A comprehensive Screening Test and Assessment of Psychological Symptoms Associated with COVID-19 in Medical Personnel

Esmaeil Sadri Damirchi[1,*], Shahriar Dargahi[2], Akbar Abravesh[3], Arezoo Mojarrad[4] and Nader Ayadi[5]

[1]Associate Professor of Counseling, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran
[2]PhD in Counseling, Department of Counseling, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran
[3]Department of Statistics, Faculty of Science, University of Mohaghegh Ardabili, Ardabil, Iran
[4]PhD Candidate of Counseling, Department of Counseling, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran
[5]PhD Candidate of Counseling, Department of Counseling, Faculty of Educational Sciences and Psychology, University of Isfahan, Isfahan, Iran

* Corresponding author: Esmaeil Sadri Damirchi, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran. Email: e.sadri@uma.ac.ir

Abstract

Background: Considering the scope of the epidemic of the COVID-19 pandemic and the psychological consequences known to be associated with infection, it seems necessary to provide a screening tool for determining the presence of psychological symptoms among the population in the healthcare sector for prevention and timely provision of psychological interventions.

Objectives: This study aimed to design and standardize a comprehensive screening test and assess clinical aspects of psychological symptoms associated with COVID-19.

Methods: This is a descriptive survey-based study. The study was permitted in two phases. The statistical population included all physicians, nurses, and staff who worked in COVID-19 care wards of hospitals in Ardabil (Iran) in 2021 and were in direct contact with these patients. A total of 200 participants in Phase I and 98 in Phase II were selected via the purposive sampling method. An initial researcher-made questionnaire was used to assess the psychological symptoms of the participants in eight and seven categories in Phase I and Phase II, respectively. The data were analyzed using SPSS26 and R software.

Results: Delphi method and second-order confirmatory factor analysis verified the validity of the questionnaire. Findings related to measuring the reliability of the questionnaire in phase I showed that although the questionnaire was reliable based on inter-rater and intra-rater, the test-retest reliability method based on Cohen's kappa coefficients showed no reliability for items 12 and 49-54. In phase II, the unreliable items were removed and the study was permitted to be conducted again with new samples. The results of intra-rater reliability also demonstrated that an intraclass correlation coefficient for each of the seven scales of the questionnaire was greater than 0.75. In addition, the results of inter-rater reliability showed that Cronbach's alpha coefficient for each scale of the questionnaire was greater than 0.70. Furthermore, high amounts of sensitivity and specificity as well as high area under the receiver operating characteristic curve verified the good accuracy of the final questionnaire.

Conclusion: Based on the findings, it can be said that the final proposed questionnaire with seven scales (55 items) was a tool with good validity, reliability, and accuracy to assess the psychological symptoms associated with COVID-19. However, since the participants of this study consisted of only medical personnel, the generalization of the results to the general population needs further investigation.

Keywords: COVID-19, Medical personnel, Psychological symptoms, Psychometrics, Reliability

1. Background

One of the most recent challenges for human survival is the epidemic of an infectious disease called COVID-19, which causes an upper respiratory tract infection and is associated with various symptoms, such as high fever and difficulty in breathing (1, 2). The spread of this virus around the world has caused rapid and unprecedented changes in people's daily lives because, with a growth in the number of people infected and killed due to this virus, strict measures to control the spread of this disease in different parts of the world have also increased (3). The implementation of quarantine measures to combat this epidemic has affected various aspects of people's lives at the individual and social levels (4). This exceptional condition is associated with important psychological consequences, including the symptoms of depression, psychological distress, symptoms of post-traumatic stress disorder (PTSD), higher levels of stress and anxiety, insomnia and irritability, and feelings of loneliness (5).

Existing evidence and studies of previous epidemics show that mental health issues are more likely to occur after the outbreak of epidemics (6). According to the results of studies, it has been found that the challenges and stresses related to COVID-19 can cause common mental disorders, such as anxiety and depression (7, 8). In other words, the mental health status of individuals at different levels of society, including patients, healthcare workers, families, children, students, mentally ill patients, and even the staff of various occupations, may be at risk due to the pandemic nature of the COVID-19, its rate of spread, and the resulting mortality rate (9-11). There has always been an exaggerated fear of pandemics due to the history of pandemics in medicine; this has led to various psychological reactions, including anxiety,

depression, and mental distress, occurring among not only the healthcare staff but also the general population in society (12, 13).

Research has shown that the staff, nurses, and doctors who work in the care departments of patients with COVID-19 have direct contact with patients, and therefore, the probability of contracting COVID-19 is higher in them than in others (14). Researchers have shown that in addition to the high risk of developing diseases, medical personnel are the most exposed group to mental disorders, especially during the outbreak of infectious diseases (15). According to the results of a study in England, the prevalence rates of PTSD and common mental disorders (e.g., generalized anxiety disorder and depression), the combined prevalence of generalized anxiety disorder, and depression in healthcare workers during the COVID-19 pandemic were 14.3%, 13.7%, 5.21%, and 7.9%, respectively (16).

Findings show that frontline medical personnel were under increased psychological pressure during the COVID-19 pandemic and experienced higher levels of stress, anxiety, and depression. To remove this burden and maintain the mental health of healthcare personnel, appropriate measures should be adopted (17). This requires regular screening of the mental health of medical personnel involved in the treatment of COVID-19. However, current studies only focus on assessing several aspects of the mental health of medical personnel that have been affected due to COVID-19 (18). Therefore, considering the research and application gap regarding the development of a tool for comprehensive screening of mental health components in medical staff involved with COVID-19, the purpose of this study was to design and standardize a comprehensive test for screening and evaluating the psychological symptoms of people who are working in the care wards of patients with COVID-19.

2. Objectives

This study aimed to design and standardize a comprehensive screening test and assess clinical aspects of psychological symptoms associated with COVID-19.

3. Methods

This was a descriptive survey-based study, which was conducted to develop and standardize a comprehensive tool for screening the presence of COVID-19-related psychological symptoms. The statistical population included all staff, nurses, and physicians in Ardabil Province (in Iran) hospitals in 2021 who worked in the care wards of patients with COVID-19 and were in direct contact with

these patients. A total of 298 participants, 200 in Phase I and 98 in Phase II, were selected via the purposive sampling method. The participants had no history of hospitalization due to mental illness and COVID-19. Inclusion criteria were working in a hospital during the COVID-19 pandemic, lacking COVID-19, lacking a history of mental disorders, not being under other stressful conditions (e.g., marital conflicts), and being willing to participate in the study. On the other hand, the individuals who had mental tension outside the work environment, retired or were on leave during the COVID-19 pandemic, had a history of mental illness, and were unwilling to participate in the study were excluded from the study.

