The Stress and Anxiety to Viral Epidemics-6 items (SAVE-6): A new instrument for assessing anxiety response to viral epidemics in the general population during the COVID-19 pandemic

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Abstract

During the COVID-19 pandemic, people have reported experiencing anxiety in response to the viral epidemic. This study aimed to explore the validity and usefulness of the Stress and Anxiety to the Viral Epidemic-6 items (SAVE-6) scale for measuring the anxiety response to the viral epidemic of the general population. A total of 1,009 respondents participated in an online survey, and 501 (49.7%) participants were rated as having at least a mild degree of anxiety response to the viral epidemic (SAVE-6 score ≥ 15), whereas 90 (8.9%) and 91 (9.0%) were rated as having depression and anxiety, respectively. A scree test and parallel analysis using MRFA extraction suggested the single factor structure (real-data eigenvalue = 69.99, 95 percentile of random eigenvalue = 45.40) of the SAVE-6. The SAVE-6 scales showed good internal consistency (Cronbach's $\alpha = .82$). ~~Confirmatory factor analysis supported a one-factor structure for the measure. Goodness-of-fit indices (χ^2/df ratio = 19.1, CFI = .92, TLI = .86, SRMR = 0.05, RMSEA = .13) were adequate.~~ The SAVE-6 was found to be a reliable, valid, and useful brief measure that can be applied to the general population. The SAVE-6 may be useful for easily assessing the anxiety symptoms during the pandemic in the general population.

Keywords: stress, anxiety, mental health, general population, COVID-19

Introduction

The COVID-19 pandemic has disrupted the daily lives of many people, leading to many individuals experiencing various psychiatric issues, including depression, anxiety, insomnia, and post-traumatic stress. In particular, people experience the fear of infection, both themselves and their loved ones, or spreading the infection to others. Research has reported on the prevalence of anxiety symptoms in pandemic era ranging from 6.33% to 50.9% (Xiong et al., 2020). Studies have assessed individuals' anxiety levels using various rating scales, such as the Generalized Anxiety Disorder-7 items (GAD-7)(Hou et al., 2021), Zung's Self-rating Anxiety Scale (SAS) (Ran et al., 2020), and Depression Anxiety and Stress Scale (Wang et al., 2020). However, these scales are not specific to assessing anxiety about the COVID-19 pandemic. As such, a rating scale specific to the viral epidemic needs to be developed, for the actual effects of the COVID-19 pandemic on individuals' anxiety to be determined.

Several rating scales were developed and applied in 2020, in response to the pandemic: the five-item Coronavirus Anxiety Scale developed by Lee et al.(Lee, 2020), the COVID-19-Anxiety Questionnaire modified by Petzold et al.(Petzold et al., 2020) based on the DSM-5 Severity Measure for Specific Phobia-Adult scale, the seven-item Fear of COVID-19 scale developed by Ahorsu et al. (Ahorsu et al., 2020), the four-item Obsession with COVID-19 Scale developed by Lee et al. (Lee, 2020), the 11-item Coronavirus Pandemic Anxiety Scale developed by Bernardo et al. (Bernardo et al., 2020), the two-factor nine-item COVID-19 Anxiety Syndrome Scale (6 items for perseverance and 3 items for avoidance) developed by Nikčević et al.(Nikcevic & Spada, 2020), and the seven-item COVID-19 Anxiety Scale developed by Silva et al. (Silva, de Sampaio Brito, & Pereira, 2020). Those scales were developed to ask one's anxiety, uncomfortable thinking, or anxiety-related physiological arousal symptoms. Originally we developed the SAVE-9 scale consists of items asking one's worry or thinking of the risk of infectivity, resultant influence on

physical health, or avoidance among each other specifically for healthcare workers (Chung et al., 2020). The SAVE-9 was designed to have two factors: first, anxiety about the viral epidemic factor, which has six items (SAVE-6); and second, work-related stress associated with the viral epidemic, which has three items (SAVE-3). We previously validated the SAVE-9 questionnaire and verified its utility in healthcare workers. In this study, we hypothesized that the SAVE-6 could be used for measuring anxiety in response to the viral epidemic and applied to the general population. We aimed to explore the psychometric properties of the SAVE-6 scale and decide the appropriate cut-off point of the SAVE-6 according to general anxiety symptom.

