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Psychometric Properties of the COVID-19 Vaccine Anxiety Scale for Adults

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ABSTRACT

Objective: The SARS-CoV-2 pandemic has been a huge challenge for the world's public health and has led to morbid fear and anxiety in many individuals. Further, many people maintain doubts and anxiety about receiving COVID-19 vaccinations due to psychological distortions regarding their effectiveness and safety. Ongoing research is designed to measure the psychometric properties of the COVID-19 Vaccine Anxiety Scale (CVAS), an instrument designed to measure fear and anxieties regarding COVID-19 vaccinations.

Methods: Three experimental stages were conducted. The first was to refine the items along the three dimensions of somatic, psychological, and behavioral symptoms. It included 450 participants, whereas the main experiment had 1296 participants, who completed the CVAS questionnaire as well as the Satisfaction with Life Scale (Diener et al., 1985). Explanatory and confirmatory factor analyses and internal consistency analyses were performed to measure reliability.

Results: The Cronbach Alpha reliability coefficients of the scale's three dimensions i.e., Physiological (Somatic), Psychological and Behavioral Symptoms were calculated as a = 0.91, 0.88, and 0.69, respectively. Factor loadings on the items belonging to each of the three factors varied between 0.62, 0.901, and 0.91. Also, the CVAS was negatively correlated with the Satisfaction with Life Scale as $r = -0.325$; $p<0.001$.

Conclusions: CVAS is a valid and reliable measure. This study can be used as a reference for future research and practice in measuring anxiety about COVID-19 vaccination. Screening individuals with CVAS can support improvement of life satisfaction for individuals and community mental health.

Keywords: Coronavirus, Vaccine, anxiety, reliability, validity, COVID-19 Vaccine Anxiety Scale (CVAS).

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INTRODUCTION

In December 2019, an outbreak of the novel coronavirus SARS-CoV-2 began in Wuhan, the largest city in China's central region; infections spread rapidly within China and to other nations. Given this, on the 30th of January 2020, the World Health Organization (WHO) declared a worldwide health emergency (Bo et al., 2021). They also declared that 176,785,667 positive cases and 3,820,907 deaths occurred by June 14, 2021 (WHO, 2021). Investigators around the world have been collaborating in a way never seen before to achieve a better understanding of the pandemic (Chan et al., 2020).

To put the current virus in context, the coronavirus family has existed and been associated with non-serious infections in humans from as long as a century ago,. However, COVID-19 can be fatal and even when not, can cause severe health difficulties, sometimes requiring prolonged hospitalization. It has been identified its transmission occurs relatively easily, among household members, relatives and friends who have had intimate interaction with patients or incubation carriers, and even among strangers who have had close physical contact (Guan et al., 2020). COVID-19 transmission occurs generally through respiration, via droplets of oral fluid, lung excretions, and person-to-person interaction (Li et al., 2020).

The COVID-19 crisis affects virtually everyone on the planet as well as the global economy, and as a result, many individuals have been living in fear and anxiety. Fear is a type of emotional response to a perceived or real impending situation, while anxiety is an expectancy or anticipation of some future threat (Roehr, 2013). Anxiety-related disorders can be comorbid with other psychological disorders (American Psychology Association, 2015) and the pandemic and subsequent emergency closures (quarantines, curfews, business shutdowns) have caused anxiety and other mental health issues, such as depression and suicidal ideation in many individuals (Huang et al., 2020). Cognitive ideation is also associated with anxiety. Pandemic-related anxiety, in turn, disrupts an individual's behavior and daily activities (Balaratnasingam & Janca, 2006). In stressful situations such as a pandemic, anxiety-related disorders can significantly affect medical personnel who are exceptionally susceptible from work in intensive isolation wards, perhaps without the advantage of family support (Wei et al., 2020).

Although some countries have successfully developed vaccinations, those that have not are reliant on other countries. Nonetheless, there are many rumors and misunderstandings regarding the capability and effectiveness of the vaccines, and many individuals and groups are still questioning whether to receive vaccinations (Mintz et al., 2021) As portrayed in the media, there have been failures and harmful effects during the vaccine trials, some of which have even resulted in death (Park et al., 2020).

Vaccine hesitancy comprises different types of fears (Bendau et al., 2021), but sometimes knowledge about COVID-19 supports a person's intention to be vaccinated (Islam et al., 2023). However, many people already in a fearful and anxious condition about the disease develop additional anxiety symptoms related to

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the vaccine (Marra et al., 2023). Anxiety or fear can be reduced by generalized avoidance behaviors, which vary from person to person and include people avoiding vaccination (Fadhel et al., 2024).

