

Validation of the Corona Virus Anxiety Scale on the Arab Environment Using Item Response Theory

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Abstract

This study uses exploratory factor analysis and item response theory (IRT) to analyze the psychometric qualities of the Arabic version of the Scale of Coronavirus Anxiety (CAS) (EFA). 1188 participants, chosen by convenience sampling, are from six Arab nations: (391 participants from the Kingdom of Saudi Arabia), (257 from Egypt), (305) from Jordan, (135) from Babrain, and 100 from the Sultanate of Oman. Of these, (389) participants are men and (799) are women. According to the EFA models, the data is represented by a one-dimensional structure that is dependable and invariant between genders. Similarly, CAS is more informative for high levels of COVID-19 anxiety, according to IRT data. The CAS in Arabic has adequate psychometric properties is a short measure to be used for COVID-19 anxiety.

Keywords: *The anxiety disorders; COVID-19; the coronavirus anxiety scale (CAS); IRT.*

Introduction

The globe Health Organization (WHO) reports that anxiety disorders are among the most prevalent mental health issues in the globe. Anxiety disorders affected 300 million people globally in 2015, accounting for 3.6% of the world's population. (2.6% of males and 4.6% of females). Thus, anxiety-related mental illnesses rank as the sixth most common cause of a deterioration in functioning and overall well-being (Valdez, 2020). Anxiety-related mental health disorders are rather common in everyday scenarios, and they are significantly more common in emergency situations, such as the spread of recently identified diseases like the coronavirus pandemic (Arnold et al., 2021). It is common among both the general public and professionals who deal directly with corona disease.

Around 149 million coronavirus cases have been recorded, and the World Health Organization estimates that the pandemic killed over three million people globally. Second only to India in terms of infection rates worldwide is believed to be the United States of America. In late 2019 or early 2020, the Chinese city of Wuhan experienced the first signs of the novel coronavirus, which went on to become known as Coronavirus Disease 2019 (covid-19). In the Arab globe, 92911 deaths were reported and over 5827,360 cases were confirmed as of April 30, 2021. Studies show that society as a whole is experiencing psychological effects from the COVID-19 epidemic (Rajkumar 2020; Roy et al. 2020; Wang et al. 2020; Zhang et al. 2020). For example, a survey conducted on 52730 individuals in China found that more than 35% of the sample reported having dealt with psychological stress. Indeed, concerns regarding the psychological effects of the coronavirus pandemic are growing in frequency (Homles, et al. 2020). (Qiu and associates, 2020). In a separate study with 7236 participants, Huang and Zhao (2020) found similar results, reporting a 20% prevalence of anxiety and sadness 35 percent. This illness is causing dread, anxiety, and terror in a particular neighborhood. Along with changes in social networks, researchers have shown that the coronavirus has caused an increase in anxiety, stress, and sadness. The psychological consequences of the Corona pandemic on society at large have been shown by numerous studies carried out in the Arab world. For instance, 1,744 people from seven Arab nations—Egypt, Kuwait, Saudi Arabia, Jordan, Algeria, Iraq, and Palestine—

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participated in the study conducted by Shuwiekh and colleagues (Shuwiekh, et al., 2020). 6.3% of them experienced significant anxiety associated with the coronavirus, and 4.9% experienced severe depression.

Researchers have also found that the transmission of the coronavirus has changed social ties and increased anxiety, stress, and sadness (Al Omari et al., results).

Numerous studies conducted in the Arab world have demonstrated the psychological effects of the coronavirus pandemic on society. For example, Shuwiekh and colleagues' (Shuwiekh, et al., 2020) study comprised 1,744 people from seven Arab countries: Egypt, Kuwait, Saudi Arabia, Jordan, Algeria, Iraq, and Palestine. Of these, 6.3% had elevated anxiety related to the Corona virus, and 4.9% had severe depression. Furthermore, Al Omari et al.'s findings. One of the early anxiety measures is the Corona Virus Anxiety Scale (CAS). The most well-known version was developed and verified in an American context, with the aim of identifying anxiety stemming from the Corona virus (Lee, 2020). It was then validated and its psychometric properties confirmed in many different nations and cultures, including as Mexico, Poland, and Turkey (Valdez, 2020). Most previous studies have examined the CAS's conceptual validity and internal consistency.

