



# COVID Stress Scales: A Cross-sectional Study of its Psychometric Properties among Africans with Chronic, Stable Medical Conditions

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Background:** The coronavirus 2019 pandemic (COVID-19) elicited in various populations, diverse psycho-behavioral responses. The COVID Stress Scales (CSS) was developed and validated in the general population, among US and Canadian adults, in response to the COVID-19 pandemic. Expectedly, population-specific variations in response are likely, hence, the need to validate psychometrically sound instruments across cultures and diverse populations.

**Aim:** To determine the factor structure and reliability estimates of the CSS among participants with chronic, stable medical conditions in a Nigerian Tertiary Hospital.

**Methods:** The cross-sectional study, involved 1047 consenting adults with chronic, stable medical conditions attending the out-patient specialist clinics of a foremost tertiary hospital in Nigeria. The participants were enrolled consecutively over a four-month period straddling the first and second waves of the COVID-19 pandemic. The CSS was administered to participants who fulfilled the study criteria. Exploratory Factor Analyses (EFA) using Principal Component Analysis and Oblimin rotation with Kaiser Normalization, was used to extract the factors.

**Results:** A six-factor structure emerged: COVID-19-related socio-economic consequences; contamination; xenophobia; traumatic stress; compulsive checking and reassurance seeking; and danger. The internal consistency within items of each domain was acceptable (Cronbach alpha 0.85 and above) and correlation between the domains was moderate to strong.

**Conclusion:** The CSS maintained a six-factor structure, corresponding to the six scales, among Nigerian participants with chronic, stable medical conditions. It has acceptable reliability estimates and can be used to assess COVID-19-related anxiety in this population. The inter-correlation of the various domains is a strong evidence for the existence of COVID stress syndrome.

*Keywords: Factor; structure; COVID-19; COVID stress scales; anxiety; pandemic; Nigeria.*

## 1. INTRODUCTION

The pronouncement of the first case and the first wave of the coronavirus 2019 pandemic (COVID-19) in Nigeria, and the subsequent austere public measures to contain the disease was perceived by many as stressful. The uncertainties about the exact nature of the disease brought about complex psycho-behavioral responses [1,2]. One specific psycho-social consequence was the emergence of a multi-dimensional stress response linked to the pandemic termed the "COVID Stress Syndrome" [3]. To measure this syndrome, Taylor and colleagues developed a multifaceted COVID Stress Scales (CSS), to assess the dimensions of COVID-19-related distress in the population [4].

Early studies on the CSS show it to be a psychometrically sound instrument for measuring COVID-19 related distress, [4-7] and it has also been postulated to be a useful tool for assessment of psycho-social distress during possible future pandemics [4]. While some studies showed that the CSS had five factors; six scales; acceptable internal consistency within the domains; and strong inter-correlation between the factors, [4-6] others however, have reported a six-factor model, corresponding to the six scales [7].

In other words, it appears that the exact nature of the structure of the CSS differs across cultures and populations. Therefore, as an emerging international measure of COVID-19-related distress, the need to test its reliability and factor structure, across various cultures and populations became imperative. In this study, the authors aimed to determine the factor structure and reliability, as well as the internal consistency of the CSS in an adult, black African population sample, with chronic but stable medical conditions. Various studies have shown that the presence of some chronic medical conditions, confer heightened risk of development of severe disease, as well as increased mortality, when such patients become infected with COVID-19 [8-11].

This study appears to be the first study from sub-Saharan Africa, to examine the factorial structure and the reliability estimates of the CSS, using a representative population sample.

The objectives of the study were:

1. To determine the factor structure of the 36-item CSS among a cross-section of Africans with chronic but stable medical conditions.
2. To examine the internal consistency of the items within each domain and the inter-correlation among the factors.

## 2. MATERIALS AND METHODS

### 2.1 Study Design and Setting

This cross-sectional study, took place at the specialist medical out-patient clinics of the University of Nigeria Teaching Hospital (UNTH) Enugu, Nigeria. The study, involved 1047 consecutive and consenting adults aged 18 years and above, with chronic medical conditions, but who were in stable clinical state (i.e., fully conscious and could optimally participate during the interview) and able to read or understand the English language. The participants were enrolled over a four-month period straddling the first and second waves of the COVID-19 pandemic in Nigeria.

Ethical approval for the study was obtained from the Health Research and Ethics Committee of the UNTH.