Materials and methods

Participants and procedure

This study was conducted via an anonymous online survey system with the professional research company EMBRAIN (www.embrain.com). The survey collected 1,009 responses from January 14 to 20, 2021. The participants voluntarily participated and responded to the survey. Mean age of the participants were 44.3 ($\pm$ 13.5) years, with 51% (n=515) being male. The study protocol was approved by the Institutional Review Board of Sungshin Women's University (SSWUIRB-2020-040). Written informed consent was waived.

Symptom assessment

1) Stress and Anxiety to Viral Epidemics-6 items

The SAVE-6 scale is a subcategory of the SAVE-9 scale developed originally for measuring the stress and anxiety to the viral epidemic among health care workers. (Chung et al., 2020). Each of the six items are rated on a five-point Likert scale ranging from 0 (never) to 4 (always). The cut-off score of the SAVE-6 scale has been reported to be 15, equivalent to at least a mild degree or $\geq$ 5 on the Generalized Anxiety Disorder-7 scale. The total score on the SAVE-6 scale can range from 0 to 12, with higher scores reflecting a higher anxiety response to the viral epidemic.

2) Generalized Anxiety Disorder-7

The GAD-7 scale is a self-rating questionnaire for measuring general anxiety (Spitzer, Kroenke, Williams, & Lowe, 2006). Each item is scored on a four-point Likert scale (0 = *not at all* to 3 = *nearly every day*). Scores can range from 0 to 21, and higher scores reflect higher levels of anxiety. The cut-off points for anxiety are 0–4 (minimal), 5–9 (mild anxiety), 10–14 (moderate), and 15–21 (severe).

3) Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 scale is a self-rating questionnaire for measuring depression (Kroenke, Spitzer, & Williams, 2001). Each item is rated on a four-point Likert scale (0 = *not at all* to 3 = *nearly every day*). Scores can range from 0 to 27, and higher scores reflect severe depression. The cut-off points for depression are 0–4 (minimal), 5–9 (mild), 10–14 (moderate), 15–19 (moderately severe), and 20–27 (severe).

Statistical analysis

We conducted an independent t-test and chi-square test to examine the difference in clinical variables or rating scales scores between male and female using IBM SPSS Statistics for Windows, Version 21.0. And also we used Spearman's correlation to examine the association of SAVE-6 scale scores with demographic variables and rating scales score, since the distribution of PHQ-9 and GAD-7 scores were not within the normal limit. We hypothesized a one factor model for the SAVE-6 scale based on our previous analysis with healthcare workers (Chung et al., 2020). The normality assumption was checked using skewness and kurtosis for an acceptable limit of range ± 2 (Gravetter & Wallnau, 2014). After examining the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of Sphericity to explore the data suitability, the Exploratory factor analysis (EFA) was conducted to evaluate construct validity. In EFA, we used principal axis factor (PAF) extraction with a Pearson correlation matrix, promax, an oblique rotation. To determine the number of factors to retain, a scree test and Parallel Analysis (Horn, 1965; Glorfeld, 1995; Timmerman & Lorenzo-Seva, 2011), based on Minimum Rank Factor Analysis (MRFA; LorenzoSeva & Ferrando, 2013), with a 95 percentile threshold based on the polychoric correlations matrix was conducted by using FACTOR 10.10.03. (Lorenzo-Seva & Ferrando, 2006) program. The reliability and internal consistency of the factor was examined using Cronbach's alpha and McDonald's Omega coefficient to verify dimensionality of the SAVE-6 scale. Finally, the

Receiver Operating Characteristics (ROC) analysis was done to explore the appropriate cut-off score of the SAVE-6 in accordance with generalized anxiety symptoms.