To address the problem of dysfunctional pandemic-related fears and phobias, Lee (2020) developed a screening instrument called the Coronavirus Anxiety Scale (CAS) to identify cases of anxiety associated with the crisis. The validation of this 5-item instrument was performed with a sample of 775 adults (436 men and 339 women having an average age of 31.69). The study showed that high CAS scores are associated with having the diagnosis of coronavirus disease, emotional decline, maladaptive coping by alcohol or drug use or negative religious thoughts, intense hopelessness, and suicidal thoughts. The evaluation of CAS showed that it discriminates well between people with and without dysfunctional anxiety using a total score and an optimized cutoff of ≥ 9 (91% sensitivity and 85% specificity). The results support the instrument as being a valid and effective scale for research and practice clinical use in the US population (Lee, 2020).

This paper's study intended to go further by developing a new scale, which measures anxiety reactions to the COVID-19 vaccines rather than the previous scales, which measured anxiety about infectious diseases. To address the newly occurring phenomenon related to the acceptance and rejection of COVID-19 vaccines, this scale is intended for use to screen and evaluate individuals regarding anxiety about these vaccines. In the case of vaccine rejection, there are higher chances of developing negative psychological symptoms, which can lead the person toward a serious psychological illness in the form of anxiety, which is always associated with multiple other behavioral and psychological factors. There is a gap in the literature about this as no such study has been conducted previously. That is why this is an indigenous scale in this field.

Other recent studies revealed that acceptance of the recommended vaccines was usually at a rate of <30%, despite the many authorities and experts confirming the vaccines' effectiveness, safety, and reliability. (Yang et al., 2020) This study therefore intends to assess and measure the psychological factors influential in a person's attitude towards the COVID-19 vaccines.

Purpose of the Study

The author developed a new measurement questionnaire, the COVID-19 Vaccine Anxiety Scale (CVAS) to evaluate people's fears and anxieties related to the COVID-19 vaccines. CVAS was built with the aim of testing its suitability for application in Arab communities. Building the scale aimed to test its suitability for application in Arab communities. The Kingdom of Saudi Arabia, Egypt and India were chosen using Google Forms. A cross-cultural study was conducted with three distinct populations: from Egypt (n=1296), India (n=877), and the Kingdom of Saudi Arabia (n=646). The current research paper aims to statistically study the validity and reliability in Egypt, in order to conduct a cross-cultural comparative study at a later stage. To this end, factorial arrangement was observed for the scales, the convergent strength, and the tool's consistency.

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Methods

For this study, we used a cross-sectional research design for the collection of self-reported response survey data from Egyptian and non-Egyptian residents. This survey was offered in the English language. Developing psychological scales in English and applying them in Arabic-speaking societies can have several benefits:

Scientific and Research Communication. Creating psychological scales in English allows researchers and scientists from diverse cultures to communicate and exchange knowledge. Translated scales can contribute to expanding the knowledge base and improving scientific research.

International Comparison and Analysis. Applying translated psychological scales in Arabic-speaking communities enables comparison of results with global data. This can reveal cultural differences and similarities, contributing to the development of psychological theories.

Diagnosis and Treatment. Internationally recognized psychological scales can aid in diagnosing mental disorders and providing appropriate treatment. These scales can assess levels of depression, anxiety, life satisfaction, and mental health.

Data collection was completed in three stages. 1. The first sample was used for building pools of items addressing three dimensions of symptoms, physical, psychological, and behavioral (described further in the next Section). 2. A second model of the scale was developed and used for a pilot experimental study and descriptive factor exploration with a sample of 450 participants (250 females and 200 males). To establish the reliability and construct validity of this indigenous scale, sample data was tested with the help of explanatory factor analysis (EFA). 3. The third sample, considered as the main sample for the research, comprised 1296 questionnaire respondents (836 females and 460 males), whose recruitment and communication were conducted via the internet and Google docs. The participants' ages in all samples ranged from 19 to 55 and older. Participants also completed the Satisfaction With Life Scale (SWLS) to measure their subjective judgment of overall life satisfaction (Diener, Emmons, Larsen, & Griffin, 1985). This study was completed in 5 months from January 2021 to May 2021.