For conducting this research, in the first step, by reviewing the studies and statistical guidelines for mental disorders (e.g., the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition), COVID-19-related mental disorders were identified and collected as a questionnaire (5-12, 19-21). Followingly, the validity of the questionnaire was assessed using the Delphi method and second-order confirmatory factor analysis (CFA). Finally, three types of reliability (test-retest, intra-rater, and inter-rater) were checked for the questionnaire.

3.1. Data collection tools

To gather the required data, a questionnaire with eight categories was designed by seven experts using the Delphi method in the following steps:

- Step 1. An initial questionnaire was designed based on the literature and sent to experts.
- Step 2. It was revised based on the experts' comments and resent to them.
- Step 3. Step 2 was repeated until reaching a between-experts agreement.
- Step 4. The final questionnaire was designed based on the last suggestions.

The involved experts were clinical psychologists and faculty members of the Ardabil University of Medical Sciences and the University of Mohaghegh Ardabili, Ardabil province, Iran, who approved the content validity of the questionnaire. Furthermore, the subcategories of psychological symptoms were confirmed using second-order CFA.

Eventually, a 64-item questionnaire was obtained. This questionnaire was used to measure the status of people in eight categories, namely depression (items 1 to 8), obsessive-compulsive disorder (items 9 to 16), anxiety (items 17 to 24), adjustment disorders (items 25 to 32), eating disorders (items 33 to 40), sleep disorders (items 41 to 48), illness anxiety (physical symptoms) (items 49 to 56), and grief (items 57 to 64). The items were scored on a 5-point Likert scale from never (0) to very high (4). The score of each

symptom ranged from 0 to 32, while the score of the whole questionnaire was obtained in the range of 0-256.

3.2. Ethical considerations

To comply with the ethical considerations of research, the research objectives were explained to the participants and they were ensured of the confidentiality of their information. Individuals who met the inclusion criteria and were willing to take part in the study completed informed consent and agreement forms. Participants could leave the course at any time, and the research was performed based on respecting the rights of the participants, anonymity, and confidentiality.

3.3. Statistical analysis

In this research, the data were analyzed in the R and SPSS26 statistical software using receiver operating characteristic (ROC) curves, three types of reliability (test-retest, intra-rater, and inter-rater), and second-order CFA.

4. Results

The authors assumed that participants' demographic features, such as gender and age, may affect the study results, and therefore, must be checked and controlled. To this aim, the Mann-Whitney U test was applied to check gender differences for all items, which showed no significant difference between male and female participants (P>0.05). Similarly, a Kruskal-Wallis test was employed to analyze all the items for different age groups (22-30, 31-40, 41-50, >51);

accordingly, no significant difference was observed among age groups (P>0.05). Considering these results, the findings of this study can be applicable for any person, irrespective of their age and gender.

The research was conducted in two phases. In phase I, we initially discussed the reliability of the questionnaire and eliminated the unreliable items. The same process was performed with 98 new participants in Phase II using the revised questionnaire (with the remained items from Phase I).

4.1. Phase I
4.1.1. Confirmatory factor analysis

The subcategories of psychological symptoms were confirmed using second-order CFA (22). We applied the statistical software R for performing CFA. The results of CFA for every eight factors are presented in Table 1. Furthermore, the path diagram of the CFA for the questionnaire is displayed in Figure 1. The goodness of fit indices reported in Table 2 verified the CFA model. Since the p-values of all the items were less than 0.05, all the items remained in the questionnaire. Consequently, the structure validity of the questionnaire was confirmed. This result as well as the Delphi method process showed that the questionnaire was valid and it measured what it was intended to.

To prepare and convert this questionnaire into a standard questionnaire, three types of reliability (test-retest, intra-rater, and inter-rater) were examined for it. First, 200 participants answered the questionnaire items, among whom two subjects were excluded from the study due to their vague answers.

Table 1. Loading factors (standardized coefficients) of the questionnaire scales

Scale	Items							
Depression	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8
	1.000	0.834	0.855	0.992	0.566	0.829	0.982	1.083
Obsessive-compulsive disorder	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Item 15	Item 16
	1.000	0.949	0.747	1.040	1.027	1.230	0.510	0.793
Anxiety	Item 17	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24
	1.000	1.118	1.050	0.872	1.105	0.834	1.106	0.758
Adjustment disorders	Item 25	Item 26	Item 27	Item 28	Item 29	Item 30	Item 31	Item 32
	1.000	0.932	0.494	0.519	1.701	1.790	1.164	1.091
Eating disorders	Item 33	Item 34	Item 35	Item 36	Item 37	Item 38	Item 39	Item 40
	1.000	0.675	1.390	1.291	0.478	0.706	0.664	0.536
Sleep disorders	Item 41	Item 42	Item 43	Item 44	Item 45	Item 46	Item 47	Item 48
	1.000	1.328	1.797	1.092	1.035	1.925	1.247	1.843
Illness anxiety	Item 49	Item 50	Item 51	Item 52	Item 53	Item 54	Item 55	Item 56
	1.000	0.994	1.054	0.610	1.024	0.718	1.103	0.682
Grief	Item 57	Item 58	Item 59	Item 60	Item 61	Item 62	Item 63	Item 64
	1.000	0.856	1.056	0.484	0.812	1.064	0.606	0.962
Total	Depression	Obsessive-compulsive disorder	Anxiety	Adjustment disorders	Eating disorders	Sleep disorders	Illness anxiety	Grief
	1.000	0.914	0.942	0.781	0.553	0.668	0.736	0.948

