Original Article

Development and Initial Validation of the COVID-19 Anxiety Scale

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Abstract

Background: Safeguarding the psychological well-being of the public is also an integral component of fighting COVID-19. However, there is limited availability of psychometric measures to document COVID-19-related anxiety among the general public. **Objectives:** This study was aimed at developing a validated scale to measure COVID-19-related anxiety. **Methods:** Three hundred and seven subjects from different gender, educational categories participated in the study. Exploratory factor analysis for the determination of factor structure, Pearson's correlation test, and Kruskal–Wallis ANOVA were employed in data analysis using SPSS version 20 software. **Results:** COVID-19 Anxiety Scale (CAS) demonstrated a two-component structure identified as: "fear of social interaction;" "illness anxiety." The final scale with seven items demonstrated good internal consistency reliability (Cronbach's Alpha 0.736). CAS exhibited good construct validity showing moderately negative correlation (Pearson's $r = -0.417$) with the self-rated mental health and resulted in higher scores among individuals with lower educational qualification (Kruskal–Wallis ANOVA χ^2 [2, 303] = 38.01; $P = 0.001$). **Conclusion:** CAS is a rapidly administrable, valid, and reliable tool that can be used to measure COVID-19-related anxiety among the Indian population.

Key words: Coronavirus, principal component analysis, psychometrics

Introduction

Coronavirus Disease (COVID-19) has been designated as a public health emergency of international concern by the World Health Organization on January 30, 2020.[1] While the early beginning of the COVID-19 outbreak occurred in December 2019 in the Hubei province of China, there has been unprecedented rise, since then, in the number of COVID-19 affected people across the globe leading to the declaration of COVID-19 as a pandemic on March 11, 2020.[2] While the primary focus has been placed on the development of COVID-19 specific vaccine, identification of COVID-19 positive cases, quarantining suspected individuals and close contacts of the affected, and developing strategies for mass screening, the psychological impact of COVID-19 on the general public was given little attention. With COVID-19 swiftly evolving globally, a substantial degree of fear is induced among the public. It is estimated that the magnitude of anxiety and stress, depression levels, and suicidal inclinations would rise as a consequence of the psychological burden posed by COVID-19 associated fear.[3] In the context of potential disease transmission, emotional discomfort among concerned populations is inevitable. In these circumstances, it is very important to alleviate people's fear and anxiety of acquiring COVID-19. However, we have limited availability of validated COVID-19-related anxiety scales, which preclude the assessment of COVID-19 related concerns among the public and the planning of informed support programs. This study was done to develop a scale to measure the anxiety relating to COVID-19 and evaluate its psychometric properties among the Indian population.

Materials and Methods

This study was conducted during February and March 2020 among the general population belonging to the southern Indian

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state of Andhra Pradesh. Ethical approval for this study was obtained from the Institutional Ethical Committee of SIBAR Institute of Dental Sciences (pr. 70/IEC/SIBAR/2020). Based on the objectives of the study, which include the identification of the underlying latent constructs by exploratory factor analysis (EFA), the rating scale for adequate sample size in factor analysis proposed by Comrey and Lee focusing on the necessity to render standard errors of correlation coefficients sufficiently small was considered, according to which a sample size of 300 was deemed to be good.[4] The study sample constituted 307 participants, aged 18 years and above, with representation from different age, educational, and gender categories. All the participants provided implied consent with voluntary participation in the study. For convenience, the methodology adopted in this study is discussed under the following subheadings.

i. Generation of item pool: various measures related to the construct of fear and disease vulnerability were reviewed before the generation of the item pool. Twelve items articulated by the primary investigator (VCC) were reviewed by the other investigators before the evaluation of the initial scale for content validity and face validity. All the items were designed to assess the anxiety associated with COVID-19 on a four-point (1–4) semantic differential scale, where the evaluative dimension was explicitly mentioned in the choices, with higher scores reflective of increased COVID-19-related anxiety
ii. Evaluation of content validity and face validity: the initial scale with 12 items was reviewed by a five-member expert panel. The scale level inter-rater agreement was assessed using the Intra-class Correlation Coefficient (Two-way mixed model, mean of 5 raters, absolute agreement). ICC was found to be 0.87 for the 10 item scale after the deletion of two items owing to limited content relevance as opined by the expert panel
iii. Assessment of item-total correlations (ITCs) and internal consistency reliability: Corrected ITCs to check the association of each of the scale items with the total score obtained were used for initial scale purification. Corrected ITC of <0.3 indicates the limited association of the corresponding item to the overall construct measured by the scale.[5] Cronbach's alpha was used to assess the internal consistency reliability of the scale, and a value >0.7 was deemed as a reflection of the optimum degree of correlation between the scale items
iv. Determination of factor structure and scale purification: EFA was done with principal components as the extraction method to determine the items which are good indicators of the construct of interest. Factor rotations were done as necessary, and items demonstrating significant cross-loadings, with a difference in loadings of <0.2, across factors were intended to be removed as a part of scale purification
v. Establishment of construct validity and temporal stability of the scale: A single self-rated mental health (SRMH) question, on a five-point scale, was used to test the construct validity of the scale.[6] Furthermore, the differences in total scale scores obtained based on the educational qualification of the subjects were considered to establish construct validity for the scale. Temporal stability was assessed by re-administering the scale to 30 participants 5 days after the initial administration.

