference	–	–
Yes	0.44	0.23 – 0.85	0.015	0.26	0.13– 0.51	<0.001
Education						
>=high	Reference	–	–	Reference	–	–
<=University	2.24	0.83– 6.02	0.110	2.25	0.84– 6.03	0.107
Income						
>100	Reference			Reference		
<= 100 & >300	1.57	0.99– 2.47	0.054	1.96	1.22– 3.15	0.005
<= 300 & >500	2.54	1.14– 5.66	0.023	4.63	2.08–10.30	<0.001
<= 500	2.31	0.50– 10.78	0.286	6.14	1.36– 27.77	0.018
Age	0.99	0.97– 1.01	0.352	0.97	0.95– 0.99	0.002
Elapsed years	0.86	0.75 – 0.99	0.040	0.95	0.83– 1.09	0.466
Individual resilience	2.88	1.95– 4.25	<0.001	13.02	8.63– 19.65	<0.001
Community resilience	1.88	1.32–2.68	0.001	3.64	2.54–5.23	<0.001

Note. CI = confidence interval; HCS = high comorbid symptom; MCS = medium comorbid symptom; LS = low symptom.

belong to the HCS group with higher mental health. The higher the individual resilience, the higher the probability of belonging to a group with low mental health. Similarly, high community resilience was strongly associated with the low psychiatric group.

Discussion

This study can be useful as the main basis for recognizing a discriminatory clinical approach to overcome complex mental disorders after disaster damage. Although this data is for Koreans, since disaster events are growing rapidly around the world and are not limited to specific regions or races, so it is expected to provide universal implications.

Major issues related to the findings of the research are as follows. First, comorbidity of PTSD, depression, anxiety, and social maladjustment were classified into three groups: the high comorbid symptom group, the medium comorbid symptom group, and the low comorbid symptom group. The relative proportions of participants belonging to three groups were as follows: 6.2% for the high comorbid symptom group; 22.6% for the medium group was; 71.2% for the low comorbid symptom group. The degrees of severity among the four symptoms were similar in a specific group. The findings are similar to those of previous research, which has proven that, regardless of natural or social disasters, the degrees

of such symptoms are similar within a group (Bowler et al., 2016; Kar & Bastia, 2006; Lenferink et al., 2017; Zhen & Zhou, 2022). That is, the findings revealed comorbidities showing parallel patterns of PTSD and similar symptoms. Network analyses showed that nodes of sleep disturbance of PTSD, the worthlessness of depression, and irritability of anxiety are connected most closely (Price et al., 2019).

Based on such findings, we can presume that PTSD, depression, anxiety, and social maladjustment are not independent symptoms, but have a mechanism in which all of them are linked together. One mechanism we can assume is that diseases of PTSD, depression, anxiety, and social maladjustment share common symptoms (Gallagher & Brown, 2015). In another mechanism, those four may have causal relations. Here, we can suppose two channels. One path is that the shock of trauma makes individuals with symptoms of depression, anxiety, and social maladjustment more vulnerable to such symptoms than before (Kim & Jhone, 2021). The other path is that a traumatic accident causes the symptoms of depression, anxiety, and social maladjustment among normal persons (Breslau et al., 2000). Longitudinal studies during the past 20 years have shown cases where PTSD could predict the occurrence of depression and anxiety, but have not shown any opposite case (Ginzburg et al., 2010).

Second, it was found that the variables useful in distinguishing the degrees of PTSD and comorbid symptoms into different groups were the type of disaster, hurt, income, age, elapsed years, resilience, and community resilience. It was revealed that, if one suffered a social disaster rather than a natural disaster, and if one experienced damage or disease, and the lower one's household income was, the younger one was, the lower individual resilience and community resilience were, the more likely a person was to belong to the high comorbid symptom group. Existing research has also proven that social disaster, low income, and injury experiences are the factors heightening the likelihood one can belong to the high comorbid symptom group (Bowler et al., 2016).

What is interesting is that, between individual resilience and community resilience, the former was more effective in making people belong to the low comorbid symptom group. The finding is inconsistent with other research findings that community-centered recovery is more effective to overcome disaster-caused trauma than individually motivated one (Kim & Oh, 2020). However, there is also research showing that individual resilience and community resilience are not separate, but that the latter has a positive effect on individual psychological resilience (Lee et al., 2018). Therefore, it is difficult to conclude that community resilience is more effective than individual one is. What is evident is that the former plays the role of a stimulant in reducing PTSD-related comorbid symptoms. The reason can be found in the fact that disaster is experienced as a community-wide one rather than as an individual one. Residents in a local community grow their community resilience in the process of restoring the community destroyed by natural and social disasters (Coles & Buckle, 2004). One example is the recovery of families of victims of the Sewol ferry disaster in Korea in 2014. Local residents helped accident survivors and bereaved family members recover from the trauma by forming social networks, among others (Kim et al., 2020). Therefore, there is a need for a strategy that promotes synergy between the two relationships while maintaining a dual focus point of view that fosters resilience at the individual and community level together.

This study is meaningful in that it proposes a differentiated intervention by exploring the empirical evidence and types of comorbidities of disaster victims. However, this study has limitations in not considering the natural recovery of disaster damage and changes in patterns over time. Therefore, in a follow-up study, the latent class growth model can be applied to confirm the longitudinal trajectory of the comorbidity pattern of mental health in disaster victims. In addition, the age of the sample was high, so it is possible that the characteristics of the elderly were reflected in a large proportion. It will be necessary to further investigate the association with geriatric diseases or to examine the differences in patterns by life cycle.

Although IES-R-K was used as a measurement for PTSD in this study, various tools suitable for PTSD measurement already exist; Davidson Trauma Scale (DTS), Mississippi Scale for Combat-related PTSD (MISS), PTSD Checklist for DSM-5 (PCL-5), PTSD Symptom Scale Self-Report Version (PSS-SR), Short PTSD Rating Interview (SPRINT) and etc. In the large-scale panel survey, it may be useful to utilize IES-R-K, which allows participants to easily and subjectively evaluate their trauma experience. Nevertheless, it seems necessary to compare the results of the measurements used with individual diagnosis by clinical experts.

The most important criterion for classifying disaster types is whether the source of the disaster originates from nature or society (man-made). However, in recent disasters, it is difficult to clearly distinguish them. For example, diseases or natural phenomena that

did not exist before appear newly through human development and animal cruelty. This study did not cover various and complex disasters due to the use of secondary data. Natural disasters include typhoons, downpours, and earthquakes, while social disasters include only fires. Future research should establish research data that includes more recent types of disasters, while also revealing differences in outcomes according to types of disasters.

Finally, the psychological impact of an individual may vary depending on the scale of disaster damage. Recently, in South Korea, a national disaster (Itaewon disaster) occurred that has been designated as a national mourning period. Considering the size of these disasters or the scale of damage is important for understanding the mental health caused by disasters, so it is recommended to be reflected in future studies.

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Conflicts of interest. None.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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