In these studies (Ahmed et al., 2020; Choi, Lee & Lee, 2020; El Sayed, Shokry & Gomaa, 2020; Evren et al., 2020; Magano et al., 2021; Lee, 2020; Padovan-Neto, et al., 2021; Silva, Brito & Pereira, 2020; 2020; Skalski et al., Valdez, 2020), the psychometric properties of the scale were assessed using the Classical Test Theory (CTT). These investigations' findings showed the scale's one-dimensionality and good validity and reliability.

However, this theory is vulnerable to crucial aspects since the CTT techniques are unable to accurately assess the symptomatology of anxiety generated by COVID-19 over the anxiety intensity range. This is because the theory is unable to account for specific issues with psychometric measurement; The test's sample of subjects affects the items' difficulty and discrimination coefficients, and the rate and scope of the subjects' abilities have an impact on the item's statistics, per the summary provided by Hambleton & Swaminathan (Hambleton & Swaminathan, 1985). When a subject's ability exceeds the average ability, the item's difficulty coefficient increases. discrimination coefficient.

In order to solve the shortcomings in the CTT, a whole new theory known as Item Response Theory (IRT) was created. Item Response Theory (IRT) bases its prediction on the idea that an individual's success on a psychological or educational test may be estimated from their distinguishing characteristics, or features or talents, which can be measured by their performance on the test items. This hypothesis, sometimes referred to as the Characteristic Curve hypothesis, demonstrates the relationship between the likelihood of correctly answering a question on an item and the associated feature or talent. From observed responses, inferences regarding the latent attribute are made use of. The item answer provides stable statistical indications for the test and its outcomes.

The graded response model was used in both of the studies that aimed to clarify the psychometric characteristics of the Item Response Theory (Kubb & Foran, 2020; Rodriguez, et al., 2021). The results showed that the Corona virus anxiety scale had high discrimination coefficients, that all of the thresholds' coefficients of difficulty are rising steadily, and that the scale is more accurate in predicting viral anxiety in individuals with high anxiety levels. Furthermore, no gender variation nor adequate information was provided for individuals scoring below average on the Corona virus anxiety scale.

Given the scale's widespread use in identifying anxiety related to the Corona virus on the one hand, and its truncated form on the other, the aim of this research is to confirm the psychometric qualities of the Corona Anxiety Scale using IRT. Due to the rapid spread of the coronavirus and the requirement for interventions to address the psychological impacts of the virus, this is required (Sousa and Rojjanasrirat, 2011). Al-Tariri (1996) pointed out that although measurement scientists are investing more overseas, especially in the US, it is still relatively uncommon to develop and validate psychological tests and measures in the Arab world using Item Response Theory and its various models.

The majority of the Arab studies that used traditional anxiety scales to diagnose coronavirus anxiety, including those by Al Omari et al. (2020), AlSalman et al. (2020), Alyami et al. (2020), Al Mahyijari et al. (2020), and Khoshaim et al. (2020), were not intended for this use, the researcher observed. This resulted from the growth in anxiety and panic around the coronavirus in regions where infection rates are rising, such as the Arab countries, as well as the absence of scales for diagnosing coronavirus-related anxiety symptoms in those nations. This study is unique in that it seeks the psychometric properties of the Arabic version of the Corona Virus Anxiety Scale according to the graded response model, in an attempt to present an objective measurement tool on the subject of detecting symptoms of anxiety from the Corona virus in the Arab environment using (IRT). This is because the latent trait models did not pay much attention to developing and validating educational and psychological scales on the Arab environment. Moreover, this study was necessary to verify the psychometric properties of this scale because there were not enough Arab studies using modern test theory.

Methodology

A. Study Participants: The study included 1,800 participants from six Arab countries. Of these, two hundred were from Egypt, three hundred from Jordan, one hundred and thirty-five from Bahrain, and one hundred from the Sultanate of Oman. Of them, three hundred were from the Kingdom of Saudi Arabia. Furthermore, 389 men and 799 women made up the participant count. There were 939 individuals under the age of forty and 249 persons older than forty. There were (238) patients with a coronavirus infection and (950) cases without one, according to the infection status.

B- Study instrument: To achieve the objectives of the research, The scale of coronavirus anxiety (CAS) by Lee (2020), was translated to measure coronavirus anxiety among individuals, which consisted of five items, each item of the CAS is rated on a 5-point scale, from 0 (not at all) to 4 (nearly every day), based on experiences over the past two weeks, as follows: (0) means never, (1) means rarely within 1 or 2 days, (2) several days (3-7 days), (3) more than 7 days, (4) daily (almost every day for the past two weeks).

