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# Development and validation of English version of COVID-19 Depression Scale for health-care workers

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## Abstract:

**BACKGROUND:** Health-care workers (HCWs) are highly vulnerable to depression during an epidemic outbreak. Protecting the mental well-being of HCWs is a priority while battling with COVID-19. However, documentation on COVID-19-related depression among HCWs is scarce due to the limited availability of measuring scales. Hence, this study was purposed to develop a scale to measure depression relating to COVID-19 and evaluate its psychometric properties among HCWs.

**MATERIALS AND METHODS:** A validation study was carried out among 320 HCWs including physicians of various medical specialties, dental specialists, and nurses in the year 2020. Exploratory factor analysis using Promax rotation with Kaiser normalization for the determination of factor structure was employed in data analysis using SPSS version 16 software.

**RESULTS:** COVID-19 Depression Scale for HCWs (CDS-HW) demonstrated a two-component structure identified as “work-related anxiety” and “psychological distress.” The mean CDS-HW score of the study participants was observed to be  $23.67 \pm 2.82$ , and the scale demonstrated good internal consistency reliability (Cronbach’s alpha: 0.741).

**CONCLUSION:** CDS-HW is a rapidly administrable, valid, and reliable tool that can be used to measure COVID-19-related depression among HCWs.

## Keywords:

Anxiety, factor analysis, health personnel, health-care provider, stress, validation

## Introduction

The outbreak of coronavirus disease-19 (COVID-19) is declared as a pandemic by the World Health Organization (WHO) on March 11, 2020.<sup>[1]</sup> As of October 16, there were nearly 7.55 million cases reported from India alone.<sup>[2]</sup> People tend to experience anxiety, stress, and depression, during times of an epidemic.<sup>[3]</sup> The World Health Organization has also issued public interest guidelines to address psychological issues that may arise.<sup>[4]</sup>

Across the world, the COVID-19 pandemic has been a challenge for frontline health-care workers (HCWs). The literature on various epidemic outbreaks reveals that the sudden onset of any life-threatening disease lands overwhelming pressure on HCWs, which, in turn, affects their physical and mental health.<sup>[5]</sup> During the Ebola outbreak, a Chinese study reported extreme depression and anxiety, among HCWs.<sup>[6]</sup> A study from Saudi Arabia reported that HCW felt unsafe at the workplace during the MERS outbreak.<sup>[7]</sup> Adding to this, their mental well-being can be further compromised

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by stigmatization, uncertainty, and risk of infections of friends and family members.<sup>[6-8]</sup> Therefore, HCWs are highly vulnerable to depression during these catastrophic times.

Many psychological assistance services, including telephone and application-based counseling, have been widely deployed by various nations in response to the COVID-19 outbreak for the general population. Furthermore, there are many clinician-rated and self-rated scales that are developed to measure depression.<sup>[8]</sup> However, evidence-based evaluations targeting front-line HCWs are relatively scarce. Hence, the purpose of this study was to develop and validate a scale to measure depression relating to COVID-19 and evaluate its psychometric properties among HCWs.

## Materials and Methods

### Study setting and type

A validation study was carried out during August and September 2020 among HCWs belonging to Pondicherry, India.

### Sampling and sample size

A simple random sampling was done to select five colleges out of nine health-care-related colleges in Pondicherry. After obtaining permission from the head of the institutions, the questionnaire was circulated through the official WhatsApp group of the selected institutions. Participants who met the following criteria were included (1) hospital staff involved in patient care and (2) volunteered for the survey. Participants could submit survey responses using the same IP address only once. A sample size of more than 300 was graded as good by Comrey and Lee.<sup>[9]</sup> We obtained a total of 328 responses of which only 320 were filled and included for the analysis. The incomplete forms were excluded from the analysis.

### Ethical consideration

The protocol was approved by the Institutional Ethical Committee of Sri Balaji Vidyapeeth, Pondicherry, India (IGIDS/2020/24). All subjects provided informed consent to participate in the study. To protect the respondents' privacy, the survey was conducted anonymously.

### Study tool

Various measures related to depression were reviewed before generating the item pool. Twelve items were formulated by the primary investigator and further reviewed by other investigators to assess face and content validity. All the items were formulated as a 5-point Likert-type scale for response options which ranged from 1 = I strongly agree to 5 = I strongly

disagree. An expert group workshop was conducted with six professionals in various fields of the health-care sector including one physician, two nurses, and three dentists. They were asked to examine the pool of 12 items concerning content, format, and scaling and to suggest improvements and reduction of items. The scale level inter-rater agreement was assessed using the intraclass correlation coefficient (ICC). ICC was found to be 0.91 for the 12-item scale. In addition, a sample of 10 HCWs was asked to fill in the questionnaire and to give feedback on the clarity and readability. The 12-item questionnaire was regarded as satisfactory by all the subjects and no further refinements were performed.