*The items are explained in Table 3.
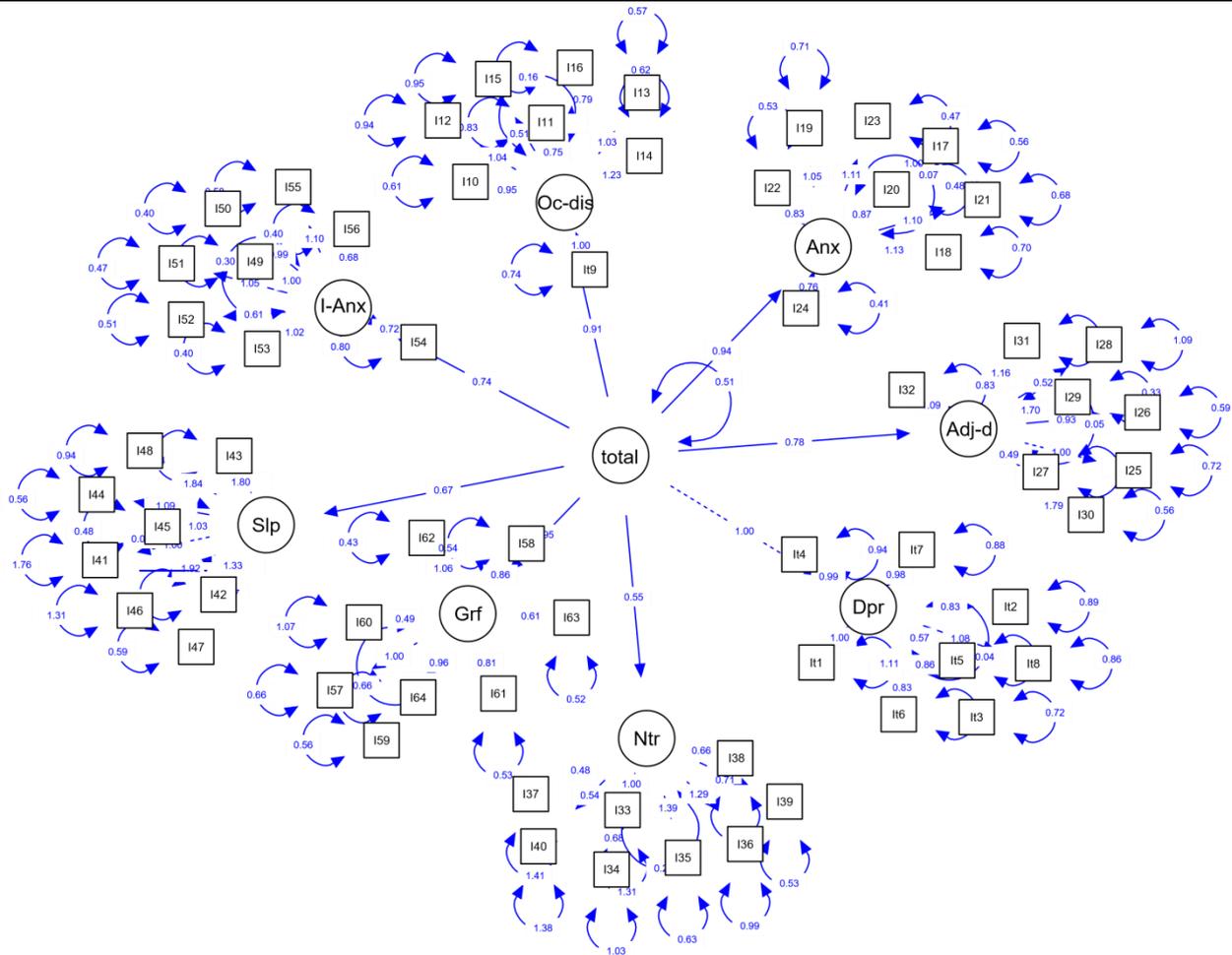
Figure 1. Path diagram of the secondary confirmatory factor analysis for the questionnaire

Table 2. Goodness of fit indices for the second-order confirmatory factor analysis

Chi-square/df	RMSEA	SRMR	CFI	TLI
2.711	0.087	0.074	0.920	0.931

RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square residual; CFI: Comparative fit index; TLI: Tucker-Lewis index

4.1.2. Test-retest reliability

To examine test-retest reliability, participants completed the questionnaire twice at a two-month interval. It is noteworthy that none of the participants contracted COVID-19 during this period. Based on the obtained data and due to the qualitative nature of the questionnaire items, Cohen's kappa coefficient was used to check the reliability of each item. Cohen's kappa coefficient was calculated as follows:

$$\kappa = \frac{P_0 - P_e}{1 - P_e},$$

where P_0 is the relative observed agreement between the first and second responses, and P_e is the value of the probability of coordination ([23]). The kappa scores lay between 0 and 1, with their large values indicating higher consistency and vice versa between the test and retest answers.

Kappa coefficients were less than 0.4 for items 55 and 56, and hence, only less than 15% of the data obtained from these two items were reliable. Moreover, kappa coefficients for items 12 and 49-54 were between 0.4 and 0.6, indicating their weak consistency. This showed the lack of consistency between the test and retest replies for these items. Therefore, to increase the reliability of the questionnaire, the mentioned nine items had to be removed from the questionnaire. For the remaining items, kappa coefficients were greater than 0.6, showing their moderate to high consistency. Kappa coefficients for all 64 questionnaire items were calculated in SPSS26 and are tabulated in Table 3.

Overall, in the final version of the questionnaire, which contained 55 items after removing unreliable items, the lowest and highest scores were between 0 and 220. In this questionnaire, higher scores indicated more psychological symptoms, while lower scores represented fewer psychological symptoms.