Statistical analysis

A. To confirm the one-dimensionality, local independence, and symmetry of anxiety assumptions made by the Corona virus and its items, by using SPSS v28 software for an exploratory factor analysis and IRTPro v5 software to calculate the value of χ^2 for local independence.

B. Using IRTPro v5 software, the graded response model for the coronavirus anxiety items was used to estimate the discrimination parameter (a) and difficulty threshold parameters (b_1, b_2, b_3, b_4). The scale's items' corrected item-total correlations were determined, and the Cronbach's alpha equation was used to measure internal consistency.

C. Based on various evaluations of each person's ability, the test information function and item information function graphs were computed.

Results

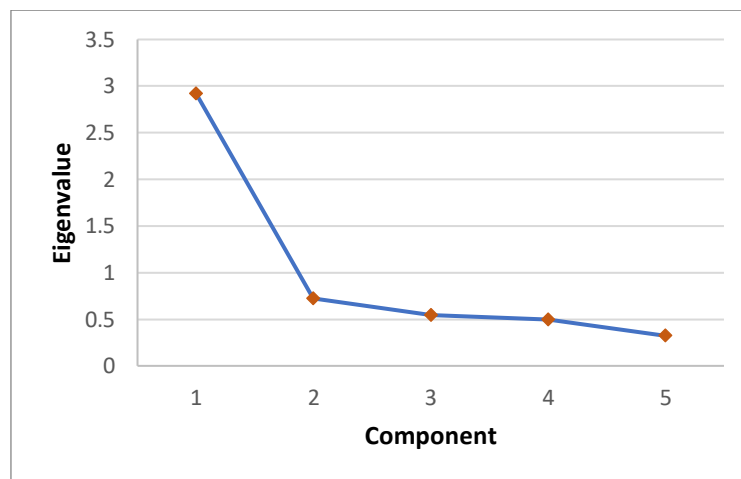
An exploratory factor analysis was done first. As shown in Table 1, the SPSS V27 software was used to verify the one-dimensionality assumption of the corona virus fear.

Table 1. The results of the exploratory factor analysis of the anxiety items of the Corona virus

| Component | Initial eigenvalues | Extracting the sums of the squares of loadings |
|-----------|---------------------|--|
|-----------|---------------------|--|

| | Value | variance% | Cumulative variance% | Value | variance% | Cumulative variance% |
|---|-------|-----------|----------------------|-------|-----------|----------------------|
| 1 | 2.92 | 58.38 | 58.38 | 2.92 | 58.38 | 58.38 |
| 2 | 0.72 | 14.40 | 72.78 | | | |
| 3 | 0.54 | 10.83 | 83.62 | | | |

As can be seen from Table 1, there is only one factor sorted in the exploratory factor analysis of the scale's items. The first component's percentage of explained variance was found to be 58.38 percent of the total explained variance, indicating that the scale items fulfilled the one-dimensionality assumption. This finding is consistent with Rechase's (1979) suggestion that "if the first factor was able to explain at least (20 percent) of the total explanatory variance of the scale items, this is an indication of the fulfillment of the one-dimensionality assumption." Additionally, the ratio of the first to the second eigenvalue achieved a value of (4.06); which



Additionally, the CAS items presumed local independence was confirmed; For every pair of items, the value of χ^2 for local independence is calculated and subsequently converted to Standardized LD χ^2 . If the χ^2 value is fewer than five, use IRTPro v5; If its value equals or exceeds (5), it indicates that the pair of items does not satisfy the program guide's instructions regarding local independence (Cai, Thissen & Du Toit, 2017), as indicated in Table 2. Otherwise, it indicates that the pair of items satisfies the assumption of local independence.

Table 2. χ^2 standard values of local independence of the Corona virus anxiety item pairs

| Item ID | Correlated with Item | | | |
|---------|----------------------|------|------|-----|
| | 1 | 2 | 3 | 4 |
| 1 | | | | |
| 2 | -1.6 | | | |
| 3 | -0.3 | 0.6 | | |
| 4 | -0.8 | -1.9 | -0.2 | |
| 5 | -0.8 | -1.6 | -0.6 | 3.8 |

Table 2 shows that all χ^2 standard values of local independence were less than (5), meaning that 100% of the ten item pairings attained local independence. This indicates that no clusters including three or more vertebral pairs were found to violate the local independence assumption (MCDONALD, 1999).