Results

Demographic characteristics

Demographic characteristics of participants were shown in Table 1. There is no significant difference in clinical variables and rating scales scores between male and female except the SAVE-9 scale score. Among the sample, 90 (8.9%) and 69 (6.8%) were rated as above the cut-off for clinical depression symptoms (PHQ-9 ≥ 10) and generalized anxiety (GAD-7 ≥ 10), respectively. Among the respondents, 222 (20.0%) reported knowing a person that had been infected, 80 (7.9%) reported having experience being quarantined, 6 (0.6%) reported experience with being infected themselves, and 186 (18.4%) reported having a serious medical illness.

SAVE-6 scores were significantly higher among respondents who were rated as having depression (PHQ-9 ≥ 10 , $t(1,007) = 9.29$, $p < .001$) and generalized anxiety (GAD-7 ≥ 10 , $t(1,007) = 8.34$, $p < .001$). Moreover, SAVE-6 scores were significantly higher among women ($t(1,007) = 2.38$, $p = .018$) compared with men, among people with a serious disease ($t(1,007) = 2.11$, $p = .035$), and among people with a known COVID-19 case ($t(1,007) = 2.07$, $p = 0.038$). However, no significant differences were observed with respect to the area of residence ($p = .19$), experience of being infected ($p = .55$), and being quarantined ($p = .09$).

Factor structure of SAVE-6

The normality assumption was checked and it revealed that the distribution of each 6 items were within the normal limit (Table 2). The Kaiser–Meyer–Olkin measure (0.82) and Bartlett’s test of sphericity ($p < 0.001$) showed adequacy for running EFA. The EFA with PAF extraction, polychoric correlation and promax rotation suggested one factor model of the SAVE-6 scale based

on Kaiser Criterion method in one eigenvalue above 1.00 (eigenvalue = 2.635, 42.3% of the variance).

A scree test and parallel analysis using MRFA extraction and polychoric correlation were used to identify the adequate number of factors for the scale. We compared the explained real-data eigenvalues to the 95th percentile of random eigenvalues, and made a decision where real-data eigenvalues exceeded the 95th percentile of random eigenvalues. The results suggested the single factor structure (real-data eigenvalue = 69.99, 95 percentile of random eigenvalue = 45.40) of the SAVE-6 similar to the previous study (Chung et al., 2020).

Reliability of the scores and Evidence Based on Relations to Other Variables

The SAVE-6 scales showed good internal consistency reliability (McDonald's $\omega = .818$, Cronbach's $\alpha = .815$). In this sample, the Cronbach's α of PHQ-9 and GAD-7 were .869 and .929. High SAVE-6 scores were significantly correlated with PHQ-9 scores ($\rho = 0.37$, $p < .001$) and GAD-7 scores ($\rho = 0.37$, $p < 0.001$). The ROC analysis revealed that 15 point of the SAVE-6 is appropriate (area under the curve, AUC=0.706, sensitivity=70.7%, specificity=60.0%) for the at least mild degree of GAD-7 score (≥ 5), and almost half of the 1,009 respondents ($n=501$, 49.7%) scored ≥ 15 on the SAVE-6 in this study. We also observed that 17 point of the SAVE-7 scale is in accordance with the moderate degree of GAD-7 (≥ 10 , AUC=0.768, sensitivity=72.5%, specificity=71.3%)

Discussion

We originally developed the SAVE-9 for health care workers in the pandemic era (Chung et al., 2020). We previously found that the SAVE-9 scale could be clustered into the two factors of anxiety about the viral epidemic (six items, SAVE-6) and work-related stress associated with the viral epidemic (three items, SAVE-3). In the present work, we investigated the usefulness of six-item first factor when applied to the general population as the SAVE-6 scale. In this study, the EFA suggested one factor model of the SAVE-6 scale, in a similar way with the result of parallel analysis. The SAVE-6 scales showed good internal consistency reliability. In addition, the ROC analysis revealed that 15 point of the SAVE-6 is appropriate for the at least mild degree of GAD-7 score (≥ 5).

