

South Korean Validation of the COVID-related-PTSD Scale in a Non-clinical Sample Exposed to the COVID-19 Pandemic

Hwa Jung Lee

Sungkyunkwan University

Ye Jin Kim

Sungkyunkwan University

Dong Hun Lee (✉ dhlawrence05@gmail.com)

Sungkyunkwan University

Research Article

Keywords: COVID pandemic, Posttraumatic Stress Disorder Checklist, PCL-5, COVID-related-PTSD, Validation, South Korea

Posted Date: February 21st, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1299106/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

The threat of COVID-19 outbreak in South Korea and around the globe challenges on not only physical health but also on mental health, it can be referred to traumatic events to citizens. The aim of the present study is to examine the psychometric properties of Posttraumatic Stress Disorder Checklist (PCL-5), named as K-COVID-related-PTSD, which investigate PTSD symptomology in the context of COVID-19 pandemic in South Korea. Total of 1434 South Korean population were included in this study. The results of confirmatory factor analysis demonstrated a superior fit for the seven-factor hybrid model consisting of reexperiencing, negative affect, anxious arousal, dysphoric arousal, avoidance, anhedonia, and externalizing behaviors. Also K-COVID-related-PTSD showed high internal consistency and the validity (concurrent validity) was confirmed by that the scale was significantly associated with negative mental health outcomes (somatization, depression, anxiety, anger, stress, negative affect, job burnout, and suicidal ideation). Overall, the current results demonstrate the South Korean COVID-related-PTSD is a valid scale therefore can be considered for future pandemic related studies.

Introduction

The COVID-19 outbreak was declared a pandemic by the World Health Organization (WHO) on March 11, 2020, and the disease continues to cause significant damage worldwide. As of August 26, 2021, the mortality rate for COVID-19 has surpassed 4,479,392 deaths worldwide and 2,257 deaths in South Korea (Korea Centers for Disease Control and Prevention, 2021). The sudden and widespread emergence of COVID-19 led to unprecedented changes in people's lives that have profoundly impacted their physical and mental health (Alonzi, La Torre, & Silverstein, 2020). Apart from the physical toll of the disease itself, people experience psychological distress due to traumatic stressors related to isolation and disturbed routines and family and social life (e.g., loss of family and loved ones due to COVID-19) (Hetkamp et al., 2020). In particular, several studies have shown that individuals may experience the spread of COVID-19 and the social distancing and self-quarantine measures instituted to mitigate its spread as traumatic stressors (Brooks et al., 2020; Hawryluck et al., 2004). Trauma exposure is the primary etiologic risk factor for many mental illnesses, including posttraumatic stress disorder (PTSD).

PTSD refers to the specific negative symptoms that may occur in people after exposure to one or more traumatic events (American Psychiatric Association, 2013). While the rate of PTSD in the general population is between 5% and 10%, its incidence can be as high as 45.9% among direct victims of disasters (Neria, Nandi, & Galea, 2008; Luo, Cai, Gao, & Chen, 2008). During previous serious infectious disease outbreaks, the prevalence of PTSD ranged from 40–76%. A survey of survivors 3 years after the SARS epidemic in Hong Kong and China showed that over 40% of them displayed symptoms of PTSD (Hong et al., 2009). In addition, results from a one-year follow-up study of Ebola-infected patients in Sierra Leone documented a PTSD diagnosis rate of 76% (Jalloh et al., 2018). With regard to South Korean samples, 41.7% of Middle East Respiratory Syndrome survivors displayed PTSD symptoms 12 months after their diagnosis (Park et al., 2020). As such, a pandemic of unrecognized infection can be defined as a traumatic experience of acute and chronic effects to individual and community level internationally. The fear of contagion and the risk of death of oneself and loved ones refers to the direct threat. Also, the indirect consequences were found to result in comorbid conditions including psychological distress, mood disorders, and general psychological symptoms of PTSD. Moreover, previous studies on COVID-19 pandemic has found that a high risk of developing PTSD was not only valid in survivors who faced the treat of death, health care workers, and people with direct contacts with infection, but also the general population subjected to prolonged restrictive measures (Forte et al., 2020).

PTSD is classified as a type of trauma- and stressor-related disorder according to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5). Specific criteria focused on identifying causes and symptoms, are required for the PTSD diagnosis. PTSD can be diagnosed after the exposure to a traumatic event and includes four specific

dimensions (re-experiencing the trauma, avoiding reminders of the trauma, negative alterations in cognitions and mood, and alterations in arousal and reactivity) (APA, 2013). Following such criterion, PCL-5 is one of the most studied screening instruments for adults at risk of developing PTSD. Although it was initially developed with four sub-factors (re-experiencing, avoidance, negative alterations in cognitions and mood, and alterations in arousal), recent findings suggested that PTSD could be described with various number of factors. Many recent PCL-5 studies have shown that PTSD symptoms can also be described as having as many as six or seven factors (Ashbaugh, Houle-Johnson, Herbert, El-Hage, & Brunet, 2016; Bovin, Marx, Weathers, Gallagher, Rodriguez, Schnurr, & Keane, 2016; Van Praag, Fardzadeh, Covic, Maas, & Steinbüchel, 2020; Wortmann et al., 2016).

Anhedonia model, as proposed by a Chinese study from a sample of Wenchuan earthquake, can be classified into six-factor: intrusion, avoidance, negative affect, anhedonia, dysphoric arousal, and anxious arousal (Liu et al., 2014). This anhedonia model separates the negative alterations in cognitions and mood factor into two distinct factors representing changes in negative versus positive affect. Similarly, the seven-factor hybrid model suggested by Armour et al., (2015) was integrated from several six-factor models, and it was found that externalizing behavior can be discriminated as one factor in the PTSD symptoms. This seven-factor hybrid model consists of the following factors: re-experiencing, negative affect, anxious arousal, dysphoric arousal, avoidance, anhedonia, and externalizing behaviors. Lastly, the research on veterans showed mixed results in which PTSD symptoms were derived as a single-factor (Grau, Garnier-Villarreal, & Wetterneck, 2019).