Table 3. Cohen's kappa coefficient for questionnaire items

Scale	Item	Cohen's kappa coefficient	Consistency rate	Percentage of reliable data
Depression	1. During COVID-19, I feel sadder than before.	0.668	Medium	36% to 63%
	2. I am pessimistic about my future due to the conditions caused by COVID-19.	0.638	Medium	36% to 63%
	3. I do not enjoy life because of the conditions caused by COVID-19.	0.649	Medium	36% to 63%
	4. I feel I can do nothing to overcome the conditions caused by COVID-19.	0.823	Strong	64% to 81%
	5. I feel worthless after the conditions caused by COVID-19.	0.763	Medium	36% to 63%
	6. Due to the current conditions caused by COVID-19, I do not have enough energy to do my daily tasks.	0.760	Medium	36% to 63%
	7. I feel that this disease is the result of the bad deeds of human beings for which they are punished.	0.800	Strong	64% to 81%
	8. I have difficulty concentrating due to COVID-19 conditions.	0.859	Strong	64% to 81%
Obsessive-compulsive disorder	9. During COVID-19, my work is delayed because I repeat everything too much.	0.679	Medium	36% to 63%
	10. I have unpleasant thoughts about COVID-19 that I cannot get rid of.	0.645	Medium	36% to 63%
	11. Under the influence of COVID-19-related news, I get upset even if someone accidentally hits me.	0.669	Medium	36% to 63%
	12. The outbreak of COVID-19 has affected my washing and cleaning.	0.498	Weak	Less than 35%
	13. During COVID-19, I have been more meticulous in all matters than in the past, and I pay attention to every detail.	0.672	Medium	36% to 63%
	14. I am worried and upset about contact with germs and diseases.	0.653	Medium	36% to 63%
	15. During COVID-19, I spend more time checking things and objects than before.	0.690	Medium	36% to 63%
	16. In this situation, I try to do my things very carefully and without the slightest mistake.	0.643	Medium	36% to 63%
Anxiety	17. I feel numbness and paresthesia in my body.	0.736	Medium	36% to 63%
	18. I'm afraid of the consequences of COVID-19 and getting it.	0.754	Medium	36% to 63%
	19. I feel more nervous during COVID-19 than before.	0.804	Strong	64% to 81%
	20. I feel terrified because of the risk of death from this disease.	0.774	Medium	36% to 63%
	21. I feel that, during COVID-19, I lost control of my life.	0.773	Medium	36% to 63%
	22. I have less desire to live due to deaths from COVID-19.	0.759	Medium	36% to 63%
	23. With the negative news that is spread about this disease, I can hardly keep calm.	0.853	Strong	64% to 81%
	24. With the emergence of COVID-19, I have palpitations and shortness of breath.	0.669	Medium	36% to 63%
Adjustment disorders	25. I am tired of the situation and I feel a lack of energy.	0.690	Medium	36% to 63%
	26. I take more drugs than before.	0.747	Medium	36% to 63%
	27. I engage in behaviors that others find dangerous and unusual.	0.758	Medium	36% to 63%
	28. I was absent from work or the places I needed to be.	0.793	Medium	36% to 63%
	29. I am worried.	0.765	Medium	36% to 63%
	30. I experience anxiety and stress.	0.810	Strong	64% to 81%
	31. I feel my heart beat too fast or too slow.	0.729	Medium	36% to 63%
	32. Sometimes I cry.	0.794	Medium	36% to 63%
Eating disorders	33. I am scared of gaining weight these days.	0.870	Strong	64% to 81%
	34. I eat slowly due to my mental preoccupation with the illness.	0.857	Strong	64% to 81%
	35. Most of my activities these days are eating and thinking about it.	0.697	Medium	36% to 63%
	36. In the days of COVID-19, I pay more attention to the calorie content of the foods I eat.	0.758	Medium	36% to 63%
	37. I take small bites when eating.	0.798	Medium	36% to 63%
	38. I try to eat less nutritious foods so that fewer calories enter my body.	0.747	Medium	36% to 63%
	39. I like my stomach to be empty.	0.765	Medium	36% to 63%
	40. When I see different foods, I cannot help overeating.	0.663	Medium	36% to 63%
Sleep disorders	41. I cannot wake up at the appointed time.	0.639	Medium	36% to 63%
	42. I prefer to sleep instead of waking up and thinking about illness.	0.790	Medium	36% to 63%
	43. On workday mornings, I try to sleep more than on normal days.	0.774	Medium	36% to 63%
	44. Feeling tired, restless, and stressed makes me sleepy.	0.779	Medium	36% to 63%
	45. Drowsiness makes it difficult for me to concentrate and memorize things. Memorization	0.723	Medium	36% to 63%
	46. I take naps many times during the day.	0.641	Medium	36% to 63%
	47. These days I fall asleep while watching TV and the news.	0.779	Medium	36% to 63%
	48. I fall asleep easily after eating.	0.698	Medium	36% to 63%
Illness anxiety	49. I keep thinking about getting COVID-19.	0.443	Weak	Less than 35%
	50. I am worried about my health.	0.529	Weak	Less than 35%
	51. In relation to my health, I show behaviors that are considered extreme by others.	0.469	Weak	Less than 35%
	52. I have seen my doctor one or more times and found that I have no particular problem.	0.423	Weak	Less than 35%
	53. I constantly think that I may have COVID-19 but the doctor is not able to diagnose it.	0.544	Weak	Less than 35%
	54. My concern for my health has prevented me from interacting with others.	0.414	Weak	Less than 35%
	55. With symptoms such as redness, cough, etc. I think I have COVID-19.	0.256	Very low	Less than 15%
	56. I think I am sick, but others cannot understand it.	0.389	Very low	Less than 15%

Table 3. Continued.

Scale	Item			
	57. I feel restless under the conditions of quarantine.	0.809	Strong	64% to 81%
	58. I feel emptier and more bored during COVID-19 than before.	0.890	Strong	64% to 81%
	59. I feel anger and hatred due to the death of my friends and acquaintances based on COVID-19.	0.894	Strong	64% to 81%
	60. During COVID-19, I faced sleep disorders.	0.872	Strong	64% to 81%
Grief	61. During COVID-19, I have impaired attention and memory.	0.847	Strong	64% to 81%
	62. I constantly think of people who have died due to COVID-19.	0.900	Relatively complete	Greater than 82%
	63. Due to the conditions caused by COVID-19, I have lost the desire to continue living.	0.944	Relatively complete	Greater than 82%
	64. I try to avoid things that remind me of COVID-19 death.	0.796	Medium	36% to 63%

Table 4. Cronbach's alpha coefficients for the scales of the questionnaire

Scale	Related items	Cronbach's alpha coefficient	Internal consistency rate
Depression	1-8	0.831	Good
Obsessive-compulsive disorder	9-16	0.843	Good
Anxiety	17-24	0.886	Good
Adjustment disorders	25-32	0.746	Good
Eating disorders	33-40	0.701	Acceptable
Sleep disorders	41-48	0.742	Acceptable
Illness anxiety	49-54	0.842	Good
Grief	57-64	0.931	Excellent
Whole questionnaire	1-54,56-64	0.965	Excellent

4.1.3. Inter-rater reliability

The most common measure to check the inter-rater reliability is Cronbach's alpha coefficient, which is calculated as follows (23):

$$\alpha = \frac{N\bar{v}}{\overline{S^2} + (N-1)\bar{v}},$$

where,

N: Number of items

$\bar{v}$: Average covariance between all pairs of items

$\overline{S^2}$: Mean variances of all items.

The closer an Alpha is to one, the higher consistency is between the items, meaning greater inter-rater reliability.

Cronbach's alpha coefficient for each scale of the questionnaire was greater than 0.7. Therefore, the internal consistency between the questionnaire items was acceptable. Alpha coefficients for the scales of the questionnaire are reported in Table 4.

4.2. Phase II

In this phase, we selected 98 new samples to investigate the reliability of the final questionnaire, which contained the remaining 55 items from Phase I. It should be noted that the same protocols of Phase I were observed in Phase II.

4.2.1. Confirmatory factor analysis for the final questionnaire

The structure validity of the final questionnaire with 7 scales and 55 items was confirmed using second-order CFA. The results of the CFA model and its goodness of fit indices are presented in Tables 5

Table 5. Loading factors (standardized coefficients) of the scales of the questionnaire

Scale	Items							
Depression	Item 1 1.000	Item 2 0.637	Item 3 0.831	Item 4 1.041	Item 5 0.687	Item 6 1.222	Item 7 1.142	Item 8 1.173
Obsessive-compulsive disorder	Item 9 1.000	Item 10 0.892	Item 11 0.670	Item 13 0.993	Item 14 1.084	Item 15 0.318	Item 16 0.518	
Illness anxiety	Item 17 1.000	Item 18 1.045	Item 19 0.952	Item 20 0.811	Item 21 1.062	Item 22 0.779	Item 23 1.050	Item 24 0.791
Adjustment disorders	Item 25 1.000	Item 26 0.851	Item 27 0.452	Item 28 0.415	Item 29 1.519	Item 30 1.544	Item 31 0.962	Item 32 0.921
Eating disorders	Item 33 1.000	Item 34 0.750	Item 35 1.359	Item 36 1.100	Item 37 0.392	Item 38 0.705	Item 39 0.631	Item 40 0.419
Sleep disorders	Item 41 1.000	Item 42 1.212	Item 43 1.511	Item 44 0.981	Item 45 0.875	Item 46 1.772	Item 47 0.988	Item 48 1.413
Grief	Item 57 1.000	Item 58 0.851	Item 59 1.053	Item 60 0.513	Item 61 0.833	Item 62 1.020	Item 63 0.642	Item 64 0.990
Total	Depression	Obsessive-compulsive disorder	Illness anxiety	Adjustment disorders	Eating disorders	Sleep disorders	Grief	
	1.000	0.982	0.950	0.877	0.658	0.591	1.023	