### 2.2 Data Collection

#### 2.2.1 Data collection Instrument and procedure

Consecutive attendees that met the eligibility criteria had the details of study explained to them and thereafter, informed consent was obtained. Socio-demographic and necessary clinical information regarding the medical condition which the subject was being managed for, were obtained using a semi-structured, researcher-designed questionnaire, designed for this study. In some instances, information was obtained from patients' case notes. Subsequently, the CSS which is self-administered, was given to each participant to complete. The CSS was developed by Taylor and colleagues, [4] in response to the clinical and research experiences that suggest psycho-behavioral changes during the COVID-19 pandemic. The CSS, initially validated in population-representative samples from the United States and Canada, [4] is a 36-item questionnaire with six scales and 5-factors, rated in a Likert scale, used to assess COVID-19-related anxiety and psychological distress. The original validation had a 5-factor structure, namely; 1) fear of danger and contamination, 2) fear about economic consequences, 3) xenophobia, 4) compulsive checking and reassurance seeking, and 5) traumatic stress symptoms. The factors have acceptable reliability and have been adjudged to be useful in future pandemics. A research assistant was at hand to provide

answers to any questions raised by the participants, as the questionnaire was being completed.

### 2.3 Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (IBM-SPSS), version 20. First, the stability of the 36-item CSS data for factor analysis was examined using the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin measure of sampling adequacy. Exploratory factor analysis [12] was done using the Principal Component Analysis and Oblimin rotation [13-16]. A factor loading of  $\geq 0.40$  was used to determine the items in each factor. The scree plot determined the number of factors selected for rotation.

## 3. RESULTS

### 3.1 Socio-demographic and Clinical Characteristics of the Participants

Table 1 shows the socio-demographic and clinical characteristics of the study participants. The female gender had a slight preponderance among the participants (56.9%), who had a mean age of 48 years. Subjects with hypertension accounted for 26.9% while those with diabetes accounted for 21.6%.

### 3.2 Baseline Factor Structure of the COVID Stress Scales among the Participants

A 6-factor (COVID-19-related COVID contamination, compulsive checking and reassurance seeking, socio-economic consequences, traumatic stress, xenophobia and danger) model of behaviors were demonstrated (Table 2). Factor 1 comprised six items that accounted for 34.8% of the variance, with factor loadings from 0.74 to 0.88. The overall variance explained by all the six factors was 66.7%. These and other details are as shown in Table 2.

### 3.3 Internal Consistency of Items within Each of the Factors

The internal consistency of the items within each of the six factors is as shown in Table 3, where the internal consistency of the domains was also shown to be acceptable (Cronbach alpha was greater than or equal to 0.85).

**Table 1. Characteristics of the study participants across intervals of measurement**

**N=1047**

<b>Variables</b>	<b>Frequency (%)</b>	<b>Mean (SD)</b>
<b>Mean Age</b>		47.76 (17.18)
<b>Gender</b>		
Male	451 (43.1)	
Female	596 (56.9)	
<b>Marital Status</b>		
Single	301 (28.7)	
Married	659 (62.9)	
Separated	13 (1.2)	
Widowed	74 (7.1)	
<b>Employment Status</b>		
Employed	695 (66.4)	
Unemployed	166 (15.9)	
Retired	186 (17.8)	
<b>Disease Conditions</b>		
Hypertension	282 (26.93)	
Diabetes Mellitus	226 (21.59)	
Respiratory disorders	52 (5.0)	
Digestive system disorders	58 (5.53)	
Neurological disorders	88 (8.4)	
Dermatological disorders	35 (3.34)	
Chronic Kidney Disease	79 (7.54)	
Other cardiac disorders	35 (3.34)	
<b>*Others</b>	192 (18.33)	

*SD=Standard Deviation, \*Include; malignancies, ophthalmic problems, infectious diseases, psychological disorders, other endocrine disorders*