The SAVE-6 was extracted from the original SAVE-9 scale for measuring healthcare workers's behavior or thinking in the situation of the COVID-19 pandemic era. Previous rating scales were developed to ask one's physiological arousal symptoms associated with clinically elevated fear and anxiety (the Coronavirus Anxiety Scale) (Lee, 2020), feeling anxious, nervousness, tense muscles, and behaviors of avoidance (the COVID-19-Anxiety Questionnaire) (Petzold et al., 2020), worry, heartbeat, or uncomfortable thinking (the Fear of COVID-19 scale, the Coronavirus Pandemic Anxiety Scale, the COVID-19 Anxiety) (Ahorsu et al., 2020; Bernardo et al., 2020; Silva, de Sampaio Brito, & Pereira, 2020), or behaviors of avoidance, checking, and worrying (the COVID-19 Anxiety Syndrome Scale) (Nikcevic & Spada, 2020). The original SAVE-9 scale consists of items asking one's afraid the current situation of the pandemic, healthcare workers' work-related stress, worry about other's avoiding me, and worry about me and my family members' health. In this contagious pandemic era, we considered that it is important to measure one's worry or thinking of the risk of infectivity, resultant influence on physical health, or avoidance among each other.

Though the results of this study showed a good single-model of the SAVE-6 with a good reliability, we observed gender difference in the SAVE-6 scale scores. In this pandemic era, the level of stress or anxiety to the viral epidemic was reported to be more higher among women compared to men among general population (Hou et al, 2020; Mohammadpour et al., 2020), even in the special population such as healthcare workers (Lee et al., 2021; Huang et al., 2021). Silva et al. also observed that female participants presented higher level of anxiety regarding COVID-19 while developing their new rating scale, COVID-19 anxiety scale (Silva, de Sampaio Brito, & Pereira, 2020). Gender difference in level of anxiety in response to the viral epidemic may be expectable, and female preponderance in anxiety level needs to be considered while developing the anxiety scale to the viral epidemic.

The original SAVE-9 scale for healthcare workers was developed to be brief and practical, could be used to identify individuals who need psychological support, and we decided to define the appropriate cut-off score of the SAVE-9 according to the at least mild degree of GAD-7 score to screen healthcare workers who may be vulnerable to COVID-19 infection and resultant work-related stress. In that study (Chung et al., 2020), the appropriate cut-off score of factor I of the SAVE-9 scale was assessed as point 15 (AUC = 0.728, sensitivity = 0.72, specificity = 0.61) among healthcare workers. In parallel with, in the current study, we also observed 15 point of the SAVE-6 scale as a cut-off among general population (AUC=0.706, sensitivity=70.7%, specificity=60.0%). As the point, 49.7% of participants were rated as having at least mild degree of anxiety to the viral epidemic, while 31.4% of participants were rated as having that in a GAD-7 ≥ 5 . Though data was not shown in the results, additional 27.5% of participant can be screened using the SAVE-6 scale among them who were not rated as having anxiety (GAD-7 < 5).

This study had a number of limitations. First, we did not measure test-retest reliability, so it is difficult to speak to the stability of the measure. Second, we could not gather information on the employment of the participants. Given that certain professions, such as healthcare workers, government officials, and schoolteachers, are at higher risk of infection in this pandemic era, the analysis could have benefited from considering the jobs or workplace of the participants. Last, results in this study needs to be interpreted with caution as it is just a cross-sectional study and further study is needed to generate more information on general population.

In conclusion, we observed that tThe SAVE-6 is a reliable, valid, and useful brief measure. Further study is needed to explore the utility of the SAVE-6 scale in general population with a more representative sample. — and can be applied to the general population. This scale may also be useful for easily assessing the anxiety symptoms of the general population.

Data Availability Statement

The datasets generated for this study are available on request to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board of Sungshin Women's University, No. SSWUIRB-2020-040. The participants provided their written informed consent to participate in this study.

Author Contributions

SC, MHA, YWS and SS conceived the study. SS obtained ethic approval. SK, SS and SL recruited participants and obtained data. SC organized the database. SC performed statistical analyses. All authors contributed to the article and approved the submitted version.

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Conflict of Interest

The author declares that there is no conflict of interest.