Table 6. Goodness of fit indices for the second-order confirmatory factor analysis

Chi-square/df	RMSEA	SRMR	CFI	TLI
2.205	0.084	0.073	0.929	0.942

RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square residual: CFI: Comparative fit index; TLI**:** Tucker-Lewis index
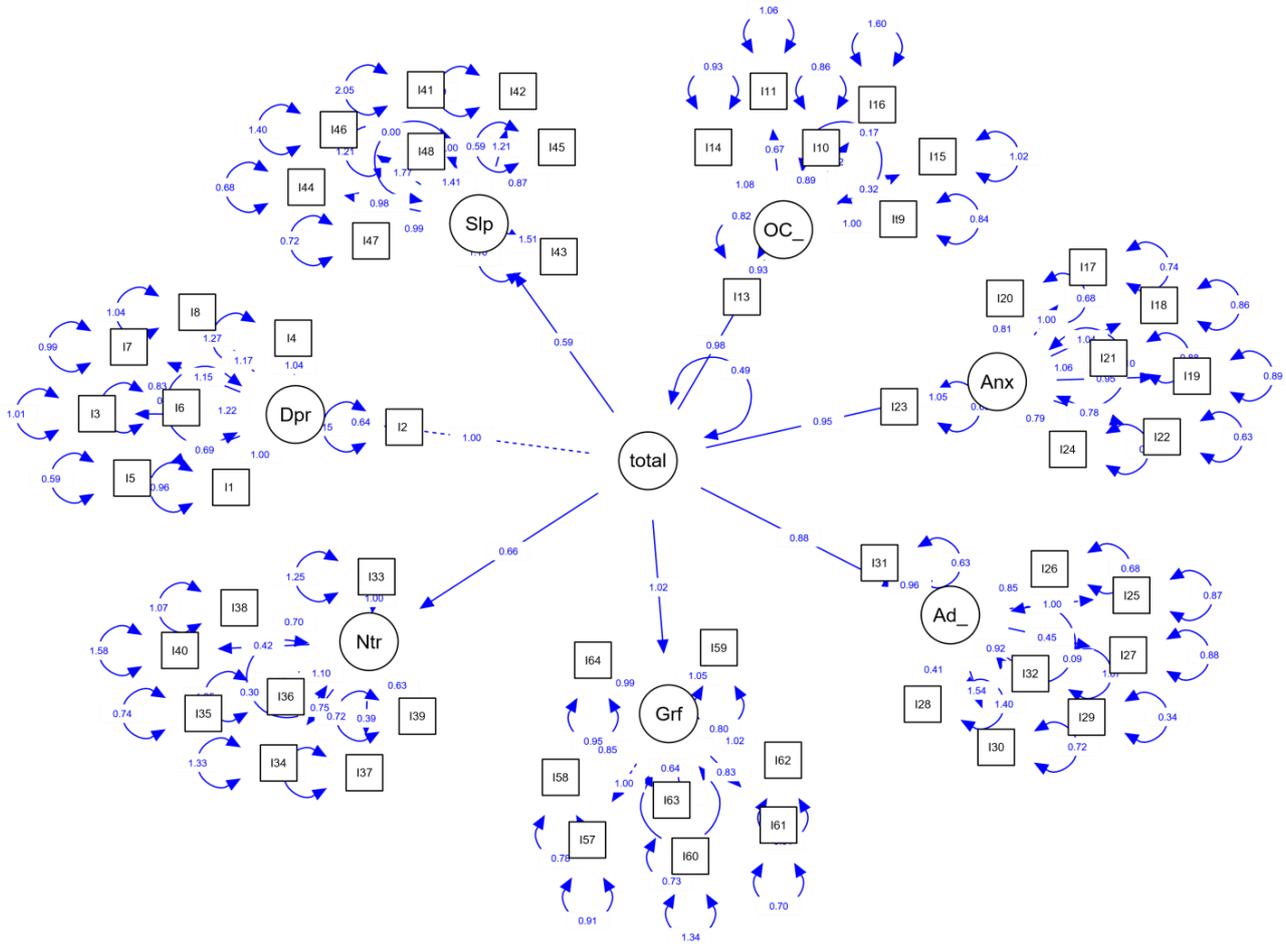
Figure 2. Path diagram of the secondary confirmatory factor analysis for the final questionnaire (Phase II)

and Table 6, respectively. Furthermore, the path diagram of the CFA for the last questionnaire is illustrated in Figure 2. The results indicated that all the items were reliable. It results in establishing the structure validity of the final questionnaire.

Cronbach's alpha coefficient for every seven scales of the final questionnaire was greater than 0.7. Therefore, the internal consistency between the questionnaire items was acceptable. Alpha

coefficients of the questionnaire scales are reported in Table 7.

4.3. Intra-rater reliability

To evaluate the intra-rater reliability of the questionnaire, we compared the results of the final questionnaire with those of the Coronavirus Anxiety Scale (CAS) (24), Adjustment Disorder-New Module 20 (25), a short version of the Perinatal

Table 7. Cronbach's alpha coefficients for the questionnaire scales

Scale	Related items	Cronbach's alpha coefficient	Internal consistency rate
Depression	1-8	0.835	Good
Obsessive-compulsive disorder	9-11,13-16	0.808	Good
Illness anxiety	17-24	0.876	Good
Adjustment disorders	25-32	0.781	Acceptable
Eating disorders	33-40	0.707	Acceptable
Sleep disorders	41-48	0.724	Acceptable
Grief	57-64	0.905	Excellent
Whole questionnaire	1-54,56-64	0.941	Excellent

Table 8. Relative and absolute reliability for the questionnaire scales

Scale	Standard tools	Corresponding items	mean±SD		Relative and absolute reliability		Absolute agreement rate
			Final questionnaire scores	Standard scores	ICC	MDC	
Depression	CAS (22)	1-8	1.03±0.791	1.13±0.669	0.931	0.750	Excellent
Obsessive-compulsive disorder	YOCS (25)	9-11, 13-16	1.28±0.778	1.58±0.683	0.953	0.769	Excellent
Illness anxiety	CAS (22)	17-24	0.97±0.820	0.49±0.730	0.964	0.510	Excellent
Adjustment disorders	ADNM-20 (23)	25-32	1.13±0.711	0.76±0.626	0.925	0.858	Excellent
Eating disorders	CAS (22)	33-40	0.76±0.659	1.16±0.530	0.911	0.628	Excellent
Sleep disorders	CAS (22)	41-48	1.57±0.711	1.75±0.657	0.932	1.135	Excellent
Grief	PGS (24)	57-64	1.30±1.239	1.47±1.098	0.948	0.722	Excellent