Based on these models, research on PCL-5 validation has been conducted in different countries in relation to various traumatic experiences, and different factor models based on their psychometric adequacy in comparison to other models. Previous CFA studies have shown that the DSM-5 four-factor model is the best fitting model in countries such as Brazil (Pereira-Lima, Loureiro, Bolsoni, Apolinario da Silva, & Osorio, 2019), Germany (Krüger-Gottschalk et al., 2017), Turkey (Boysan et al., 2017), and Malaysia (Bahari, Alwi, & Ahmad, 2019). In addition, the six-factor model was found to fit well in Bangladesh (Islam et al., 2021) and the Netherlands (Van Praag, Fardzadeh, Covic, Mass, & von Steinbüchel, 2020), and the seven-factor model displayed a superior fit in France (Ashbaugh, Houle-Johnson, Herber, El-Hage, & Brunet, 2016), Italy (Forte et al., 2020), and the Netherlands (Van Praag et al., 2020). A previous South Korean validation study that utilized Vietnam War veterans as its sample supported the superiority of the single-factor model (Lee, Aldwin, Kang, & Ku, 2020). The seven-factor hybrid model was found to be most appropriate in a PCL-5 validation study that targeted adults in South Korea (Lee, Gu, Kwon, & Kim, 2020).

Previous studies on the convergent validity and discriminant validity of the pandemic related PTSD, as well as COVID-19-PTSD found that it is correlated with several psychological variables such as somatization, stress, depression, anger, negative affect, fear, distrust, job burnout, satisfaction with life, and suicidal ideation (Bryant-Genevier et al., 2021; Chen et al., 2021; Li, Fu, Fan, Zhu, & Li, 2021; Megalakaki et al., 2021; Mencía-Ripley, Paulino-Ramírez, Félix-Matos, Ruiz-Matuk, & Sánchez-Vincitore, 2021; Oh & Neal, 2021; Velotti, Civilla, Rogier, & Beomonte Zobel, 2021; Zhang et al., 2021).

However, we are unaware of any research that has examined the dimensional structure of the PCL-5 and its associations with other mental health outcomes among South Koreans during the COVID-19 pandemic. This study is important not only because it develops a Korean version of the PCL-5 scale, but also because it estimates the total score that represents the overall severity of PTSD in Korean society owing to the COVID-19 pandemic. Taking the unique characteristics of the COVID-19 pandemic in South Korea into account, the present study aimed to examine the psychometric properties of the PCL-5 during this public health emergency.

The first goal of the current research was to assess the psychometric properties of the COVID-related-PTSD questionnaire, which was designed to investigate the severity of PTSD symptoms in the South Korean population during the COVID-19 crisis. This assessment was performed by testing the questionnaire's factorial structure (one, four, six, or seven factors) using a CFA approach. The second goal was to examine its reliability and concurrent validity by exploring

the relationship between COVID-related-PTSD and variables found to be related to pandemic situation such as PTSD, somatization, stress, depression, anger, negative affect, fear, distrust, job burnout, satisfaction with life, and suicidal ideation.

Method

Participants

This study used a national sample by implementing an online survey based on the South Korean population census standard in 2018, such as age, gender, and residential area. Initially, 2440 individuals entered the survey and 988 subjects who did not meet the criterion of the present study or did not complete the survey were excluded, indicating completion rate of 59.5%. Lastly, 18 participants were excluded due to careless responses by screening partially random or inattentive data. Thus, a total of 1434 participants were used for the final analysis. Among the total sample, 731 (51%) were men and 703 (49%) were women. The mean age of the participants, who ranged from 19 to 84 years of age, was 44.34 (SD = 13.93). All participants met the following eligibility criteria: They were able to read and write Korean proficiently, were able to provide informed consent, and were aged 19 years or older. Table 1 provides sociodemographic information as well as COVID-19-related information of the total sample in more detail.

Procedure

The survey was conducted via an Internet survey company between February 19 and March 3, 2021. The number of confirmed COVID-19 cases and deaths in South Korea during the survey period were 91,236 and 1,612, respectively. During this period, government regulations that mandated social distancing, banned private gatherings of more than five people, and ensured that restaurants and bars were closed after 10 pm were in place in the nation's capital area. In addition, the AstraZeneca and Pfizer vaccination campaigns had begun in Hong Kong, Nepal, the United States, and Japan for high-risk groups (e.g., people with chronic diseases, medical staff, and the old and infirm). The participants were assured that their data would remain confidential and anonymous, and their informed consent for participating in this study was subsequently taken. The survey took approximately 20–30 minutes to complete, and a certain amount of online credit points were provided to the participants as compensation. The questionnaire consisted of two sections. The first section asked about participants' sociodemographic information and COVID-19-related experiences, whereas the second section included the PCL-5 and different sociological and psychological scales. The survey company is certified by ISO 9001, indicating that it meets the most recognized quality management system standards. To ensure the security of the survey, the company used a firewall (WAF) and DigiCert security service. Moreover, all survey responses were collected through an encrypted secure socket layer (SSL), which enabled the authentication, encryption, and decryption of data. At the end, all the data was removed securely once the operation of the system expired. The current study was approved by the Institutional Review Board (IRB) of the university that the researchers are affiliated with and all methods were performed in accordance with the relevant guidelines and regulations.