Statistical analysis

SPSS version 20 software (IBM SPSS statistics for windows version 20, Armonk, NY, USA) was used to analyze the data. Descriptive statistics, EFA (principal components extraction) using Promax rotation with Kaiser Normalization for determination of factor structure, Pearson's correlation test for checking the correlation between SRMH and CAS scores, Kruskal–Wallis ANOVA for identifying differences in CAS scores based on educational qualification were employed in data analysis.

Results

The background characteristics of the study population are described in Table 1. The mean age of the study participants was 35.32 ± 10.9 years. Corrected ITCs for the ten-item scale suggested removal of two items having ITC <0.3. The retained eight items demonstrated ITCs from 0.33 to 0.63; Cronbach's alpha if item deleted values ranged from 0.67 to 0.75 [Table 2]. Cronbach's alpha for the eight-item scales was 0.77. KMO measure of 0.731 indicated underlying factor structure and significance from Bartlett's test of sphericity reflected the correlation among item responses indicating the appropriateness of factor analysis. A two-factor solution was obtained from EFA with principal components as the extraction method based on the Eigenvalue >1 criterion. The unrotated matrix showed cross-loadings for three items (Items 3, 4, 10). Therefore, Promax rotation with Kaiser normalization, owing to the correlated nature of items loaded on the two factors, was employed to simplify the factor structure. Item 10 demonstrated cross loading in the rotated matrix too and hence was removed from the scale. The final scale (CAS) with seven items, with the possible range of scale scores being (7–28), yielded a two-factor solution: "fear of social interaction;" "illness anxiety." Table 3 shows the factor loadings, communalities,

Table 1: Background characteristics of the study participants (*n*=307)

Variable	Category	*n* (%)
Gender	Male	205 (66.8)
	Female	102 (33.2)
Age group (years)	18-30	93 (30.29)
	31-40	107 (34.85)
	41-50	61 (19.86)
	51 and above	46 (14.98)
Educational qualification	Secondary education	65 (21.2)
	Bachelor's degree/diploma	109 (35.5)
	Master's degree	129 (42)
	Doctoral degree	4 (1.3)

Table 2: Item level descriptive statistics, item-total correlation, and internal consistency reliability estimates (n=307)

Itemp	Mean (SD)	Median (IQR)	Cronbach's alpha*	Corrected item-total correlations[5]	Corrected item-total correlations‡
How afraid are you of acquiring COVID-19 when going into the public? (Item 1)	2.78 (0.91)	3 (1)	0.67	0.576	0.601
In your opinion, how susceptible you are for COVID-19? (Item 2)	2.21 (0.95)	2 (2)	0.74	0.155§	Eliminated
How frequently are you feeling worried that you have acquired COVID-19? (Item 3)	1.64 (0.67)	2 (1)	0.71	0.378	0.334
How frequently is your sleep getting affected because of thoughts relating to COVID-19? (Item 4)	1.64 (0.8)	1 (1)	0.7	0.398	0.352
How frequently are you avoiding conversations on COVID-19-related information out of fear/anxiety? (Item 5)	2.67 (0.8)	3 (1)	0.67	0.596	0.636
How worried are you of acquiring COVID-19 when an unknown person is coming closer to you? (Item 6)	2.95 (0.84)	3 (2)	0.68	0.553	0.583
How anxious are you getting when knowing information on COVID-19? (Item 7)	2.57 (0.86)	3 (1)	0.7	0.382	0.401
In your opinion, how much COVID-19 has affected your personality (Item 8)	1.88 (0.95)	2 (1)	0.75	0.122§	Eliminated
How concerned are you when people cough or sneeze because of the fear that you may acquire COVID-19? (Item 9)	2.68 (1.01)	3 (2)	0.72	0.326	0.379
How often you are thinking about COVID-19 on a routine day? (Item 10)	2.57 (0.85)	2 (1)	0.68	0.526	0.575