Scale Description and Item Pooling

Administration of the instrument to main sample

To establish the psychometric properties of the indigenous scale, item development and item pooling into categories were based on: (i) conducting a systematic literature review, including existing grey literature regarding surveys and scales on vaccination effects, hesitancies, and anxieties; (ii) consultations from experts about the development of statements for the scale, getting opinions on the theoretical supports for the scale statements, and for analyzing the results with statistical experts; and (iii) examining tentative scale items regarding human behaviors, doubts, views, hesitancies, phobias, and anxieties in light of the pilot studies. Based on these, the researcher developed three domains for the COVID-19 Vaccine Anxiety Scale: (a) Physiological (somatic) symptoms, (b) Psychological symptoms, and (c) Behavioral symptoms.

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Results

To perform multivariate analyses such as factor analysis, various established criteria and opinions about sample size exist. Preacher and MacCallum (2002) specify a minimum sample size of 100 to 250. The sample size in the research is more than 100 times the number of items (Tavşancil, 2002), while the number of items in the final version of CVAS was 19. Information regarding age, gender, marital status, residence, and governorate was gathered. Among those, 460 participants identified themselves as being of male gender (35.5%) and 836 as female gender (64.5%). There were 1266 participants from Egypt (97.2%) and 30 from outside of Egypt (2.8%). Regarding the age variable, the researcher classified participants into five categories, with 297 (22.9%) between the ages of 19–24, 715 (55.2%) from 25–34, 211 (16.3%) from 35–44, 57 (4.4%) from 45–54, and finally 16 (1.2%) who were 55 or older (Table 1). Figures 1 and 2 portray the socio-demographic variables of age and gender.

Table 1

Demographic Profile of the Sample, n=1296

Variable	Category	f	%
Gender	Male	460	35.5 %
	Female	836	64.5 %
Age	19 to 24	297	22.9 %
	25 to 34	715	55.2 %
	35 to 44	211	16.3 %
	45 to 54	57	4.4 %
	55 or old	16	1.2 %
Relationship Status	Single	663	51.2 %
	Married	597	46.1 %
	Divorced	36	2.7 %
Nationality	Egyptian	1266	97.2 %
	Outside of Egypt	30	2.8 %

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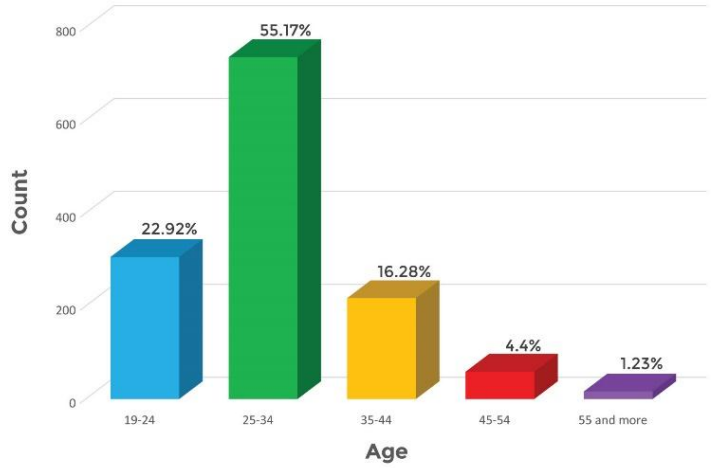
Figure 1

Participant Ages



Validity and Reliability

For analyzing the data gathered from the 1296 participants, the researcher used IBM SPSS version 24 for mean, reliability, and validity statistics. A dataset was created based on the participants' responses on the CVAS; this dataset was then moved into the Amos statistical software package for CFA. Emerging from the EFA, each factor was analyzed using CFA. This technique observes the dimension model to ensure that every item contributed only to its forecast hidden variable (Thompson, 2004).

Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) was conducted to inspect the arrangement underlying the original form of the CVAS with 19 items. The Satisfaction With Life Scale was used to ensure reliability and concurrent validity of the CVAS.

Confirmatory Factor Analysis (CFA)

To regulate the configuration of the scale's features, the principal mechanisms technique was used for dynamic extraction so varimax rotation was functional for the scores attained. From the responses given by 450 questionnaire respondents in the pilot study to the entire scale, the cut score is 0.4.

How fit the data is for dynamic analysis can be evaluated using the Kaiser-Mayer-Olkin (KMO) constant and the Barlett Sphericity Test. Pallant (2010) recommends that a KMO value of 0.6 and beyond and a substantial Bartlett's test of sphericity ($p < 0.05$) are sufficient for the factor exploration to be measured appropriately. The results of this analysis are displayed in Table 2.