### Assessment of item-total correlations and internal consistency reliability

Item total correlations (ITCs) were analyzed to purify the measure by eliminating garbage items. According to Cristobal *et al.*, the items with corrected ITCs lower than 0.30 are not acceptable.<sup>[10]</sup> Internal consistency reliability of the scale was assessed using Cronbach's alpha and values above 0.7 were considered satisfactory.

### Determination of factor structure

Kaiser–Meyer–Olkin (KMO) test of sampling adequacy and Bartlett's test of sphericity were applied. The KMO compares the observed correlation coefficients to the partial correlation coefficients, which range from 0 to 1, where a value <0.6 is unacceptable.<sup>[9]</sup> Bartlett's test of sphericity tests the null hypothesis that the correlation matrix is an identity matrix, which indicates no relationship among the items. A significant result is desired for Bartlett's test of sphericity.<sup>[9]</sup> For the current study, the eigenvalue greater-than-one rule and the scree plot strategies were used to determine the number of the factors to extract. Principal axis factoring (PAF) seeks to identify and predict the least number of factors that can account for the common variance (correlation) of a set of variables. The current study aims at extracting the least number of factors that account for depression among HCWs. Hence, PAF was determined to be the appropriate factor-extraction method for the current study. An oblique rotation was chosen as we assumed that there would be a correlation between the factors (as they are supposed to assess different aspects of the depression construct). After rotation, items with the loading of at least 0.35 were considered to load significantly onto a particular factor.<sup>[10]</sup>

### Statistical analysis

The collected data were analyzed using the Statistical Package for the Social Sciences version 21.0 (IBM Corp, Chicago, IL, USA). Descriptive characteristics (means, standard deviation, and frequencies) were calculated for each item in the scale. The scale level inter-rater agreement was assessed using the intraclass correlation

coefficient. Internal consistency reliability of the scale was assessed using Cronbach’s alpha. KMO test of sampling adequacy and Bartlett’s test of sphericity were applied. Exploratory Factor Analysis (EFA) using Promax rotation with Kaiser normalization for the determination of factor structure was employed in data analysis.

## Results

### Descriptive characteristics

Among 320 HCWs, 106 were physicians of various medical specialties, 110 were dental specialists, and the remaining 104 were nurses. The mean age of the study participants was  $43.02 \pm 4.4$  years. The key characteristics of the study population are described in Table 1. A total of 320 HCWs who were posted in the hospitals during the COVID-19 pandemic completed the questionnaire. Table 2 describes the 10-item COVID-19 depression scale at a categorical level with percentages for each response. The overall mean COVID-19 Depression Scale for HCW (CDS-HW) score of the study participants was observed to be  $23.67 \pm 2.82$ . The highest and lowest mean scores of the COVID-19 depression scale were observed in item 5 (mean =  $3.11 \pm 0.90$ ) and item 3 (mean =  $1.87 \pm 0.87$ ), respectively [Table 3].

### Item-total correlations and internal consistency reliability

Corrected ITCs for ten items on the scale ranged between 0.39 and 0.52, two items with ITC  $<0.3$  were removed [Table 3]. Cronbach’s alpha for the ten-item scale was 0.741 which demonstrates an optimum degree of correlation between the items.

### Factor structure and scale purification

KMO measure of sampling 0.710 indicated that the sample was adequate and significance from Bartlett’s test of sphericity indicated factor analysis as an appropriate technique for further analysis of data. In the EFA, factor extraction resulted in two factors: factor 1 with a significant eigenvalue of 5.668 and factor 2 with an eigenvalue of 1.712 [Figure 1]. The two factors explained 61.4% of the total variance on the COVID-19 Depression Scale item inter-correlations. After rotation of the two-factor solution, items were considered to load on a factor if the rotated factor loading was at least 0.50. The first factor (Factor I) accounting for 47.2% of the scale variance was composed of five items: item 1, item 2, item 3, item 8, and item 10. The second factor (Factor II) accounting for 14.2% of the scale variance consisted of five items: item 4, item 5, item 6, item 7, and item 9. The two-factor solution was validated and an identical factor solution was obtained with high congruence coefficients for each factor: 0.98 (Factor I) and 0.95 (Factor II) [Table 4].