CAS: Coronavirus Anxiety Scale; YOCS: Yale-Brown Obsessive Compulsive Scale; ADNM-20: Adjustment Disorder-New Module 20; PGS: Pandemic Grief Scale

Grief Scale (PGS) (26), and Yale-Brown Obsessive Compulsive Scale (YOCS) (27). The individuals' scores in each scale of the questionnaire as well as the standard scores based on CAS, ADNM, PGS, and YOCS were calculated. The individuals' scores on each scale were measured as the mean scores of the items related to the corresponding scale. Afterward, the relative reliability and absolute reliability were obtained using a two-way mixed-effects model of intraclass correlation coefficient (ICC) and minimal detectable change (MDC) (28). The ICC provides a value to determine the absolute agreement between individuals' scores calculated by the final questionnaire and standard scores for each scale. The closeness of this value to one represents a higher agreement between the results obtained for the pre-test and post-test. Additionally, MDC is a function of ICC and is defined as follows (29):

$$MDC = sd \times 1.96 \times \sqrt{2(1-ICC)}$$

A smaller MDC is indicative of a more accurate and sensitive measuring instrument.

According to Table 8, ICCs for each scale of the questionnaire were greater than 0.75. Therefore, the absolute agreement between the questionnaire scales was at a good level, and the relative reliability of the data extracted from the questionnaire was good. Furthermore, since the MDC for all scales was small, the absolute reliability of the questionnaire was good.

Scales to measure the sensitivity and specificity of the components.

4.4. Receiver operating characteristic

Receiver operating characteristic curves were plotted to determine the accuracy of the final questionnaire as a screening tool for the assessment of psychological symptoms associated with COVID-19.

The scores of each scale were expressed as the mean of their corresponding items, which ranged from 1 to 5. Considering this, we set the cut-off point equal to the median score (i.e., 2.5) for all the scales in calculating sensitivity and specificity. In other words, an individual with a score greater than 2.5 on a scale was considered a person who had some issues on that scale. Furthermore, the final score could be calculated as the mean scores of all the scales and so the median score (i.e., 2.5) could be determined as the cut-off point. Similarly, an individual whose final score was greater than 2.5 had psychological symptoms.

As presented in Table 9, a score of 2.5 in the final questionnaire optimally classified participants, for example, as having (91.1% sensitivity) or lacking (92.4% specificity) dysfunctional levels of depression. Furthermore, the proposed questionnaire could categorize participants as having (94.2% sensitivity) or lacking (91.5% specificity) psychological symptoms.

The ROC curves for each scale of the final questionnaire are displayed in Figure 3. Since the area under the curve is near 1, the accuracy of the questionnaire was very good. These results reinforce the use of this questionnaire as a screening tool with diagnostically accurate psychological symptoms related to COVID-19 and strong classification features.

Table 9. Sensitivity and specificity of the questionnaire scales (cut-off point=2.5)

Scale	Depression	Obsessive-compulsive disorder	Illness anxiety	Adjustment disorders	Eating disorders	Sleep disorders	Grief
Sensitivity	0.911	0.985	0.906	0.944	0.953	0.963	0.930
Specificity	0.924	0.903	0.971	0.968	0.909	0.795	0.935
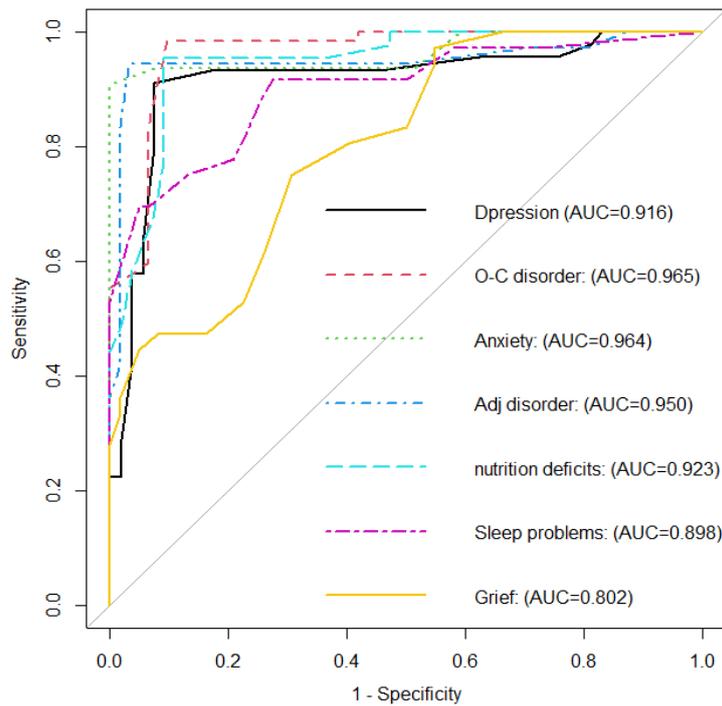
Figure 3. Receiver operating characteristic curve for the scales of the final questionnaire

5. Discussion

Given that fear and anxiety caused by the prevalence of possible illness create a high and destructive psychological strain that can lead to the development of mental disorders, weakness of the immune system, and a reduction in the body's ability to fight disease (30). Assessing psychological symptoms associated with COVID-19 in medical personnel and other workers can enhance our understanding of healthcare workers' mental health needs in COVID-19 or other epidemic situations (31). Therefore, in the present study, it was attempted to create and standardize a valid and reliable test for screening and evaluating mental disorders in people exposed to COVID-19; therefore, such a tool can be used to diagnose and treat related disorders as soon as possible.

For this purpose, first, the items were designed, and then, to determine the content validity of the test, the designed items were given to seven psychologists and counselors and edited using the Delphi method in several stages. Finally, a questionnaire with 64 items was obtained. The prepared questionnaire was utilized to measure the status of individuals on seven scales, namely obsessive-compulsive disorder, anxiety, adjustment disorders, eating disorders, sleep disorders, anxiety disorders (physical symptoms), and grief disorders. In addition, three types of reliability (test-retest, intra-rater, and inter-rater) were applied to determine the reliability of the questionnaire. The test-

retest reliability method based on Cohen's kappa coefficients showed no reliability of items 12 and 49-54, therefore, these items were removed from the final questionnaire. The structure validity of the final questionnaire with 7 scales and 55 items was confirmed using second-order CFA.