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Table 2
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.915
Bartlett's Test of Sphericity	Approx. Chi-Square	5052.351
	Df	190
	Sig.	<0.001

Table 2 shows that the KMO value was 0.915, which was suitable in principle confirmatory factor analysis. An additional indicator of the strength of the association among the variables is provided by Bartlett's Sphericity Test. In this research, the experimental consequence level was $p<0.001$, which showed a strong relationship between the variables.

EFA was then completed to observe the CVAS dimensions for 19 items**.** To define the configuration of the scale factor, varimax rotation was used and the principal mechanisms analysis technique was applied to the scores obtained from the 450 pilot study questionnaires. EFA on the CVAS extracted three factors with eigenvalues above 1.0 for each with loadings greater than 0.4 (cut-score).

The results of the variances and corresponding eigenvalues of the extracted factors are shown in Table 3. As portrayed in the table, the three factors explained 60.402% of the variance of results for the CVAS with eigenvalues greater than 1. The scree plot graph for the scores of the extracted factors is displayed in Figure 2. The factor analysis resulted in three independent factors with factor loadings greater than 0.4. Table 4 presents their factor loadings and factor structures.

Table 3
Eigenvalues and Variance of Factors Extracted

Factor	Eigenvalues	Variance of Factors (%)	N Items
Factor I: Physiological (somatic) symptoms (PH)	7.691	28.232	9
Factor II: Psychological Symptoms (PS)	3.277	23.336	7
Factor III: Behavioral symptoms (B)	1.112	8.834	4

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Figure 2

The Score Plot of the Extracted Factors

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Table 4
EFA for the 20-Item CVAS and Loading Factors

Factors and Items	Factor Loading
Factor I: Physiological (Somatic) Symptoms (PH)	
PH.1: I am afraid that the COVID-19 vaccine could harm my body.	0.806
PH.2: I am worried about the consequences of the COVID-19 vaccine.	0.786
PH.3: I think the COVID-19 vaccine could cause the disease.	0.785
PH.4: I want to avoid the COVID-19 vaccine.	0.784
PH.5: There is a lot of information about the positive side of the COVID-19 vaccine, but I cannot trust it.	0.732
PH.6: I would prefer to be among the last to get the COVID-19 vaccine.	0.73
PH.7: Reading about the COVID-19 vaccine makes me feels uncomfortable.	0.724
PH.8: I cannot get rid of negative thoughts about the COVID-19 vaccine**.**	0.716
PH.9: It is difficult to relax when I think about getting vaccinated for COVID-19.	0.715
Factor II: Psychological Symptoms (PS)	
PS.1: I feel faint while thinking about the COVID-19 vaccination.	0.874
PS.2: My palms start sweating when I think about the getting the COVID-19 vaccine.	0.808
PS.3: Whenever I think about the COVID-19 vaccination, I cannot concentrate on anything.	0.785
PS.4: I miss a beat when I think about the COVID-19 vaccine.	0.757
PS.5: I lose my appetite when I think of getting myself vaccinated for COVID-19.	0.721
PS.6: The thought of the COVID-19 vaccination makes me feel like I am choking.	0.699
PS.7: I must use the washroom urgently when I think about the COVID-19 vaccine.	0.582
Factor III: Behavioral Symptoms (B)	
B.1: I feel a pricking sensation when I think about the COVID-19 vaccination process and consequences.	0.660
B.2: The thought of getting the COVID-19 vaccination gives me a tingling sensation.	0.618
B.3: My stomach becomes upset when I think about taking the COVID-19 vaccination.	0.552

Extraction Method: Principal Component Analysis

CVAS Dimensions

The first extracted factor consists of nine items and accounted for 28.232% of total variance with an eigenvalue 7.691. This was the Physiological (somatic) symptoms

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(PH) factor. The second factor comprised of ten items and accounted for 23.336% of the total variance with an eigenvalue 3.277. This was the Psychological symptoms (PS) factor. Five items accounted for the third extracted factor with 8.834% of total variance and an eigenvalue 1.112. This is the Behavioral symptoms (B) factor. Thus, each item in the scale represented one of the three dimensions of physical or somatic symptoms, psychological symptoms, and behavioral symptoms. The development of this scale kept in mind the basic principle from the literature that all items should be clear with a single meaning.