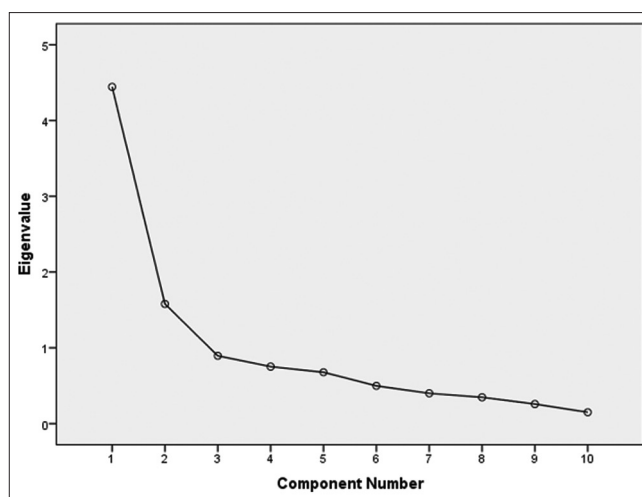


Figure 1: Scree plot

Table 1: Key characteristics of the study population (n=320)

Characteristic	Category	n (%)
Age group (years)	31-40	107 (33.5)
	41-50	131 (40.9)
	51-above	82 (25.6)
Gender	Male	172 (53.8)
	Female	148 (46.2)
Profession	Physicians	106 (33.1)
	Dentists	110 (34.4)
	Nurses	104 (32.5)

### Comparison of factor scores by demographic characteristics

A *post hoc* analysis revealed that nurses had significantly higher scores in Factor I (work-related anxiety) followed by physicians and dentists ( $P = 0.001$ ). Female HCWs presented significantly higher scores in Factor II (psychological distress) in comparison to their male counterparts ( $P = 0.0005$ ). A similar comparison between age groups revealed that HCWs over the age of 50 years presented significantly higher scores in Factor I (work-related anxiety) and Factor II (psychological distress) than those under 50 years ( $P = 0.006$ ).

## Discussion

CDS-HW is a brief, rapidly administrable, 10-item instrument demonstrating face and content validity, internal consistency reliability, structural validity, and test-retest reliability. The two factors extracted from the factor analysis were interpreted, based on the items in each factor, as work-related anxiety (Factor I) and psychological distress (Factor II). A similar study revealed perceived threat and anxiety as the factors contributing to COVID19-related depression among the general population.<sup>[11]</sup> The factor work-related anxiety appears to group the items that reflect typical

**Table 2: Item-level descriptive statistics at a categorical level**

Question	Strongly agree, n (%)	Agree, n (%)	Neutral, n (%)	Disagree, n (%)	Strongly disagree, n (%)
I feel stressed to work even after knowing the consequences of COVID-19 (item 1)	49 (15.2)	207 (64.6)	45 (14.1)	16 (5.1)	3 (1)
I feel hopeless during the management of the COVID-19 pandemic (item 2)	36 (11.1)	167 (52.5)	42 (13.1)	55 (17.2)	20 (6.1)
I'm worried about acquiring COVID from my workplace in this pandemic (Item 3)	48 (15.2)	220 (68.7)	29 (9.1)	6 (2)	16 (5.1)
I have a fear that I might become the reason for the spread of disease among my family members in this pandemic (item 4)	74 (23.2)	184 (57.6)	29 (9.1)	16 (5.1)	16 (5.1)
I feel financial burden during COVID-19 pandemic (item 5)	45 (14.1)	174 (54.5)	61 (19.2)	36 (11.1)	3 (1)
I find it difficult to manage the daily household chores during this pandemic (Item 6)	39 (12.1)	165 (52.5)	55 (17.2)	55 (17.2)	3 (1)
I have lost interest in aspects of life that used to be important to me during this pandemic (item 7)	55 (17.2)	152 (47.5)	45 (14.1)	65 (20.2)	3 (1)
I find it stressful when the public ignores/dislikes my presence due to my profession (item 8)	55 (17.2)	171 (53.5)	29 (9.1)	52 (16.2)	13 (4)
I have less time to spend with family members (item 9)	103 (22.2)	174 (54.5)	16 (5.1)	45 (14.1)	13 (4)
I feel sleep deprived because of increased duty time during this pandemic (item 10)	24 (7.4)	201 (62.8)	27 (8.5)	58 (18.1)	10 (3.2)