The result of inter-rater reliability indicated that the consistency agreement between the questionnaire items and the relative reliability of the data extracted from the final questionnaire were good. In addition, the result of Cronbach's alpha coefficients for each scale of the questionnaire showed that the internal consistency between the questionnaire items was acceptable. Finally, ROC curves determined that the final questionnaire was an accurate tool for the assessment of psychological symptoms associated with COVID-19.

Although there is little research on the comprehensive assessment of mental health associated with COVID-19 in medical personnel, the results of this research were partially in line with those of research that aimed to measure each component of the mental disorders associated with COVID-19 as separate factors. For instance, in a study conducted by Nikopoulou et al. (32) to develop and evaluate the properties of the CAS, which is a brief mental health screener to identify probable cases of dysfunctional anxiety associated with the COVID-19 crisis, it has been reported that this scale has significant predictive power for anxiety, health anxiety, and posttraumatic stress symptoms. In

addition, considering that one of the components of the screening tool resulting from the present study was adjustment disorders, in line with this component, researchers have shown that psychological inflexibility plays a mediating role in the effect of fear of COVID-19 on the psychological adjustment skills of healthcare professionals (33). The findings of another study have demonstrated that healthcare workers who are exposed to COVID-19-infected patients at emergency wards, infectious wards, and intensive care units are at a much higher risk of showing symptoms of anxiety, depression, and sleep disorders than their peers working in other wards (34). In addition, in agreement with the grief component identified in this research, Lee and Neimeyer (35) conducted research to develop and examine the properties of the Pandemic Grief Scale (PGS), which is a brief mental health screener to identify probable cases of dysfunctional grief associated with a COVID-19 death. The result of their study revealed that PGS is an efficient and valid screening tool for clinical research and practice during a pandemic. In the explanation of dysfunctional grief during the pandemic period, researchers have shown that experiencing more than one death in a short period can create an overload of grief that impairs one's ability to cope (36). Among medical personnel facing the deaths of patients, psychological grief reactions, such as thinking about the patient, feelings of helplessness, crying or despondency, disbelief or shock, difficulty concentrating, anger, and anxiety, often persist for more than 1 month and may warrant professional intervention (37).

Overall, due to the lack of a comprehensive tool for screening the psychological symptoms of medical staff during epidemics, on the one hand, and due to the confirmation of the psychometric indicators of the tool introduced in this research on the other hand, it is suggested that researchers and therapists use this tool to screen the psychological symptoms of medical personnel in the conditions of epidemics.

6. Conclusion

According to the results of the validity, reliability, and accuracy of the final questionnaire, it can be said that this questionnaire has good psychometric properties. Therefore, it can be an accurate tool to screen and evaluate mental disorders caused by the epidemic of COVID-19. However, because this study was conducted only on medical personnel, it is recommended to be cautious in using this tool for other groups and the general population.

Acknowledgments

Footnotes

Conflicts of Interest: The authors report no actual or potential conflicts of interest.

Ethical statements: This study was approved by the Ethics Committee of Ardabil University of Medical Sciences in the 2021-3-1- years with the ethics code of IR.ARUMS.REC.1400.044. To comply with the ethical considerations of research, the research objectives were explained and participants were ensured that their information would remain confidential. Afterward, those who were willing to take part in the study completed informed consent and agreement forms. Participants were also informed of the possibility of withdrawing the research at any time. The research was performed based on respecting the rights of the participants, anonymity, and confidentiality.

References

1. Grover S, Sahoo S, Mehra A, Avasthi A, Tripathi A, Subramanyan A, et al. Psychological impact of COVID-19 lockdown: an online survey from India. *Indian J Psychiatry*. 2020;**62**(4):354. doi: 10.4103/psychiatry.indianJPsychiatry_427_20. [PubMed: 33165368].
2. Ustun G. Determining depression and related factors in a society affected by COVID-19 pandemic. *Int J Soc Psychiatry*. 2021;**67**(1):54-63. doi: 10.1177/0020764020938807. [PubMed: 32605422].
3. Lee SA. Coronavirus anxiety scale: a brief mental health screener for COVID-19 related anxiety. *Death Stud*. 2020;**44**(7):393-401. doi: 10.1080/07481187.2020.1748481. [PubMed: 32299304].
4. Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *Gen Psychiatr*. 2020;**33**(2):e100213. doi: 10.1136/gpsych-2020-100213. [PubMed: 32215365].
5. Ausín B, González-Sanguino C, Castellanos MÁ, Muñoz M. Gender-related differences in the psychological impact of confinement as a consequence of COVID-19 in Spain. *J Gend Stud*. 2021;**30**(1):29-38. doi: 10.1080/09589236.2020.1799768.
6. Vadivel R, Shoib S, El Halabi S, El Hayek S, Essam L, Bytyçi DG, et al. Mental health in the post-COVID-19 era: challenges and the way forward. *Gen Psychiatr*. 2021;**34**(1):e100424. doi: 10.1136/gpsych-2020-100424. [PubMed: 33644689].
7. Tang F, Liang J, Zhang H, Kelifa MM, He Q, Wang P. COVID-19 related depression and anxiety among quarantined respondents. *Psychol Health*. 2021;**36**(2):164-78. doi: 10.1080/08870446.2020.1782410. [PubMed: 32567952].
8. Shah K, Kamrai D, Mekala H, Mann B, Desai K, Patel RS. Focus on mental health during the coronavirus (COVID-19) pandemic: applying learnings from the past outbreaks. *Cureus*. 2020;**12**(3):e7405. doi: 10.7759/cureus.7405. [PubMed: 32337131].
9. Bao Y, Sun Y, Meng S, Shi J, Lu L. 2019-nCoV epidemic: address mental health care to empower society. *Lancet*. 2020;**395**(10224):37-8. doi: 10.1016/S0140-6736(20)30309-3. [PubMed: 32043982].
10. Chen Q, Liang M, Li Y, Guo J, Fei D, Wang L, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry*. 2020;**7**(4):15-6. doi: 10.1016/S2215-0366(20)30078-X. [PubMed: 32085839].
11. Ryu S, Chun BC, of Epidemiology KS. An interim review of the epidemiological characteristics of 2019 novel

coronavirus. *Epidemiol Health*. 2020;**42**:e2020006. doi: 10.4178/epih.e2020006. [PubMed:32023775].

12. Tian F, Li H, Tian S, Yang J, Shao J, Tian C. Psychological symptoms of ordinary Chinese citizens based on SCL-90 during the level I emergency response to COVID-19. *Psychiatry Res*. 2020;**288**:112992. doi: 10.1016/j.psychres.2020.112992. [PubMed: 32302816].

13. Wang Q, Xu R, Volkow ND. Increased risk of COVID-19 infection and mortality in people with mental disorders: analysis from electronic health records in the United States. *World Psychiatry*. 2021;**20**(1):124-30. doi: 10.1002/wps.20806. [PubMed: 33026219].