**Table 2. Factor structure of the CSS among the study population at baseline**

Items	Factors						Dimensions	% Variance
	I	II	III	IV	V	VI		
I am worried that I might catch the virus from handling money or using a debt machine	<b>0.88</b>	0.31	0.39	-0.35	0.39	0.39	COVID Contamination	34.8
I am worried about taking change in cash transaction	<b>0.87</b>	0.34	0.38	-0.39	0.36	0.37		
I am worried that I touch something in a public space, I would catch the virus	<b>0.82</b>	0.35	0.38	-0.28	0.39	0.40		
I am worried that if someone coughed or sneezed near me, I catch the virus.	<b>0.78</b>	0.30	0.37	-0.27	0.39	0.38		
I am worried that my mail has been contaminated by mail handlers	<b>0.78</b>	0.25	0.35	-0.34	0.39	0.38		
I am worried that people around me will infect me with the virus	<b>0.74</b>	0.26	0.24	-0.39	0.31	0.23		
Social media posts concerning COVID-19.	0.21	<b>0.82</b>	0.24	-0.21	0.22	0.25	COVID	9.6
YouTube videos about COVID-19	0.30	<b>0.80</b>	0.23	-0.29	0.15	0.30	Compulsive	
Searching the internet for treatments for COVID-19.	0.26	<b>0.79</b>	0.19	-0.35	0.19	0.25	Checking and	
Seeking reassurance from friends or family about COVID-19.	0.19	<b>0.79</b>	0.15	-0.27	0.11	0.20	Reassurance	
Asking health professionals for advice about COVID-19.	0.23	<b>0.77</b>	0.20	-0.29	0.16	0.22	Seeking	
Checking your body for signs of infection.	0.31	<b>0.76</b>	0.16	-0.29	0.13	0.17		
I am worried about grocery stores running out of cold or flu remedies	0.37	0.20	<b>0.88</b>	-0.25	0.39	0.39	COVID	6.8
I am worried about grocery stores running out of cleaning or disinfectant supplies	0.32	0.22	<b>0.86</b>	-0.25	0.38	0.40	Socio-economic Consequences	
I am worried about pharmacies running out of prescription medicines	0.32	0.25	<b>0.85</b>	-0.26	0.37	0.40		
I am worried about grocery stores running out of food	0.29	0.19	<b>0.83</b>	-0.27	0.36	0.39		
I am worried about grocery stores running out of water	0.31	0.18	<b>0.81</b>	-0.24	0.34	0.39		
I am worried that the grocery stores will close down	0.30	0.20	<b>0.79</b>	-0.28	0.34	0.29		
I had trouble concentrating because I kept thinking about the virus.	0.38	0.28	0.24	<b>-0.83</b>	0.26	0.29	COVID	6.3
Disturbing mental images about the virus popped into my mind against my will.	0.33	0.36	0.32	<b>-0.82</b>	0.26	0.31	Traumatic Stress	
I had trouble sleeping because I worried about the virus.	0.31	0.33	0.35	<b>-0.80</b>	0.27	0.36		
I thought about the virus when I didn't mean to.	0.28	0.37	0.30	<b>-0.76</b>	0.23	0.23		
I had bad dreams about virus.	0.25	0.23	0.18	<b>-0.76</b>	0.23	0.23		

Items	Factors						Dimensions	% Variance
Reminders of the virus caused me to have physical reactions, such as sweating or pounding heart.	0.32	0.26	0.23	<b>-0.73</b>	0.23	0.22		
If I met a person from a foreign country, I'd be worried that they might have the virus.	0.37	0.19	0.40	-0.24	<b>0.93</b>	0.31	COVID Xenophobia	5.0
I am worried about coming in contact with foreigners because they might have the virus	0.37	0.19	0.40	-0.24	<b>0.93</b>	0.38		
I am worried that foreigners are spreading the virus in country.	0.28	0.17	0.41	-0.24	<b>0.80</b>	0.36		
If I went to a restaurant that specialized in foreign food, I'd be worried about catching the virus.	0.50	0.26	0.39	-0.55	<b>0.76</b>	0.21		
If I was in an elevator with a group of foreigners, I'd be worried that they're infected with the virus.	0.42	0.14	0.38	-0.28	<b>0.73</b>	0.25		
I am worried that foreigners are spreading the virus because they're not as clean as we are.	0.41	0.20	0.35	-0.32	<b>0.69</b>	0.30		
I am worried that our healthcare system is unable to keep me safe from the virus.	0.34	0.21	0.40	-0.25	0.11	<b>0.84</b>	COVID Danger	4.2
I am worried that our healthcare system won't be able to protect my loved ones.	0.22	0.23	0.39	-0.23	0.32	<b>0.83</b>		
I am worried that I can't keep my family safe from the virus	0.37	0.23	0.38	-0.36	0.29	<b>0.80</b>		
I am worried that basic hygiene is not enough to keep me safe from the virus	0.34	0.27	0.37	-0.25	0.32	<b>0.76</b>		
I am worried that social distancing is not enough to keep me safe from the virus.	0.37	0.24	0.37	-0.22	0.33	<b>0.73</b>		
I am worried about catching the virus	0.40	0.31	0.38	-0.38	0.34	<b>0.63</b>		

Notes: Extraction Method; Principal Component Analysis; Rotation Method; Oblimin with Kaiser Normalization. Loadings larger than 0.4 are in bold.