For each of the items in the CVAS, participants choose from five response options ranging from "strongly disagree" (scored as 1) at one end of the spectrum to "strongly agree" (score as 5) at the opposite end. Example items are I am afraid that the COVID-19 vaccine could harm my body, I feel faint while thinking about the COVID-19 vaccination, Whenever I think about the COVID-19 vaccination, I cannot concentrate on anything, and My palms start sweating when I think about the getting the COVID-19 vaccine. The full list of items in the final version of CVAS is shown in the Appendix. A subtotal was calculated for each subscale dimension, with higher numbers indicating greater levels of difficulty regarding its respective subscale. A grand total from 19 to 95 on the entire scale of 19 items indicated the overall level of anxiety, again with higher numbers indicating greater anxiety.

Reliability and Validity

Reliability Test

The inner reliability of the scale was evaluated by defining the overall stability of the measures. The value of α for accepting a construct is 0.5. Below that, according to the criteria, the construct can be labeled as unacceptable (Hair et al., 2010).

As shown in Table 5, the Cronbach's α for all CVAS constructs is greater than 0.6, which exceeds the approved limit.

Construct Validity

The statistical suitability of data for positive factor analysis (CFA) should be confirmed. This requires observation of the matrix of correlations with the Kaiser-Meyer-Olkin (KMO) measure of sampling competence and Bartlett's Sphericity Test (Pallant, 2010). De Vaus (2002) suggests that KMO values above 0.6 indicate adequate correlations for CFA to be performed.

As portrayed in Table 5, the measure of KMO is suitable for estimating CFA for CVAS since the KMO statistics were >0.60 for all constructs. Also, the Barlett's test of sphericity is significant for all constructs because the p-value was <0.05.

Convergent Validity and Divergent Validity

Average variance extracted (AVE) and composite reliability (CR) were measured to evaluate the convergent strength of the hypotheses in the proposed model. The tolerance threshold for AVE is 0.5 and the approved limit for CR is at least 0.7 (Hair et al., 2010). The Pearson correlation coefficient method was used to check the divergent validity on the all three CVAS sub-scales, which revealed that the divergent validity was 0.71 overall with p>0.001 as shown in Table 5.

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As shown in Table 5, the CR is higher than the approved limit of 0.7 for the CVAS for all constructs, and the AVE is greater than the tolerance threshold of 0.5.

Table 5
Reliability and Validity Measures

Construct	Reliability	Construct Validity		Convergent Validity		Divergent Validity
	Cronbach's α	KMO	Barlett's Sphericity Test	CR	AVE	
Physiological (Somatic) Symptoms (PH)	0.913	0.924	2222.65***	0.922	0.568	0.722
Psychological Symptoms (PS)	0.876	0.850	1713.66***	0.900	0.565	0.711
Behavioral Symptoms (B)	0.609	0.704	436.11***	0.675	0.502	0.691

*** P-value <0.001.

Concurrent Validity

To examine the concurrent validity of the , Pearson correlation coefficients were calculated between CVAS and the Satisfaction with Life Scale. As expected, CVAS was significantly negatively correlated with the SWLS ($r = -0.325$; $p<0.001$) indicating an acceptable concurrent validity.

Confirmatory Factor Analysis (CFA)

To confirm the factor configuration that developed in the EFA using the data sample from pilot study, CFA was conducted on every dimension using the IBM SPSS AMOS application version 24 for the third sample. This technique observes the guideline that the proposed measurement model must validate that each item only loads on its forecast latent variable (Thompson, 2004).

The output showing the CFA regression paths is shown in Figure 3. In the figure, the three dimensions appear as ovals and the individual questionnaire items are shown as rectangles. Some modification indices have been applied to the proposed model to get the results for each regression path to its respective dimensions.