Table 1
Sociodemographic and COVID-19-related information of the participants

Variables		Total Sample (N = 1434)
Sex	Men	731 (51.0)
	Women	703 (49.0)
Age	19–29 years	275 (19.2)
	30–39 years	267 (18.6)
	40–49 years	317 (22.1)
	50–59 years	319 (22.2)
	60–69 years	219 (15.3)
	> 70 years	37 (2.6)
Occupation	Student	121 (8.4)
	Office worker	731 (51.0)
	Medical practitioner	53 (3.6)
	Self-employed	157 (10.9)
	Housewife	205 (14.3)
	Unemployed	121 (8.4)
	Others	47 (3.3)
Residential Area	Capital area	695 (48.4)
	Other metropolitan area	289 (20.0)
	Medium and small sized cities	450 (31.6)
Socio-economic level	Upper middle class	56 (3.9)
	Middle class	602 (42.0)
	Lower middle class	776 (54.1)
Household type	One-person household	228 (15.9)
	Group household	1206 (84.1)
COVID-19-related experiences	Similar symptoms	48 (3.3)
	Cohort isolation	2 (0.1)
	Quarantine	35 (2.4)
	Infected	2 (0.1)
	No symptoms	1347 (93.9)
COVID-19-related experiences of family and acquaintances	Symptoms similar to COVID-19	75 (5.2)
	Cohort isolation	7 (0.5)

Variables	Total Sample (N = 1434)
Quarantine	157 (10.9)
Infected	68 (4.7)
No symptoms	1127 (78.6)

Measures

PCL-5 To measure the level of the participants' PTSD symptoms, we used the Korean version (Park et al., 2020) of the Posttraumatic Stress Disorder Checklist (PCL) (Weathers, Litz, Herman, Huska, & Keane, 1993), which later applied the diagnostic criteria of the DSM-5 (Blevins, Davis, Witte, & Domino, 2015). The PCL-5 has a total of 20 items, and the sub-factors are re-experiencing (five items; e.g., painful and unwanted memories about the stressful experience repeatedly come to mind), avoidance (two items; e.g., avoiding memories, thoughts, or emotions related to the stressful experience), negative alterations in cognition and mood (seven items; e.g., difficulty remembering important parts of the stressful experience), and hyperarousal (six items; e.g., nervousness, anger, externalizing behavior, or explosive/aggressive behavior). Responses are provided using a 5-point Likert scale that ranges from "not at all" (0 points) to "very much" (4 points). Higher scores indicate more severe PTSD symptoms. According to Lee, Gu, Kwon, and Lee (2020), the Cronbach's alpha coefficients were .92, .91, .93, .93 for re-experiencing, avoidance, negative alterations in cognitions and mood, and hyperarousal, respectively. In this study, the PCL-5 showed good internal consistency with Cronbach's alpha coefficients of .93, .88, .90, and .91, and a Composite Reliability (CR) of .94, .88, .90, and .91 for re-experiencing, avoidance, negative alterations in cognitions and mood, and hyperarousal, respectively.

K-PC-PTSD In this study, we utilized the Korean version of the PC-PTSD-5 (K-PTSD-5) scale that was developed by Yum (2017) to screen for PTSD symptoms. Originally, the PC-PTSD-5 scale was developed by Prins et al. (2003) and revised by Prins et al. (2016). The K-PTSD-5 consists of five items as a single factor, with items scored dichotomously as either "yes" (1 point) or "no" (0 point). Higher scores indicate a higher risk of symptoms, and the cut-off point for high-level PTSD symptoms is estimated to be 3. The Cronbach's alpha coefficient at the time of the scale's development was .73 (Prins et al., 2003), and Cronbach's alpha coefficient in this study was .66.

Somatization The revised Patient Health Questionnaire (PHQ-15) by Kurt, Spitzer, and Williams (2002) was used to assess the pattern and severity of physical symptoms. The PHQ-15 consists of 15 items extracted from the PHQ (Spitzer, Kroenke, & Williams, 1999). Each item is scored on a 3-point Likert scale that ranges from 0 (not bothered at all) to 2 (very distressed). The cumulative score ranges from 0 to 45, with a higher score indicating a higher level of physical symptoms. The Cronbach's alpha coefficient of the Korean version of the PHQ-15 was .73. In this study, the Cronbach's alpha coefficient was .87.

Depression The Center for Epidemiological Studies Depression Scale (CES-D)—a self-reporting simple screening test tool developed by the American Institute of Mental Health in 1971—was used to examine the participants' level of depression. The scale was originally validated by Cho and Kim (1993), and the short Korean version of the CES-D-10 was standardized by Shin (2011). The scale consists of ten items, and participants were asked to answer the questions, which pertained to the symptoms of depression experienced over the past week, with either "yes" (1 point) or "no" (0 points). The cut-off point that indicates a significant level of depression was estimated to be 3. In this study, the Cronbach's alpha coefficient was .83.

Anxiety The Generalized Anxiety Scale (GAD-7)—developed by Spitzer et al. (2006) and later validated in Korean by Seo and Park (2015)—was used to identify the anxiety level of the participants and the probable cases of generalized anxiety

disorder. Seven items that asked about participants' anxiety and worries related to the COVID-19 crisis were rated by them using a 4-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). A higher total score indicates a higher severity of anxiety symptoms, with an optimal cut-off point of 5. Out of a total score of 21, 5 or more, 10 or more, and 15 or more are classified as mild, moderate, and severe anxiety symptoms, respectively (Spitzer et al., 2006). In the validation study conducted by Seo and Park (2015), the Cronbach's alpha coefficient was .92. In this study, the Cronbach's alpha coefficient was .93.

Posttraumatic Anger The dimensions of anger Reactions-5 (DAR-5), which was developed by Forbes et al. (2014), was used to measure the level of anger symptoms. The instrument was first translated into Korean by bilingual researchers and was later back-translated by a professor of counseling and PhD-level researchers. Any discrepancies were noted and discussed until the final version was completed. This scale has a total of five items: frequency, intensity, duration, aggression, and interference with social relations. On the original scale, participants were asked to respond while recalling their daily lives over the past 4 weeks. However, in this study, participants responded while thinking about the difficulties that they experienced in their daily lives during the COVID-19 pandemic in order to measure individual anger symptoms related to the COVID-19. The participants responded using a 5-point Likert scale ranging from 1 (none of the time) to 5 (all of the time). Higher scores reflected worse symptoms of anger. The Cronbach's alpha coefficient for all items in the DAR-5 was .90, indicating a high level of reliability. In this study, the Cronbach's alpha coefficient was .91.

Negative Affect The Positive and Negative Affect Schedule (PANAS) scale, which was developed and validated by Hong (2004) based on the circumstances in Korea, was used. The PANAS is a widely used checklist that reflects two subscales that contain 11 items of positive affect and 11 items of negative affect. Each item is scored on a 5-point Likert scale that ranges from 1 (not at all) to 5 (very much). As the purpose of this study was to measure the negative affect of citizens during the COVID-19 crisis, the 11 items of negative affect were extracted for use. The Cronbach's alpha coefficient of the Korean version of the PANAS (Hong, 2004) was .90. In this study, the Cronbach's alpha coefficient was .93.