14. Sarailoo M, Matin S, Vosoughi M, Dargahi A, Gholizadeh H, Damavandi MR, et al. Investigating the relationship between occupation and SARS-CoV2. *Work*. 2021;**68**(1):27-32. doi: 10.3233/WOR-205066. [PubMed: 33459683].

15. Alalawi M, Makhlouf M, Hassanain, O, Abdelgawad AA, Nagy M. Healthcare workers' mental health and perception towards vaccination during COVID-19 pandemic in a pediatric cancer hospital. *Sci Rep.* 2023;**13**(1):329. doi: 10.1038/s41598-022-24454-5. [PubMed: 36609572].

16. Scott HR, Stevelink SA, Gafoor R, Lamb D, Carr E, Bakolis I, et al. Prevalence of post-traumatic stress disorder and common mental disorders in health-care workers in England during the COVID-19 pandemic: a two-phase cross-sectional study. *Lancet Psychiatry*. 2023;**10**(1):40-9. doi: 10.1016/S2215-0366(22)00375-3. [PubMed: 36502817].

17. Antonijevic J, Binic I, Zikic O, Manojlovic S, Tosic-Golubovic S, Popovic N. Mental health of medical personnel during the COVID-19 pandemic. *Brain Behav*. 2020;**10**(12):e01881. doi: 10.1002/brb3.1881. [PubMed:33070475].

18. Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic–A review. *Asian J psychiatry*. 2020;**51**:102119. doi: 10.1016/j.ajp.2020.102119. [PubMed: 32339895].

19. Moradi MH, Khademi R. Covid-19 & Psychopathology: drawing the scientific map of international researches in the web of science citation databases. *J Clin Psychol.* 2021;**13**(2):23-32.

20. Damirchi ES, Mojarrad A, Pireinaladin S, Grjibovski AM. The role of self-talk in predicting death anxiety, obsessive-compulsive disorder, and coping strategies in the face of coronavirus disease (COVID-19). *Iranian J psychiatry*. 2020;**15**(3):182-8. doi: 10.18502/ijps.v15i3.3810. [PubMed: 33193766].

21. Zandian H, Sarailoo M, Dargahi S, Gholizadeh H, Dargahi A, Vosoughi M. Evaluation of knowledge and health behavior of university of medical sciences students about the prevention of COVID-19. *Work*. 2021;**68**(3):543-9. doi: 10.3233/WOR-203395. [PubMed: 33612505].

22. Keith TZ. Multiple regression and beyond: An introduction to multiple regression and structural equation modeling. *Routledge*; 2014.

23. Cohen J. A coefficient of agreement for nominal scales. *Educ Psychol Meas.*1960;**20**(1):37-46. doi: 10.1177/001316446002000104.

24. Lee SA. Coronavirus Anxiety Scale: A brief mental health screener for COVID-19 related anxiety. *Death stud*. 2020;**44**(7):393-401. doi: 10.1080/07481187.2020.1748481. [PubMed: 32299304]

25. Lorenz L, Bachem RC, Maercker A. The adjustment disorder–new module 20 as a screening instrument: Cluster analysis and cut-off values. *Int J Occup Environ Med*. 2016;**7**(4):215-20. doi: 10.15171/ijoem.2016.775. [PubMed: 27651082].

26. Potvin L, Lasker J, Toedter L. Measuring grief: a short version of the perinatal grief scale. *J Psychopathol Behav Assess*. 1989;**11**(1):29-45. doi: 10.1007/BF00962697.

27. Woody SR, Steketee G, Chambless DL. Reliability and validity of the Yale-Brown obsessive-compulsive scale. *Behav Res Ther*. 1995;**33**(5):597-605. doi: 10.1016/0005-7967(94)00076-v. [PubMed: 7598684].

28. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. *Psychol Bull*. 1979;**86**(2):420-8. doi: 10.1037//0033-2909.86.2.420. [PubMed: 18839484].

29. Weir JP. Quantifying test-retest reliability using the intraclass correlation coefficient and the SEM. *J Strength Cond Res*. 2005.**19**(1):231-40. doi: 10.1519/15184.1. [PubMed: 15705040].

30. Anderson RM, Heesterbeek H, Klinkenberg D, Hollingsworth TD. How will country-based mitigation measures influence the course of the COVID-19 epidemic? *Lancet*. 2020;**395**(10228):931-4. doi: 10.1016/S0140-6736(20)30567-5. [PubMed: 32164834].

31. Mrklas K, Shalaby R, Hrabok M, Gusnowski A, Vuong W, Surood S, et al. Prevalence of perceived stress, anxiety, depression, and obsessive-compulsive symptoms in health care workers and other workers in Alberta during the COVID-19 pandemic: cross-sectional survey. *JMIR Mental Health*. 2020;**7**(9):e22408. doi: 10.2196/22408. [PubMed: 32915764].

32. Nikopoulou VA, Holeva V, Parlapani E, Karamouzi P, Voitsidis P, Porfyri GN, et al. Mental health screening for COVID-19: A proposed cutoff scores for the Greek version of the Fear of COVID-19 Scale (FCV-19S). *Int J Ment Health Addict*. 2020;1-14. doi: 10.1007/s11469-020-00414-w. [PubMed: 33199975].

33. Seçer İ, Ulaş S, Karaman-Özlü Z. The effect of the fear of COVID-19 on healthcare professionals' psychological adjustment skills: mediating role of experiential avoidance and psychological resilience. Front Psychol. 2020;11:561536. doi: 10.3389/fpsyg.2020.561536. [PubMed:33192830].

34. Wańkowicz P, Szylińska A, Rotter I. Assessment of mental health factors among health professionals depending on their contact with COVID-19 patients. *Int J Environ Res Public Health*. 2020;**17**(16):5849. doi: 10.3390/ijerph17165849 . [PubMed: 32806699].

35. Lee SA, Neimeyer RA. Pandemic Grief Scale: A screening tool for dysfunctional grief due to a COVID-19 loss. *Death Stud*. 2022; **46**(1):14-2. doi: 10.1080/07481187.2020.1853885. [PubMed: 33349159].

36. Caycho-Rodríguez T, Vilca LW, Vivanco-Vidal A, Saroli-Araníbar D, Carbajal-León C, Gallegos WL, et al. Assessment of dysfunctional grief due to death from COVID-19 in Peru: adaptation and validation of a Spanish version of the pandemic grief scale. *Trends in Psychol*. 2021;**29**(4):595-616. doi: 10.1007/s43076-021-00091-1.

37. Rabow MW, Huang CH, White-Hammond GE, Tucker RO. Witnesses and victims both: Healthcare workers and grief in the time of COVID-19. *J Pain Symptom Manage*. 2021;**62**(3):647-56. doi: 10.1016/j.jpainsymman.2021.01.139. [PubMed: 33556494].