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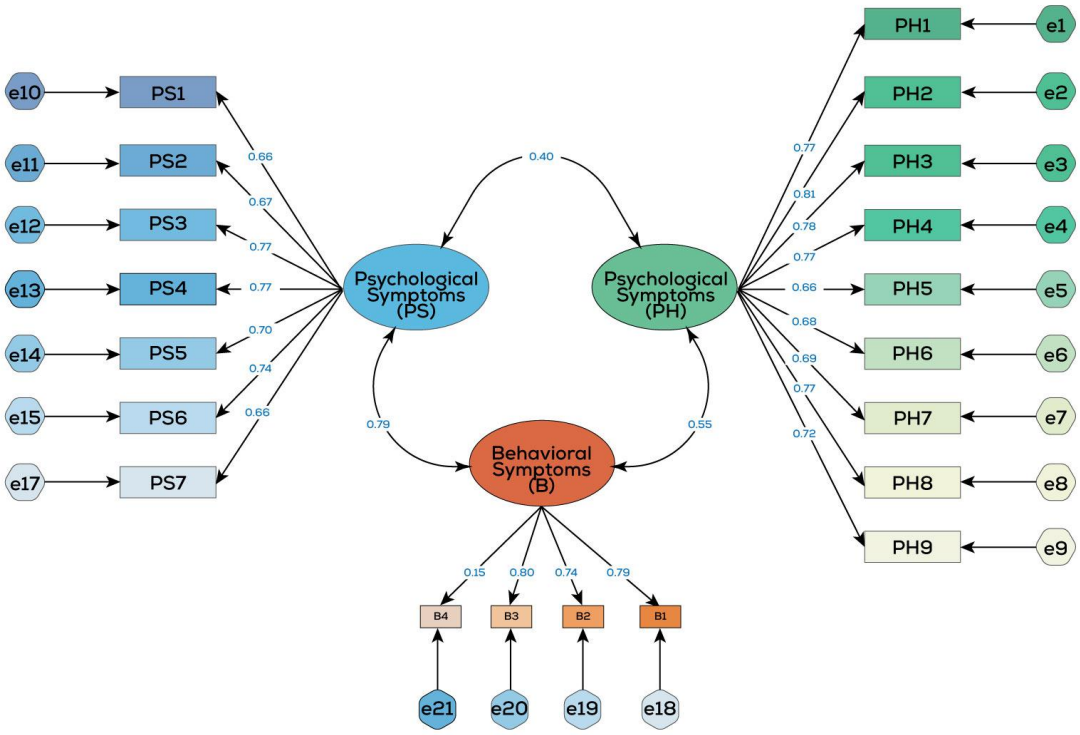
Figure 3

Standardized Coefficients for the Three-Factors Model of CVAS



In Table 6, the standardized loading estimates (λ) of the items are shown as 0.4 and above, which is acceptable, apart from item B4, I keep on checking for more and more details about to the COVID-19 vaccine, for which the factor loading was less than 0.4. Thus, this item needed to be deleted from the proposed scale. All coefficients were significant at $p < 0.001$. The critical ratios correlated with the factor loadings and their standard errors all exceeded 1.96, which was used as a standard to apply a 5% significance level in samples using critical values. Additionally, using the limit of 0.7 for all constructs, the level of the CR was higher than this limit for all three dimensions. Moreover, the AVE was essentially greater than the acceptance level of 0.5 (Hair et al., 2010). Based on these results, the aggregate reliability and convergent validity were approved.

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Table 6
Loading, Critical Ratios, Reliability and Validity for CVAS

Constructs and Items	Unstandardized Loading	Standardized Loading	Critical Ratio	CR	AVE
Physiological (Somatic) Symptoms (PH)				**0.916**	**0.548**
PH1	1.000	0.774			
PH2	1.040	0.807	30.984		
PH3	0.948	0.784	29.906		
PH4	1.075	0.765	29.061		
PH5	0.873	0.664	24.621		
PH6	0.988	0.677	25.142		
PH7	0.884	0.694	25.871		
PH8	1.014	0.765	29.060		
PH9	0.978	0.718	26.924		
Psychological Symptoms (PS)				**0.877**	**0.506**
PS1	1.695	0.736	22.888		
PS2	1.487	0.701	21.998		
PS3	1.464	0.772	23.811		
PS4	1.512	0.773	23.840		
PS5	0.886	0.666	21.046		
PS6	0.824	0.662	20.954		
PS7	1.000	0.659			
Behavioral Symptoms (B)				**0.822**	**0.607**
B1	1.000	0.794			
B2	1.168	0.742	26.815		
B3	0.981	0.800	29.041		
B4	0.242 (deleted)	0.148	4.979		

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Table 7
Test Re-test Reliability statistics for CVAS

Item	Adjusted item total correlation	Cronbach alpha when the item is deleted
PH1	0.711	0.969
PH2	0.601	0.969
PH3	0.691	0.969
PH4	0.701	0.969
PH5	0.698	0.969
PH6	0.708	0.969
PH7	0.601	0.969
PH8	0.792	0.969
PH9	0.701	0.969
PS1	0.707	0.967
PS2	0.601	0.967
PS3	0.699	0.967
PS4	0.701	0.967
PS5	0.724	0.967
PS6	0.601	0.967
PS7	0.699	0.967
B1	0.722	0.966
B2	0.688	0.966
B3	0.721	0.966

In checking the test-retest reliability of CVAS, good consistency and test-retest reliability on the subscales of CVAS was found (Table 7).