Work Burnout We used the Maslach Burnout Inventory-General Survey (MBI-GS) that was developed by Schaufeli et al. (1996) to measure job burnout. The original MBI-GS consists of 16 items, including five items that measure exhaustion, five items that measure cynicism, and six items that measure professional efficacy. A validation study of the South Korean version (Shin, 2003) that consisted of only 15 items was referred to, and the one remaining item was translated and back-translated by PhD-level researchers. All items are scored on a seven-point scale; higher scores on exhaustion and cynicism and lower scores on professional efficacy indicate a higher level of burnout. In Shin's study, the Cronbach's alpha coefficients for exhaustion, cynicism, and professional efficacy were .90, .81, and .86, respectively. In this study, the Cronbach's alpha coefficients for exhaustion, cynicism, and professional efficacy were .92, .90, and .92, respectively.

Suicidal Ideation To assess the degree of suicidal ideation, a Korean validation study (Suh et al., 2017) of the depressive symptom inventory-suicidality subscale (DSI-SS)—a subscale of the Hopelessness Depression Symptom Questionnaire (Metalsky et al., 1997)—was used. The items asked about the frequency, intensity, controllability, and content of suicidal thoughts. Each item is rated on a 4-point Likert scale (0–3 points), and the total score ranges from 0 to 12. Higher scores are indicative of a greater severity of suicidal ideation. The Cronbach's alpha coefficient of the Korean version of the DSI-SS was .93. In this study, the Cronbach's alpha coefficient was .95.

Data Analysis

Descriptive statistics were used to analyze the participants' characteristics, and a normality test was subsequently conducted to determine if the data followed a normal distribution. A CFA was conducted to evaluate four potential structural models of the K-COVID-PTSD scale based on theoretical and empirical evidence of PTSD. First, the single-factor model where all items were loaded in one general factor was tested. The DSM-5 four-factor model, which included re-experiencing, avoidance, negative alterations in cognitions and mood, and hyperarousal, was tested next. We then

examined the third model—a six-factor anhedonia model that consisted of re-experiencing, negative affect, anxious arousal, dysphoric arousal, avoidance, and anhedonia. The final model that was tested was a seven-factor model that was suggested by Armour et al. (2015); it included re-experiencing, avoidance, negative affect, anhedonia, externalizing behavior, anxious arousal, and dysphoric arousal. A CFA was conducted considering the maximum likelihood (ML) estimation. Model fit indices of each model were examined using the chi-square test, comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Additionally, the Akaike information criterion (AIC) and Bayesian information criteria (BIC) index were used to compare between different models (Kass & Raftery, 1995; Raftery, 1995). The reliability analysis was followed by a Cronbach's alpha analysis. It presented a value of more than .7, which indicated good internal consistency. Lastly, the concurrent validity of the scale was verified via Pearson correlations between measures of PTSD, somatization, depression, anxiety, posttraumatic anger, negative affect, job burnout, and suicidal ideation, respectively. The data were statistically analyzed using SPSS 21.0 and Mplus 8.0.

Results

The normality test was performed by calculating the mean, standard deviation, skewness, and kurtosis; the skewness ranged from 314 to 1.371, and the kurtosis ranged from $- .956$ to $.738$. The values of both skewness and kurtosis were below the absolute value of skewness ($\leq |2.0|$) and kurtosis ($\leq |4.0|$) (Hong, Malik, & Lee, 2003), indicating that the items followed a normal distribution.

In the CFA analysis, the parameters for the measurement model were estimated using the ML method with Mplus 8.0. The fit of each model was evaluated using SRMR, RMSEA, and TLI, which are indices that favor simplicity without being affected by the sample size, and CFI—a goodness-of-fit index that is less sensitive to sample size and measures the error of the model (see Table 2). An RMSEA and SRMR of less than .08 and a CFI and TLI of .90 or more are considered to be adequate model fits (Hong, 2000; Mulaik, 1989; Hu & Bentler, 1999). The CFA revealed that the value of one-factor model was 4866.417 ($df = 170, p < .001$); its CFI was .818, TLI was .796, RMSEA was .139, and SRMR was .066, indicating that the model was not adequate. The CFA of the DSM four-factor model presented a value of 2678.033 ($df = 164, p < .001$); its CFI was .902, TLI was 0.887, and RMSEA was .103, indicating that this model was also not adequate. The six-factor model showed adequate CFI, TLI, and SRMR values of .902, .925, and .035, respectively, but an inadequate RMSEA value of .084. However, the value of the seven-factor model was 1425.445 ($df = 149, p < .001$); its CFI was .950, TLI was .937, and RMSEA was .077, indicating adequate to good fit indices. Additionally, the AIC value (63648.541) for the seven-factor model was lower than the one-factor (67047.512), four-factor (64871.128), and six-factor model (63948.969), indicating a better comparative fit. Also considering the BIC value, the model with the lowest absolute value of BIC becomes the optimal model (Nagin, 2005), indicating the seven-factor model showed lowest BIC index with the difference all greater than 10 (Raftery, 1995). Based on these considerations, the seven-factor model was finally selected. The confirmation of the factor loadings revealed that the factor loading of the items was .5 or more in all models, which was also appropriate (see Table 3).

Table 2

Confirmatory factor analyses results for one-factor model, four-factor model, six-factor model, and seven-factor model.

Model	$\chi^2(df)$	CFI	TLI	SRMR	RMSEA	AIC	BIC
One-Factor Model	4866.417 (170)	0.818	0.796	0.066	0.139	67047.512	67363.605
Four-Factor Model	2678.033 (164)	0.902	0.887	0.049	0.103	64871.128	65218.831
Six-Factor Model	1737.874 (155)	0.939	0.925	0.035	0.084	63948.969	64344.086
Seven-Factor Model	1425.445 (149)	0.950	0.937	0.033	0.077	63648.541	64075.267
CFI: comparative fit index; TLI: Tucker-Lewis fit index; SRMR: standardized root mean residual; RMSEA: root mean square error of approximation; AIC: Akaike information criteria.							