*Depicts internal consistency estimates of remaining items if the corresponding item is removed from the total score, [5]Corrected item-total correlations for the 10 item scale, ‡Corrected item-total correlations after eliminating items 2, 8, §Corrected item-total correlations of <0.3. SD: Standard deviation, IQR: Interquartile range, COVID: Coronavirus disease

Table 3: Pattern matrix from exploratory factor analysis showing the factor loadings and communalities for the seven items of the coronavirus disease-19 anxiety scale

Item	Factor 1	Factor 2	Communality
How afraid are you of acquiring COVID-19 when going into the public? (Item 1)	0.661		0.579
How frequently are you feeling worried that you have acquired COVID-19? (Item 3)		0.862	0.718
How frequently is your sleep getting affected because of thoughts relating to COVID-19? (Item 4)		0.813	0.64
How frequently are you avoiding conversations on COVID-19 related information out of fear/anxiety? (Item 5)	0.788		0.675
How worried are you of acquiring COVID-19 when an unknown person is coming closer to you? (Item 6)	0.65		0.528
How anxious are you getting when knowing information on COVID-19? (Item 7)	0.749		0.503
How concerned are you when people cough or sneeze because of the fear that you may acquire COVID-19? (Item 9)	0.693		0.434
Eigen value	2.806	1.271	
Percentage of total variance explained	40.08	18.15	

KMO measure of sampling adequacy (0.731), Bartlett's test of sphericity - χ^2 (df)=503.42 (21), P<0.001, Extraction method: Principal components, Rotation: Promax rotation with Kaiser normalization, Factor 1: Fear of social interaction, Factor 2: Illness anxiety, KMO: Kaiser-Meyer Olkin, COVID: Coronavirus disease

and the total variance explained by the components in EFA. The mean CAS score of the study participants was observed to be 16.93 ± 3.71, and the scale demonstrated good internal consistency reliability (Cronbach's alpha 0.736). Significant moderately negative correlation was identified between SRMH and CAS scores (r = −0.417; P = 0.001). An apparent difference was noted in the mean CAS scores based on educational qualification, with participants having higher educational qualifications demonstrating significantly lower CAS scores as analyzed using Kruskal–Wallis ANOVA (χ^2 [2, 303] = 38.01; P = 0.001*). The temporal stability of the instrument was established with an ICC (Two-way mixed-effects model, single rater, absolute agreement) of 0.91 between test and re-test. The seven-item CAS was provided in Appendix 1.

Discussion

CAS is a brief, rapidly administrable, 7-item instrument demonstrating face and content validity, internal consistency reliability, structural validity, construct validity, and test-retest reliability. The semantic differential scale was considered over the Likert scale to eliminate the potential acquiescence bias.[7] When the mean inter-item correlations were examined factor wise, items loaded on "fear of social interaction" factor had average inter-correlation of 0.5, where as the items on "illness anxiety" factor had an average inter-correlation of 0.42 which are within the suggested range of (0.4–0.5) by Briggs and Cheek.[8] The mean inter-item correlation for the seven-item CAS was 0.45, suggesting that the two sets of items are better represented as a summary measure. It is for this reason of inter-correlation

between items from both the factors that the decisions of using promax rotation and representing CAS score as an aggregate measure of "fear of social interaction" and "illness anxiety" scores were made. It was identified that subjects with higher educational qualifications had lesser CAS scores, the rationale for which could be better information seeking and accessing behaviors, more scientific outlook compared to people with lesser educational qualifications. Furthermore, a significant negative correlation was identified between CAS and SRMH scores. In spite of the aforementioned associations of CAS scores with educational qualification and SRMH scores, more thorough approaches could be adopted to establish the construct validity of the scale, such as determining the correlation between CAS and perceived vulnerability to disease scale scores.[9]

One of the limitations of this study includes the loading of only two items on the "illness anxiety" factor. Although a minimum of three items for factor is suggested, it is not uncommon in literature for subscales to have two items.[10,11] It is also important to acknowledge here that the construct of anxiety relating to COVID-19 is dynamic in nature, and the additional dimensions of "fear of losing livelihood post COVID-19" and "uncertainty about future" have emerged with prolonged lockdown since the beginning of this study. Therefore, future directives for psychometric research with regard to COVID-19 would be to strengthen the factor structure by the addition of relevant items and to encompass the ever-changing construct with emerging dimensions. Based on the results from this initial validation, we conclude that CAS is a rapidly administrable, valid, and reliable tool that can be used to measure COVID-19-related anxiety among the Indian population.