COVID-19=Coronavirus disease-2019

**Table 3: Item level descriptive characteristics and item-total correlation estimates (n=320)**

Item	Mean±SD	Corrected item total correlations
I feel stressed to work even after knowing the consequences of COVID-19 (item 1)	2.11±0.77	0.46
I feel hopeless during the management of the COVID-19 pandemic (item 2)	2.50±1.08	0.41
I'm worried about acquiring COVID from my workplace in this pandemic (item 3)	1.87±0.87	0.47
I have a fear that I might become the reason for the spread of disease among my family members in this pandemic (item 4)	2.30±1.00	0.52
I feel a financial burden during the COVID-19 pandemic (item 5)	3.11±0.90	0.39
I find it difficult to manage the daily household chores during this pandemic (item 6)	2.43±0.96	0.43
I have lost interest in aspects of life that used to be important to me during this pandemic (item 7)	2.38±1.03	0.42
I find it stressful when the public ignores/dislikes my presence due to my profession (item 8)	2.28±1.04	0.49
I have less time to spend with family members (item 9)	2.23±1.10	0.44
I feel sleep deprived because of increased duty time during this pandemic (item 10)	2.46±0.98	0.47

SD=Standard deviation

**Table 4: Factor solution of the Coronavirus Disease-2019 Depression Scale for health-care workers**

Factors and items	CC	Factor weights
Factor 1: "Work-related anxiety"	0.98	
Item 1: I feel stressed to work even after knowing the consequences of COVID-19		0.693
Item 2: I feel hopeless during the management of the COVID-19 pandemic		0.801
Item 3: I'm worried about acquiring COVID from my workplace in this pandemic		0.708
Item 8: I find it stressful when the public ignores/dislikes my presence due to my profession		0.647
Item 10: I feel sleep deprived because of increased duty time during this pandemic		0.70
Factor 2: "Psychological distress"	0.95	
Item 4: I have a fear that I might become the reason for the spread of disease among my family members in this pandemic		0.629
Item 5: I feel financial burden during the COVID-19 pandemic		0.826
Item 6: I find it difficult to manage the daily household chores during this pandemic		0.878
Item 7: I have lost interest in aspects of life that used to be important to me during this pandemic		0.821
Item 9: I have less time to spend with family members		0.583

CC=Congruence coefficient, COVID-19=Coronavirus disease-2019

aspects of the anxiety-related work environment such as emotional instability, stress, hopelessness, and sleep deprivation.<sup>[11,12]</sup> Factor I has the greatest weight,

accounting for 47.2% of the variance, which suggests that items on this factor are more specific of depression and more relevant for assessing depression among



HCWs. The items on psychological distress appear to reflect general aspects of depression-like dissatisfaction and loss of interest to enjoy things. Studies conducted by Ana *et al.*<sup>[11]</sup> and Silva *et al.*<sup>[13]</sup> also show that anxiety contributes significantly in assessing depression related to COVID-19.

A 5-point Likert scale ranging from “strongly agree” to “strongly disagree” was employed as it has been most recommended by the researchers that it would reduce the frustration level of respondents and increase response rate and response quality.<sup>[14,15]</sup> When the factor-wise mean inter-item correlations were examined, the average inter-item correlation of items loaded on the factor “work-related anxiety” was 0.46, whereas for the items on “psychological distress” factor, it was 0.44 which are within the range suggested by Briggs and Cheek.<sup>[14]</sup>

Pandemics exert significant psychological impacts on HCWs, highlighting the need for appropriate psychological support, interventions, and staff support measures. Consistent with the results of an international study, in this study, it was identified that nurses had higher scores in Factor I (work-related anxiety). This could be because frontline nurses work in close contact with patients for longer working hours, which may result in fatigue, stress, and depression.<sup>[13,15]</sup> A study conducted by Nikčević and Spada<sup>[11]</sup> among the general population also has extracted psychological distress as one of the contributing factors in the assessment of COVID-19 anxiety. However, those tools did not have a 5-point Likert construct.

## Conclusion

The results from this preliminary validation suggest that CDS-HW can be considered a reliable tool that can be used among HCWs to measure depression during pandemic or epidemic outbreaks. Limitations of the study include (1) the cross-sectional design of this study does not allow the identification of the stability of the factors determined and (2) the data were solely based on self-report questionnaires, which may be subject to social desirability, self-report errors, and poor recall. We recommend further research to identify other dimensions of depression among HCWs and also to confirm the results of our study.

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## Conflicts of interest

There are no conflicts of interest.

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