Table 3

Confirmatory factor analysis factor models of the Korean version of the COVID-related-PTSD (K-COVID-related-PTSD)

K-COVID-related-PTSD Items	Single-Factor		DSM-5		Six-factor		Seven-Factor	
	Model		Four-Factor Model		Anhedonia Model		Model	
	Factor	Factor Loading	Factor	Factor Loading	Factor	Factor Loading	Factor	Factor Loading
1. Disturbing memories of the experience	1	0.823	1	0.867	1	0.868	1	0.867
2. Disturbing dreams of the experience	1	0.809	1	0.860	1	0.863	1	0.863
3. Suddenly feeling as if the stressful experience were actually happening again	1	0.845	1	0.900	1	0.901	1	0.902
4. Upset when reminded of stressful experience	1	0.842	1	0.869	1	0.867	1	0.866
5. Physical reactions to reminders of the experience	1	0.841	1	0.863	1	0.863	1	0.863
6. Avoiding memories, thoughts, or feelings related to experience	1	0.788	2	0.905	2	0.903	2	0.904
7. Avoiding external reminders of the stressful experience	1	0.765	2	0.869	2	0.871	2	0.870
8. Trouble remembering the experience	1	0.785	3	0.773	3	0.799	3	0.799
9. Negative beliefs of self, other people, and the world	1	0.809	3	0.820	3	0.839	3	0.839
10. Blaming self or others for the experience	1	0.794	3	0.802	3	0.821	3	0.821
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame	1	0.774	3	0.795	3	0.772	3	0.772
12. Loss of interest in activities	1	0.601	3	0.649	4	0.764	4	0.768
13. Feeling distant or cut-off from other people	1	0.627	3	0.679	4	0.819	4	0.822
14. Trouble experiencing positive feelings	1	0.732	3	0.775	4	0.870	4	0.866
15. Irritability, angry outbursts, or acting aggressively	1	0.774	4	0.841	6	0.843	5	0.890
16. Taking too many risks or doing things that could cause you harm	1	0.756	4	0.804	6	0.797	5	0.861
17. Being "superalert," watchful, or on guard	1	0.735	4	0.809	5	0.837	6	0.834
18. Feeling jumpy or easily started	1	0.781	4	0.854	5	0.888	6	0.892

K-COVID-related-PTSD Items	Single-Factor		DSM-5		Six-factor		Seven-Factor	
	Model		Four-Factor Model		Anhedonia Model		Model	
	Factor	Factor Loading	Factor	Factor Loading	Factor	Factor Loading	Factor	Factor Loading
19. Having difficulty concentrating	1	0.714	4	0.792	6	0.796	7	0.860
20. Trouble falling or staying asleep	1	0.661	4	0.705	6	0.711	7	0.766

The items of each model of the K-COVID-related-PTSD exhibited a high internal reliability (see Table 4). The Cronbach's alpha for the subscales was all good and adequate, considering the single-factor model (Cronbach's $\alpha = 0.965$), DSM-5 four-factor model (Cronbach's $\alpha = 0.881-0.939$), and the seven-factor model (Cronbach's $\alpha = 0.793-0.939$). Overall, the correlations between the selected seven-factor model and each of its subscales fell within the recommended level, ranging from .524 to .792. This indicated that each subscale assessed independent content simultaneously.

Table 4
Internal reliabilities for and correlations between K-COVID-related-PTSD (N = 1434)

	Re-experiencing	Avoidance	Negative Affect	Anhedonia	Externalizing Behaviors	Anxious Arousal	Dysphoric Arousal
α	.939	.881	.880	.863	.865	.853	.793
Full Scale	.910**	.819**	.931**	.800**	.836**	.843**	.804**
Re-experiencing	-	.792**	.846**	.592**	.705**	.687**	.620**
Avoidance		-	.770**	.524**	.586**	.616**	.557**
Negative Affect			-	.685**	.739**	.723**	.687**
Anhedonia				-	.656**	.662**	.696**
Externalizing Behavior					-	.764**	.659**
Anxious Arousal						-	.726**
Dysphoric Arousal							-
** $p < .01$							

As presented in Table 5, significant correlations were found between K-COVID-related-PTSD and other related variables. The K-COVID-related-PTSD and its subscales displayed a strong positive correlation with somatization, depression, anxiety, and anger. Additionally, the full scale and its subscales displayed a comparatively low positive correlation with stress, negative affect, job burnout, and suicidal ideation. Satisfaction with life was negatively correlated with the K-COVID-PCL-5 and its subscales.

Table 5

Correlations coefficients between the full scale/subscales and other variables (N = 1434)

Variable	Total score	Intrusion	Avoidance	Negative Mood	Anhedonia	Externalizing Behavior	Anxious Arousal	Dysphoric Arousal
PTSD	.542**	.504**	.453**	.485**	.457**	.388**	.483**	.432**
Somatization	.556**	.478**	.424**	.494**	.474**	.424**	.508**	.541**
Depression	.552**	.480**	.399**	.483**	.480**	.482**	.486**	.507**
Anxiety	.639**	.566**	.502**	.573**	.514**	.537**	.572**	.567**
Posttraumatic Anger	.635**	.537**	.452**	.580**	.529**	.625**	.569**	.541**
Negative affect	.490**	.398**	.392**	.436**	.471**	.374**	.432**	.451**
Job burnout	.420**	.333**	.321**	.359**	.423**	.328**	.361**	.417**
Suicidal ideation	.490**	.464**	.365**	.451**	.391**	.453**	.406**	.372**
** $p < .01$								

Discussion

The outbreak of the COVID-19 pandemic worldwide was a traumatic event that challenged individuals' physical and mental health that it can be referred to traumatic events to citizens. The aim of this investigation was to examine the psychometric properties of PCL-5 scale, which investigates PTSD symptomology, in the context of the COVID-19 pandemic in South Korea. The results revealed that the seven-factor COVID-related-PTSD exhibited superior fit indices with good internal reliability and convincing concurrent validity, thereby demonstrating that it is a psychometrically sound and culturally relevant scale.