**Table 3. Reliability as internal consistency: Cronbach alphas**

<b>Factors</b>	<b>Internal Consistency (Cronbach Alphas)</b>
COVID Socio-economic Consequences	0.92
COVID Contamination	0.89
COVID Xenophobia	0.90
COVID Traumatic Stress	0.87
COVID Compulsive Checking and Reassurance Seeking	0.88
COVID Danger	0.85

**Table 4. Correlation among the COVID stress scale**

<b>Factors</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>
Factor I Rho (p-value)	1					
Factor II Rho (p-value)	0.49 (<0.001)	1				
Factor III Rho (p-value)	0.52 (<0.001)	0.57 (<0.001)	1			
Factor IV Rho (p-value)	0.37 (<0.001)	0.45 (<0.001)	0.38 (<0.001)	1		
Factor V Rho (p-value)	0.29 (<0.001)	0.38 (<0.001)	0.24 (<0.001)	0.41 (<0.001)	1	
Factor VI Rho (p-value)	0.60 (<0.001)	0.53 (<0.001)	0.44 (<0.001)	0.40 (<0.001)	0.34 (<0.001)	1

### 3.4 Correlation between the Factors

There was a positive significant moderate to strong correlation between the factors as shown in Table 4.

## 4. DISCUSSION

The study aimed to determine the factor structure and the reliability estimates of the CSS among participants with chronic, stable medical conditions in a Nigerian Tertiary Hospital. This was with a view to assessing whether the dimensions and reliability estimates of the CSS fits well into the experiences of Nigerians with such medical conditions.

Majority of the patients were middle-aged or older, married and employed, and there was a female gender predominance.

Together, the triad of diabetes, hypertension and other cardiovascular diseases, either singly or in combination, accounted for over half of the medical conditions which the subjects had. This illustrates the typical spread of non-communicable diseases in Nigeria [17,18].

The highlights of the findings of this study are: (1) a 6-factor structure of behaviors namely, socio-economic consequences, contamination, xenophobia, traumatic stress, compulsive checking and reassurance seeking, and danger dimensions were demonstrated at the cross-sectional level (2) the CSS has acceptable internal consistency across the six domains and (3) the factors inter-correlated positively with each another.

The finding of a 6-factor structure in this study, differs from the 5-factor structure reported by Taylor and colleagues in the original validation of the instrument [4]. One major difference between the two studies is that while the danger and contamination scales loaded as a single factor in the original validation, [4] these scales loaded as distinct factors in the index study. The possible explanation is not very clear. However, looking through the prism of the healthcare delivery services in the two study populations, one could offer some plausible explanations. Firstly, it is easily understandable that participants in under-developed healthcare system could potentially differentiate the risk of contamination with the danger the virus poses to their health and that of their family vis-à-vis their poorly responsive healthcare system. This is contrary to participants in well-developed health care system who are aware of the capabilities of the system

to meet their health needs, therefore, blurring the concept of contamination and danger. Secondly, the participants in the index study all had a chronic disease, with a significant majority having co-morbidity. It is known that the danger posed by the virus to this group is graver than that in the general population utilized in the original validation study [19,20]. Furthermore, similar to the finding of the index study, some authors have also reported a 6-factor structure of the CSS in a low-and middle-income country, with similar healthcare system dynamics [7].

Another important finding is the generally acceptable internal consistency of the items within each factor and the inter-correlation between the factors. The high internal consistency within the items of each domain and the inter-correlation across domains have been widely replicated in previous studies. [4-7] For example, studies in US and Canada, [4] Poland, [5] Egypt [6] and Palestine, [7] have all reported high internal consistency (i.e., Cronbach alpha of above 0.7) and moderate to strong inter-correlation between the factors. These findings lend credence to the usefulness of CSS in assessing COVID-19-related distress.

## 5. CONCLUSION

The CSS has a 6-factor structure among Nigerian participants with chronic but stable medical conditions and has acceptable reliability measures. The inter-correlation of the various domains is a strong evidence for the existence of the COVID stress syndrome.

## 6. LIMITATIONS

This study used exploratory factor analysis to extract the factors. Although the exploratory factor analysis is a simple and acceptable method, a confirmatory factor analysis (CFA) is the gold standard for measuring the stability of these factors.

## CONSENT

Consecutive attendees that met the eligibility criteria had the details of the study explained to them and thereafter, written informed consent was obtained.

## ETHICAL APPROVAL

Ethical approval for the study was granted by the Health Research and Ethics committee of the University of Nigeria Teaching Hospital Enugu,



and all methods and procedure were performed in accordance with the declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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