Model Fit

We used specific fit measures to determine the acceptability of the proposed CVAS measurement from the dimensions. These measures of model fit included the Tucker Lewis index (TLI), goodness-of-fit index (GFI), comparative fit index (CFI), adjusted goodness-of-fit index (AGFI), normal fit index (NFI), and finally, root mean square error of approximation (RMSEA). As shown in Table 8, the final measurement model was a good fit. Its indices are all within a suitable range for an acceptable fit.

Table 8
The Fit of the Proposed Model

Fit Measure	Accepted Fit	Computed Fit
GFI	> 0.90	0.904
AGFI	> 0.80	0.879
RMSEA	< 0.05	0.043

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NFI	> 0.90	0.905
TLI	> 0.90	0.904
CFI	> 0.90	0.916

Modified from: (Hair et al., 2010)

Discussion

The major aim of this research was to address individuals with COVID-19 vaccine anxiety, measure their anxiety levels using CVAS, verify CVAS's validity and reliability, and ultimately provide a measurement tool that can be used in clinics and scientific studies. For these purposes, content validity, factor structure by determining construct validity, and internal consistency by calculating reliability were examined.

Watching, reading, or listening to news about COVID-19 vaccination trials, deaths, and side effects have the powerful potential to make individuals feel anxious or fearful. It may be necessary for the person to minimize paying attention to news, seek information only from reliable sources, and take practical steps to protect themselves and their loved ones. Learning the facts and avoiding rumors and false information reduce the level of anxiety. Mass tragedies, especially those involving infectious diseases, are often important factors in one's behavior and psychological well-being, bur can cause increased fear that then causes severe phobias. All this also seems to trigger anxiety regarding coronavirus vaccination among people who are sensitive.

The CVAS is a brief 19-item instrument having a quick and easy administration. It demonstrates face and content validity, internal consistency reliability, structural validity, construct validity, and test-retest reliability. Only one item was deleted due to an unstandardized loading. When the mean inter-item correlations were examined factor-wise, items focused on the nine physiological (somatic) symptoms accounted for 28.232% of the total variance with an eigenvalue 7.691. The second factor, psychological symptoms, consisted of ten items and accounted for 23.336% of the total variance with an eigenvalue 3.277. The third factor, behavioral symptoms, consisted of five items and accounted for 8.834% of the total variance with an eigenvalue of 1.112. All were within the range suggested by Briggs and Cheek (1988).

The mean inter-item correlation for the nineteen CVAS items was 0.41, suggesting that the three sets of items are better represented as a summary measure. It is for this reason that the decisions was made to use ProMax rotation and represent the CVAS score as an aggregate measure of psychological somatic symptom, psychological symptom, and behavioral symptom sub scores. Subjects with higher education levels were found to have lower CVAS scores. The reason could have been that they had better information seeking and accessing behaviors, and a more scientific outlook compared to people with less education. Furthermore, a significant negative correlation was identified between the CVAS and SWLS scores (r = -0.325;

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p<0.001), demonstrating standard concurrent validity. Despite the association of CVAS scores with education levels and SWLS scores, more thorough approaches could be adopted to establish the scale's construct validity, such as determining the correlation between CVAS and SWLS scores (Duncan et al., 2009). Several studies have explored the impact of the pandemic on mental well-being and life satisfaction. While not specific to SWLS or CVAS, they highlight the importance of monitoring mental health during crises (Wang et al., 2020; Xiong et al, 2020).

Average variance extracted (AVE) and composite reliability (CR) were measured to evaluate the convergent strength of the hypotheses in the proposed model. The tolerance threshold for AVE is 0.5 and the approved limit for CR is at least 0.7 (Hair et al., 2010). For CVAS, the CR is higher than the approved limit of 0.7 for all constructs. Also, the AVE is greater than the tolerance threshold of 0.5. Similarly, the divergent validity analysis showed the measure for the three dimensions of CVAS was r=0.71.