The results of this study supported the seven-factor model by comparing it with the single-factor model, four-factor model, and a six-factor model in the context of COVID-19. Equivalent factor models were extracted in Italy and China during the COVID-19 outbreak (Cheng et al., 2020; Forte, Favieri, Tambelli, & Casagrande, 2020). However, based on studies of the use of the PCL-5 in relation to various kinds of traumatic events such as transportation accidents, exposure to war, financial crises, and bereaved experiences, varying factor solutions were yielded. Other studies with individuals who were injured in car and motor vehicle accidents (Bahari, Alwi, & Ahmad, 2019; Cernovsky, Loureiro, Bolsoni, Apolinario, & Osorio, 2019) and individuals who were exposed to lifetime traumatic events (Boysan, Guzel Ozdemir, Ozdemir, Selvi, Yilmaz, & Kaya, 2017; Krüger-Gottschalk et al., 2017; Pereira-Lima et al., 2019) found the four-factor model to be the best fit. A South Korean study on the PCL-5 with Korean veterans of the Vietnam War supported a one-factor model (Kim et al, 2017). However, it is somewhat difficult to generalize its results because of the specificity of its study sample. Recently, a study conducted with the South Korean national survey data supported a seven-factor model, which is in line with the results of the present study even though the type of traumatic event differed (Lee, Gu, Kwon, & Kim, 2020). Moreover, many recent PCL-5 studies have shown that PTSD symptoms can be further subdivided into six- or seven-factor models (Ashbaugh, Houle-Johnson, Herbert, El-Hage, & Brunet, 2016; Bovin, Marx, Weathers, Gallagher, Rodriguez, Schnurr, & Keane, 2016; Van Praag, Fardzadeh, Covic, Maas, & Steinbüchel, 2020; Wortmann et al.,

2016). Considering the previous results of both the original PCL-5 scale and pandemic-specific one, the results of the present study appear to be reasonable.

The concurrent validity of the K-COVID-related-PTSD was satisfactory in that all of the variables— PTSD, somatization, depression, anxiety, traumatic anger, negative affect, job burnout, and suicidal ideation—were positively correlated with the complete scale as well as all seven subscales. This result is consistent with the previous validation studies of the PCL-5, which illustrated that negative psychological variables were closely related to and coexisted with PTSD symptoms (Boysan et al., 2017; Forte, Favieri, Tambelli, & Casagrande, 2020; Liu, Zhang, Wong, & Hyun, 2020; Tang et al., 2020). Moreover, previous studies found that variables such as job burnout and suicidal ideation are closely related to pandemic-induced PTSD symptoms (Czeisler et al., 2020; Talaee et al., 2020), and the same was reported in the present study.

Several limitations emerged in the present study which should be considered. First, the present study relied on a single self-report measure. To overcome this limitation, additional assessment methods such as structured interviews or observational measures are recommended to ensure the validity of the data. Second, despite the large sample size, the cross-sectional nature of the study limited the inference of causal relations between variables. Therefore, longitudinal research that considers different pandemic-related contexts, such as the vaccination rate, social distancing rate, and severity of the pandemic would serve to further validate the scale. Third, as the study utilized a non-clinical sample, future studies with clinical samples diagnosed with psychopathologies should be replicated to improve the study's validity. If possible, cross-national studies would lead to a broader understanding of the scale.

Despite its limitations, to our knowledge, the present study is the first to translate and evaluate the psychometric properties of the COVID-related-PTSD in South Korea, considering the COVID-19 pandemic as a traumatic event. The results showed that the K-COVID-related-PTSD is a valid and reliable instrument for screening PTSD symptoms during the COVID-19 pandemic. The COVID-19 pandemic has been estimated to not be an isolated event, but a calamitous one that bears a high possibility of reoccurring even after the resolution. Therefore, measuring the consequences of the pandemic could be useful in preparing for similar future situations. Another key strength of the present study is that it used a nation-wide sample, which can be interpreted to be representative of the South Korean population. Future studies should not only confirm the results of the present study, but also examine other facets of mental health and trauma within the context of the pandemic.

Declarations

Ethics approval and consent to participate: Approval was obtained from the Institutional Review Board (protocol no. SKKU 2020-05-005) of the Sungkyunkwan university and all methods throughout the study were performed in accordance with the relevant guidelines and regulations. Informed consent was obtained from all participants prior to enrolment in the study.

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analyzed during the current study are not publicly available due to the datasets currently being used for ongoing research but are available from the corresponding author on reasonable request.

Competing interests: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding: The publishing of this study was supported by the National Research Foundation of Korea (award no. 2021S1A3A2A02089682).

Authors' Contributions: All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by [Dong Hun Lee], [Hwa Jung Lee], and [Ye Jin Kim]. The first draft of the manuscript was written by [Hwa Jung Lee] and [Ye Jin Kim], all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Acknowledgements: Not applicable