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Table 1. Demographic characteristics of participants (N = 1,009)

Variables	Male (N=515)	Female (N=494)	P- value
	Mean ± SD, N (%)		
Age (Years)	44.0 ± 13.5	44.7 ± 13.5	0.59
19~29 years old	99 (19.2%)	89 (18.0%)	0.94
30~39 years old	98 (19.0%)	89 (18.0%)	
40~49 years old	114 (22.1%)	109 (22.1%)	
50~59 years old	118 (22.9%)	116 (23.5%)	
60~69 years old	86 (16.7%)	91 (18.4%)	
Marital status (Single)	173 (33.6%)	142 (28.7%)	0.10
Education			
High school and under	121 (23.5%)	134 (27.1%)	0.27
University or college	331 (64.3%)	311 (63.0%)	
Postgraduate	63 (12.2%)	49 (9.9%)	
Region			
Metropolitan Cities (Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan)	222 (43.1%)	293 (56.9%)	0.38
Suburban Provinces (Gyeonggi, Gangwon, Chungcheong, Jeolla, Gyeongsang, Jeju)	227 (46.0%)	267 (54.0%)	
COVID-19 questions			
Is there anyone you know who has been infected with COVID-19? (Yes)	123 (23.9%)	99 (20.0%)	0.15
Did you experience being quarantined for having been infected with COVID-19? (Yes)	45 (8.7%)	35 (7.1%)	0.35
Did you experience being infected with COVID-19? (Yes)	4 (0.8%)	2 (0.4%)	0.69
Do you have any serious medical problems, such as cardiovascular or pulmonary disease? (Yes)	91 (17.7%)	95 (19.2%)	0.57
Rating scales			
Stress and Anxiety to Viral Epidemics-6 items	14.0 ± 4.7	14.7 ± 4.6	0.02
Patient Health Questionnaire-9 (PHQ-9)	6.0 ± 5.0	6.4 ± 4.9	0.28
Depression (PHQ-9 ≥ 10)	44 (8.5%)	46 (9.3%)	0.74

Generalized Anxiety Disorder-7 (GAD-7)	3.2 ± 3.9	3.4 ± 3.7	0.53
Generalized anxiety (GAD-7 ≥ 10)	36 (7.0%)	33 (6.7%)	0.90

Table 2. Frequencies of participants' answers to each SAVE-6 item

Items	Response scale, N (%)					Descriptive	<u>Skewness</u>	<u>Kurtosis</u>	<u>Factor loading</u>
	Never	Rarely	Sometimes	Often	Always	Mean ± SD			
1. Are you afraid the virus outbreak will continue indefinitely?	12 (1.2%)	51 (5.1%)	132 (13.1%)	473 (46.9%)	341 (33.8%)	3.07 ± 0.88	<u>-1.008</u>	<u>1.047</u>	<u>0.66670</u>
2. Are you afraid your health will worsen because of the virus?	30 (3.0%)	101 (10.0%)	216 (21.4%)	427 (42.3%)	235 (23.3%)	2.73 ± 1.02	<u>-0.679</u>	<u>-0.033</u>	<u>0.8445</u>
3. Are you worried that you might get infected?	55 (5.5%)	132 (13.1%)	262 (26.0%)	397 (39.3%)	163 (16.2%)	2.48 ± 1.08	<u>-0.523</u>	<u>-0.332</u>	<u>0.8078</u>
4. Are you more sensitive toward minor physical symptoms than usual?	72 (7.1%)	180 (17.8%)	259 (25.7%)	367 (36.4%)	131 (13.0%)	2.30 ± 1.12	<u>-0.366</u>	<u>-0.662</u>	<u>0.67981</u>
5. Are you worried that others might avoid you even after the infection risk has been minimized?	281 (27.8%)	368 (36.5%)	156 (15.5%)	133 (13.2%)	71 (7.0%)	1.35 ± 1.21	<u>0.695</u>	<u>-0.501</u>	<u>0.5935</u>
6. Do you worry your family or friends may become infected because of you?	79 (7.8%)	142 (14.1%)	236 (23.4%)	373 (37.0%)	179 (17.7%)	2.43 ± 1.168	<u>-0.505</u>	<u>-0.562</u>	<u>0.74951</u>

Note: Cronbach's Alpha is .82 for total SAVE-6 measure, SD = Standard Deviation

Figure 1. A single factor model of the SAVE-6 scale