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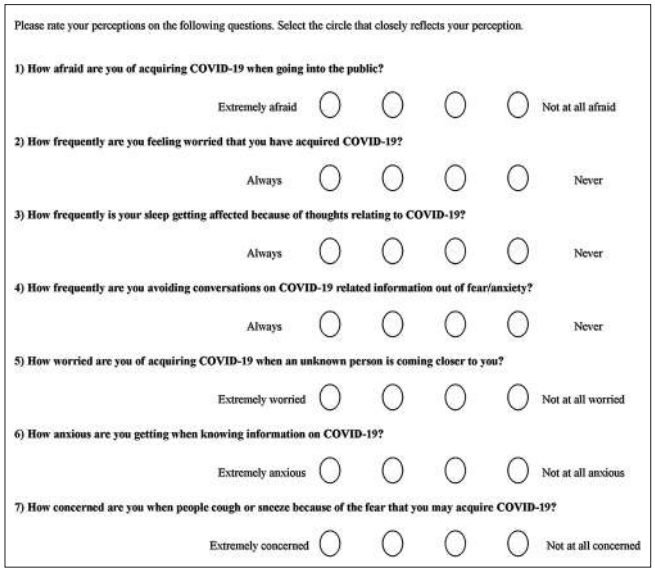
Appendix



Please rate your perceptions on the following questions. Select the circle that closely reflects your perception.

1) How afraid are you of acquiring COVID-19 when going into the public?

Extremely afraid ○ ○ ○ ○ Not at all afraid

2) How frequently are you feeling worried that you have acquired COVID-19?

Always ○ ○ ○ ○ Never

3) How frequently is your sleep getting affected because of thoughts relating to COVID-19?

Always ○ ○ ○ ○ Never

4) How frequently are you avoiding conversations on COVID-19 related information out of fear/anxiety?

Always ○ ○ ○ ○ Never

5) How worried are you of acquiring COVID-19 when an unknown person is coming closer to you?

Extremely worried ○ ○ ○ ○ Not at all worried

6) How anxious are you getting when knowing information on COVID-19?

Extremely anxious ○ ○ ○ ○ Not at all anxious

7) How concerned are you when people cough or sneeze because of the fear that you may acquire COVID-19?

Extremely concerned ○ ○ ○ ○ Not at all concerned

Appendix 1: COVID-19 Anxiety Scale.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Mahase E. China coronavirus: WHO declares international emergency as death toll exceeds 200. BMJ 2020;368:m408.
2. World Health Organization. WHO Director-General's Opening Remarks at the Media Briefing on COVID-19. World Health Organization; 11 March, 2020. Available from: https://www.who. int/dg/speeches/detail/who-director-general-sopening-remarks-at-the-media-briefing-on-covid-19---11-march-2020. [Last accessed on 2020 Apr 17].
3. World Health Organization. Coronavirus Disease 2019 (COVID-19): Situation Report-86 World Health Organization;2020b. Available from:https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200415-sitrep-86-covid-19.pdf?sfvrsn=c615ea20_2. [Last accessed on 2020 Apr 16].
4. Comrey AL, Lee HB. A First Guide to Factor Analysis. Hillsdale, NJ: Erlbaum; 1992.
5. Cristobal E, Flavián C, Guinalíu M. Perceived e-service quality (PeSQ): Measurement validation and effects on consumer satisfaction and web site loyalty. Manag Serv Q Int J 2007;17:317-40.
6. Ahmad F, Jhajj AK, Stewart DE, Burghardt M, Bierman AS. Single item measures of self-rated mental health: A scoping review. BMC Health Serv Res 2014;14:398.
7. Hinz A, Michalski D, Schwarz R, Herzberg PY. The acquiescence effect in responding to a questionnaire. Psychosoc Med 2007;4:Doc07.
8. Briggs SR, Cheek JM. The role of factor analysis in the development and evaluation of personality scales. J Pers 1986;54:106-48.
9. Duncan LA, Schaller M, Park JH. Perceived vulnerability to disease: Development and validation of a 15-item self-report instrument. Pers Individ Differ 2009;47:541-6.
10. Gosling SD, Rentfrow PJ, Swann WB Jr. A very brief measure of the Big Five personality domains. J Res Pers 2003;37:504-28.
11. Jansson BS, Nyamathi A, Duan L, Kaplan C, Heidemann G, Ananias D. Validation of the patient advocacy engagement scale for health professionals. Res Nurs Health 2015;38:162-72.

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