References

1. Alonzi, S., La Torre, A., & Silverstein, M. W. (2020). The psychological impact of preexisting mental and physical health conditions during the COVID-19 pandemic. *Psychological trauma: theory, research, practice, and policy*, 12(S1), S236.
2. American Psychiatric Association, & American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. United States.
3. Ashbaugh, A. R., Houle-Johnson, S., Herbert, C., El-Hage, W., & Brunet, A. (2016). Psychometric validation of the English and French versions of the posttraumatic stress disorder checklist for DSM-5 (PCL-5). *PLoS one*, 11(10), e0161645.
4. Bahari, R., Alwi, M. N. M., & Ahmad, M. R. (2019). Translation and validation of the Malay posttraumatic stress disorder checklist for DSM-5 (MPLC-5). *Malaysian Journal of Medicine and Health Sciences*, 15(Suppl 1), 15-20.
5. Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *Journal of traumatic stress*, 28(6), 489-498.
6. Boysan -Lima, K., Loureiro, S. R., Bolsoni, L. M., Apolinario da Silva, T. D., & Osório, F. L. (2019). Psychometric properties and diagnostic utility of a Brazilian version of the PCL-5 (complete and abbreviated versions). *European journal of psychotraumatology*, 10(1), 1581020.
7. Boysan, M., Guzel Ozdemir, P., Ozdemir, O., Selvi, Y., Yilmaz, E., & Kaya, N. (2017). Psychometric properties of the Turkish version of the PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders, (PCL-5). *Psychiatry and Clinical Psychopharmacology*, 27(3), 300-310.
8. Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The lancet*, 395(10227), 912-920.
9. Bryant-Genevier, J., Rao, C. Y., Lopes-Cardozo, B., Kone, A., Rose, C., Thomas, I., ... & Byrkit, R. (2021). Symptoms of depression, anxiety, post-traumatic stress disorder, and suicidal ideation among state, tribal, local, and territorial public health workers during the COVID-19 Pandemic—United States, March–April 2021. *Morbidity and Mortality Weekly Report*, 70(26), 947.
10. Cernovsky, Z. Z., Fattahi, M., Litman, L. C., & Diamond, D. M. (2021). Validation of the PTSD Checklist for DSM-5 (PCL-5) on Patients Injured in Car Accidents. *European Journal of Medical and Health Sciences*, 3(2), 154-159.
11. Chen, R., Sun, C., Chen, J. J., Jen, H. J., Kang, X. L., Kao, C. C., & Chou, K. R. (2021). A large-scale survey on trauma, burnout, and posttraumatic growth among nurses during the COVID-19 pandemic. *International journal of mental health nursing*, 30(1), 102-116.
12. Cheng, P., Xu, L. Z., Zheng, W. H., Ng, R. M., Zhang, L., Li, L. J., & Li, W. H. (2020). Psychometric property study of the posttraumatic stress disorder checklist for DSM-5 (PCL-5) in Chinese healthcare workers during the outbreak of corona virus disease 2019. *Journal of Affective Disorders*, 277, 368-374.

13. Czeisler, M. É., Lane, R. I., Petrosky, E., Wiley, J. F., Christensen, A., Njai, R., ... & Rajaratnam, S. M. (2020). Mental health, substance use, and suicidal ideation during the COVID-19 pandemic—United States, June 24–30, 2020. *Morbidity and Mortality Weekly Report*, 69(32), 1049.
14. Forte, G., Favieri, F., Tambelli, R., & Casagrande, M. (2020). COVID-19 pandemic in the Italian population: validation of a post-traumatic stress disorder questionnaire and prevalence of PTSD symptomatology. *International Journal of Environmental Research and Public Health*, 17(11), 4151.
15. Ghazali, S. R., & Chen, Y. Y. (2018). Reliability, concurrent validity, and cutoff score of PTSD Checklist (PCL-5) for the Diagnostic and Statistical Manual of Mental Disorders, among Malaysian adolescents. *Traumatology*, 24(4), 280.
16. Grau, P., Garnier-Villarreal, M., & Wetterneck, C. (2019). An analysis of the latent factor structure of the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) in a PTSD partial hospitalization program. *Traumatology*, 25(4), 269.
17. Hawryluck, L., Gold, W. L., Robinson, S., Pogorski, S., Galea, S., & Styra, R. (2004). SARS control and psychological effects of quarantine, Toronto, Canada. *Emerging infectious diseases*, 10(7), 1206.
18. Hetkamp, M., Schweda, A., Bäuerle, A., Weismüller, B., Kohler, H., Musche, V., & Skoda, E. M. (2020). Sleep disturbances, fear, and generalized anxiety during the COVID-19 shut down phase in Germany: relation to infection rates, deaths, and German stock index DAX. *Sleep medicine*, 75, 350-353.
19. Hong, X., Currier, G. W., Zhao, X., Jiang, Y., Zhou, W., & Wei, J. (2009). Posttraumatic stress disorder in convalescent severe acute respiratory syndrome patients: a 4-year follow-up study. *General hospital psychiatry*, 31(6), 546-554.
20. Ibrahim, H., Ertl, V., Catani, C., Ismail, A. A., & Neuner, F. (2018). The validity of Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) as screening instrument with Kurdish and Arab displaced populations living in the Kurdistan region of Iraq. *BMC psychiatry*, 18(1), 1-8.
21. Islam, M. S., Ferdous, M. Z., Sujan, M. S. H., Tasnim, R., Masud, J. H. B., Kundu, S., Mosaddek, A. S. M., Choudhuri, M. S. K., Kira, I. A., & Gozal, D. (2021). The Psychometric Properties of the Bangla Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): A Large-scale Validation Study. *Research Square*, 2(1), 1-23.
22. Jalloh, M. F., Li, W., Bunnell, R. E., Ethier, K. A., O'Leary, A., Hageman, K. M., Sengeh, P., Jalloh, M. B., Morgan, O., Hersey, S., Marston, B. J., Dafaie, F., & Redd, J. T. (2018). Impact of Ebola experiences and risk perceptions on mental health in Sierra Leone, July 2015. *BMJ global health*, 3(2), e000471.
23. Kass, R. E., & Raftery, A. E. (1995). Bayes factor. *Journal of the American Statistical Association*, Vol.90, pp.773-795.
24. Korea Centers for Disease Control and Prevention (2021). Coronavirus Disease-19, Republic of Korea. Republic of Korea Retrieved from <http://ncov.mohw.go.kr/>.
25. Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2002). The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Medicine*, 64(2), 258–266.
26. Krüger-Gottschalk, A., Knaevelsrud, C., Rau, H., Dyer, A., Schäfer, I., Schellong, J., & Ehring, T. (2017). The German version of the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): psychometric properties and diagnostic utility. *BMC psychiatry*, 17(1), 1-9.
27. Lee, D., Gu., Kwon., & Kim. (2020). A Study on Reliability and Validity of the Korean Version of PCL-5 (Posttraumatic Stress Disorder Checklist for DSM-5) for Adults. *The Korean Journal of Counseling and Psychotherapy*, 32(2), 559-582.
28. Li, X., Fu, P., Fan, C., Zhu, M., & Li, M. (2021). COVID-19 stress and mental health of students in locked-down colleges. *International Journal of Environmental Research and Public Health*, 18(2), 771.
29. Liu, P., Wang, L., Cao, C., Wang, R., Zhang, J., Zhang, B., Wu, Q., Zhang, H., Zhao, Z., Fan, G., & Elhai, J. D. (2014). The underlying dimensions of DSM-5 posttraumatic stress disorder symptoms in an epidemiological sample of Chinese earthquake survivors. *Journal of Anxiety Disorders*, 28(4), 345-351.