One of the limitations of this study includes the loading of only four items on the behavioral symptoms factor. Although a minimum of five items per factor is suggested, it is not uncommon in the literature for subscales to have four items (Gosling et al., 2003; Jansson et al., 2015). It is also significant to acknowledge that the construct of anxiety relating to COVID-19 vaccines was dynamic in nature and the additional dimensions of fear of losing one's livelihood post COVID-19 and uncertainty about the future have emerged with the prolonged lockdown since the beginning of this study. Therefore, future directives for psychometric research regarding COVID-19 and vaccinations would be to strengthen the factor structure by the addition of relevant items and to encompass the ever-changing construct with newly emerging dimensions. Based on the results from this initial validation, we conclude that CVAS has a quickly testable and good level of validation, and is a reliable scale to measure the level of anxiety regarding COVID-19-related vaccination among various cultures, countries, and populations.

As the study sample was collected from different populations, the results allow us to generalize the use of this newly developed, valid and reliable COVID-19 Vaccine Anxiety Scale.

Conclusion

The COVID-19 Vaccine Anxiety Scale is a highly reliable and valid measure that can be used in the assessment of fear and anxiety regarding COVID-19 vaccination for all kinds of populations and countries. Prior to this work, no such scale had been developed to measure all three domains of anxiety related to COVID-19 vaccination. Thus, the CVAS is a very handy scale to address the psychological issues caused by vaccination phobias and anxieties.

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Appendix

We can conclude that the CVAS is applicable after completing the pilot and final studies and conducting the necessary tests to ensure that the factors derived are representative of the measure. This scale is valid and reliable to use in research and practice for adult populations globally.

Final Version of the COVID-19 Vaccination Anxiety Scale (CVAS)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Physiological (somatic) symptoms (PH)					
PH.1: I am afraid that the COVID-19 vaccine could harm my body. أخشى أن يتسبب اللقاح في إلحاق الضرر بجسدي					
PH.2: I am worried about the consequences of the COVID-19 vaccine. أخشى من عواقب لقاح كوفيد19					
PH.3: I think the COVID-19 vaccine could cause the disease. أخشى من أن لقاح كوفيد-19 قد يتسبب في حدوث المرض					
BH.4: I want to avoid the COVID-19 vaccine. أرغب في تجنب لقاح كوفيد-19					
PH.5: There is a lot of information about the positive side of the COVID-19 vaccine but I cannot trust it. هناك الكثير من المعلومات حول الجانب الإيجابي للقاح ولكني لست قادراً على الوثوق بها					
BH.6: I would prefer to among the last to get the COVID-19 vaccine. أفضل أن أكون من بين آخر من يحصلون على لقاح كوفيد-19.					
PH.7: Reading about the COVID-19 vaccine makes me feels uncomfortable. تمنحني القراءة عن اللقاح شعوراً غير سار					
PH.8: I cannot get rid of negative thoughts about the COVID-19 vaccine**.** لا أستطيع التخلص من الأفكار السلبية المتعلقة باللقاح					

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PH.9: It is difficult to relax when I think about getting vaccinated for COVID-19.
يصعب علي الاسترخاء عندما أفكر في تلقي التطعيم

Psychological Symptoms (PS)

PS.1: I feel faint while thinking about the COVID-19 vaccination.
ينتابني شعورا بالإغماء أثناء التفكير في التطعيم

PS.2: My palms start sweating when I think about the getting the COVID-19 vaccine.
يتعرق كفى عندما أفكر بأمر الحصول على اللقاح

PS.3: Whenever I think about the COVID-19 vaccination, I cannot concentrate on anything.
عندما أفكر في التطعيم ضد فيروس ، لا أستطيع التركيز على أي شيء.

PS.4: I miss a beat when I think about the COVID-19 vaccine.
: 19-يتباطأ النبض عندما أفكر بأمر لقاح كوفيد.

PS.5: I lose my appetite when I think of getting myself vaccinated for COVID-19.
أشعر بفقدان الشهية عندما أتخيل نفسي أتلقى التطعيم

PS.6: The thought of the COVID-19 vaccination makes me feel like I am choking.
أشعر بالاختناق عند التفكير في التطعيم

PS.7: I must use the washroom urgently when I think about the COVID-19 vaccine.
أشعر بحاجة طارئة لاستخدام الحمَّام عندما أفكر في اللقاح

Behavioral symptoms (B)

B.1: I feel a pricking sensation when I think about the COVID-19 vaccination process and consequences.
ينتابني إحساسا بالوخز عندما أفكر في عملية التطعيم وتوابعها

B.2: The thought of getting the COVID-19 vaccination gives me a

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tingling sensation.
أشعر بالوخز عند التفكير في الحصول على التطعيم

B.3: My stomach becomes upset when I think about taking the COVID-19 vaccination.
تؤلمني معدتي عندما أفكر في أخذ التطعيم