30. Luo, X. W., Cai, T. S., Gao, X. P., & Chen, J. D. (2008). The investigation of mental state in victims of Wen-chuan Earthquake. *Chinese Journal of Clinical Psychology*, 16, 571-573.
31. Megalakaki, O., Kokou-Kpolou, C. K., Vaudé, J., Park, S., Iorfa, S. K., Cénat, J. M., & Derivois, D. (2021). Does peritraumatic distress predict PTSD, depression and anxiety symptoms during and after COVID-19 lockdown in France? A prospective longitudinal study. *Journal of psychiatric research*, 137, 81-88.
32. Mencía-Ripley, A., Paulino-Ramírez, R., Féliz-Matos, L., Ruiz-Matuk, C. B., & Sánchez-Vincitore, L. V. (2021). Psychological Responses to the COVID-19 Outbreak are Related to Trust in Public Institutions: Implications for Management of Emerging Infectious Diseases. *InterAmerican Journal of Medicine and Health*, 4.
33. Nagin, D. S. (2005). *Group-based modeling of development*. Cambridge, MA: Harvard University Press.
34. Neria, Y., Nandi, A., & Galea, S. (2008). Post-traumatic stress disorder following disasters: a systematic review. *Psychological medicine*, 38(4), 467-480.
35. Oh, J., & Neal, Z. P. (2021). Two's Company, but Four's a Crowd: The Relationship Among COVID-19 Stress, Household Size, and Life Satisfaction. *Collabra: Psychology*, 7(1), 24923.
36. Park, H. Y., Park, W. B., Lee, S. H., Kim, J. L., Lee, J. J., Lee, H., & Shin, H. S. (2020). Posttraumatic stress disorder and depression of survivors 12 months after the outbreak of Middle East respiratory syndrome in South Korea. *BMC public health*, 20(1), 1-9.
37. Pereira-Lima, K., Loureiro, S. R., Bolsoni, L. M., Apolinario da Silva, T. D., & Osório, F. L. (2019). Psychometric properties and diagnostic utility of a Brazilian version of the PCL-5 (complete and abbreviated versions). *European journal of psychotraumatology*, 10(1), 1581020.
38. Prins, A., Ouimette, P., Kimerling, R., Cameron, R. P., Hugelshofer, D. S., Shaw-Hegwer, J., & Sheikh, J. I. (2003). The primary care PTSD screen (PC-PTSD): Development and operating characteristics. *Primary Care Psychiatry*, 9(1), 9–14.
39. Prins, A., Bovin, M.J., Smolenski, D.J., Marx, B.P., Kimerling, R., Jenkins-Guarnieri, M. A., Kaloupek, D.G., Schnurr, P.P., Kaiser, A.P., Leyva, Y.E., & Tiet, Q.Q. (2016). The primary care PTSD screen for DSM-5 (PC-PTSD-5): development and evaluation within a veteran primary care sample. *J. Gen. Intern. Med.* 31, 1206-1211.
40. Raftery, A. E. (1995). Bayesian model selection in social research. *Sociological Methodology*, Vol.25, pp.111-164.
41. Spitzer, R. L., Kroenke, K., & Williams, J. B. (1999). Validation and utility of a self-report version of PRIME-MD: The PHQ Primary Care Study. *Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. JAMA*, 282(18), 1737–1744.
42. Talaee, N., Varahram, M., Jamaati, H., Salimi, A., Attarchi, M., Kazempour Dizaji, M., ... & Seyedmehdi, S. M. (2020). Stress and burnout in health care workers during COVID-19 pandemic: validation of a questionnaire. *Journal of Public Health*, 1-6.
43. Tang, W., Hu, T., Hu, B., Jin, C., Wang, G., Xie, C., ... & Xu, J. (2020). Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. *Journal of affective disorders*, 274, 1-7.
44. Van Praag, D. L., Fardzadeh, H. E., Covic, A., Maas, A. I., & von Steinbüchel, N. (2020). Preliminary validation of the Dutch version of the Posttraumatic stress disorder checklist for DSM-5 (PCL-5) after traumatic brain injury in a civilian population. *PloS one*, 15(4), e0231857.
45. Velotti, P., Civilla, C., Rogier, G., & Beomonte Zobel, S. (2021). A fear of COVID-19 and PTSD symptoms in pathological personality: the mediating effect of dissociation and emotion dysregulation. *Frontiers in psychiatry*, 12, 250.
46. Verhey, R., Chibanda, D., Gibson, L., Brakarsh, J., & Seedat, S. (2018). Validation of the posttraumatic stress disorder checklist–5 (PCL-5) in a primary care population with high HIV prevalence in Zimbabwe. *BMC psychiatry*, 18(1), 1-8.

47. Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). The PTSD checklist for DSM-5 (PCL-5). Scale available from the National Center for PTSD at www.ptsd.va.gov, 10.
48. Wortmann, J. H., Jordan, A. H., Weathers, F. W., Resick, P. A., Dondanville, K. A., Hall-Clark, B., ... & Litz, B. T. (2016). Psychometric analysis of the PTSD Checklist-5 (PCL-5) among treatment-seeking military service members. *Psychological Assessment*, 28(11), 1392.
49. Zhang, S., Zhou, Y., Ge, L. K., Zeng, L., Liu, Z., Qian, W., . & Zhang, X. (2021). Interaction of Insomnia and Somatization with Post-Traumatic Stress Disorder in Pregnant Women During the COVID-19 Pandemic. *Neuropsychiatric Disease and Treatment*, 17, 2539.