Using IRTPro v5 software, they will be able to confirm whether the graded response model ($\alpha = 0.001$) matches their scale items, as seen in Table 3.

Table 3. $s-\chi^2$ values for the items of anxiety about Corona virus and their degrees of freedom

| Item ID | S- χ^2 | df | Sig. |
|---------|-------------|----|------|
| 1 | 23.81 | 33 | 0.88 |
| 2 | 47.88 | 47 | 0.44 |
| 3 | 32.45 | 38 | 0.72 |
| 4 | 26.84 | 41 | 0.96 |
| 5 | 44.29 | 45 | 0.50 |

Every item in Table 3 matches the response of the graded model. Second, the Graded Response Model (GRM) was employed since the findings of the exploratory factor analysis (EFA) support the one-dimensionality independence assumptions. Table 4's item discrimination parameters are all more than 1, which is thought to be a good discrimination value (Baker, 2001). Consequently, all the characteristics of difficulty of the threshold estimators show a trend towards monotonicity.

Table 4. Difficulty and discrimination parameters for scale items.

| Item ID | Parameters of: | | | | | | | | | |
|---------|----------------|--------|-----------------------|-----------|--------|-----------|-------|-----------|--------|-----------|
| | discrimination | | Difficulty thresholds | | | | | | | |
| | | | First | | Second | | Third | | Fourth | |
| | A | se_a | b_1 | se_{b1} | b_2 | se_{b2} | b_3 | se_{b3} | b_4 | se_{b4} |
| 1 | 1.651 | 0.146 | 1.231 | 0.083 | 2.106 | 0.140 | 2.689 | 0.190 | 3.048 | 0.228 |
| 2 | 2.135 | 0.176 | 0.840 | 0.057 | 1.789 | 0.100 | 2.297 | 0.135 | 2.710 | 0.172 |
| 3 | 2.737 | 0.246 | 1.222 | 0.065 | 1.970 | 0.106 | 2.273 | 0.128 | 2.561 | 0.155 |
| 4 | 3.333 | 0.298 | 0.962 | 0.053 | 1.658 | 0.082 | 2.047 | 0.106 | 2.385 | 0.133 |
| 5 | 3.574 | 0.376 | 1.029 | 0.055 | 1.698 | 0.085 | 1.988 | 0.104 | 2.223 | 0.122 |
| Minimum | 1.651 | 0.146 | 0.840 | 0.053 | 1.658 | 0.082 | 1.988 | 0.104 | 2.223 | 0.122 |
| Mean | 2.686 | 0.248 | 1.057 | 0.063 | 1.844 | 0.103 | 2.259 | 0.132 | 2.585 | 0.162 |
| SD | 0.804 | 0.093 | 0.169 | 0.012 | 0.189 | 0.023 | 0.276 | 0.035 | 0.317 | 0.042 |
| Maximum | 3.574 | 0.376 | 1.231 | 0.083 | 2.106 | 0.140 | 2.689 | 0.190 | 3.048 | 0.228 |

The revised item-total correlation coefficients for the Corona Virus Anxiety components were also computed in order to confirm the construction validity of the scale items. as displayed in Table 5.

Table 5. The values of the corrected item-total correlation coefficients for the Corona Virus Anxiety items

| Items | CITC* |
|-------|-------|
| 1 | 0.49 |
| 2 | 0.60 |
| 3 | 0.63 |
| 4 | 0.68 |
| 5 | 0.65 |

* CITC: Corrected Item-Total correlation

Table 5 shows that for the Corona Virus Anxiety items, the correlation values of the corrected item-total coefficients varied from (0.49-0.68). The scale's elements' internal consistency as determined by the

Cronbach's alpha equation (0.82). In the graded response model, the Item Response Theory's value of marginal empirical stability was (0.88).

Thirdly, Figure 2 shows that the scale's and the five items' information curves (IIC and TIC respectively). It can be seen from the IIC that the most pertinent items on the scale for assessing the latent variable are 3, 4, and 5. Furthermore, the test's increased reliability is indicated by the TIC in the -0.5 to -3 region of the scale.

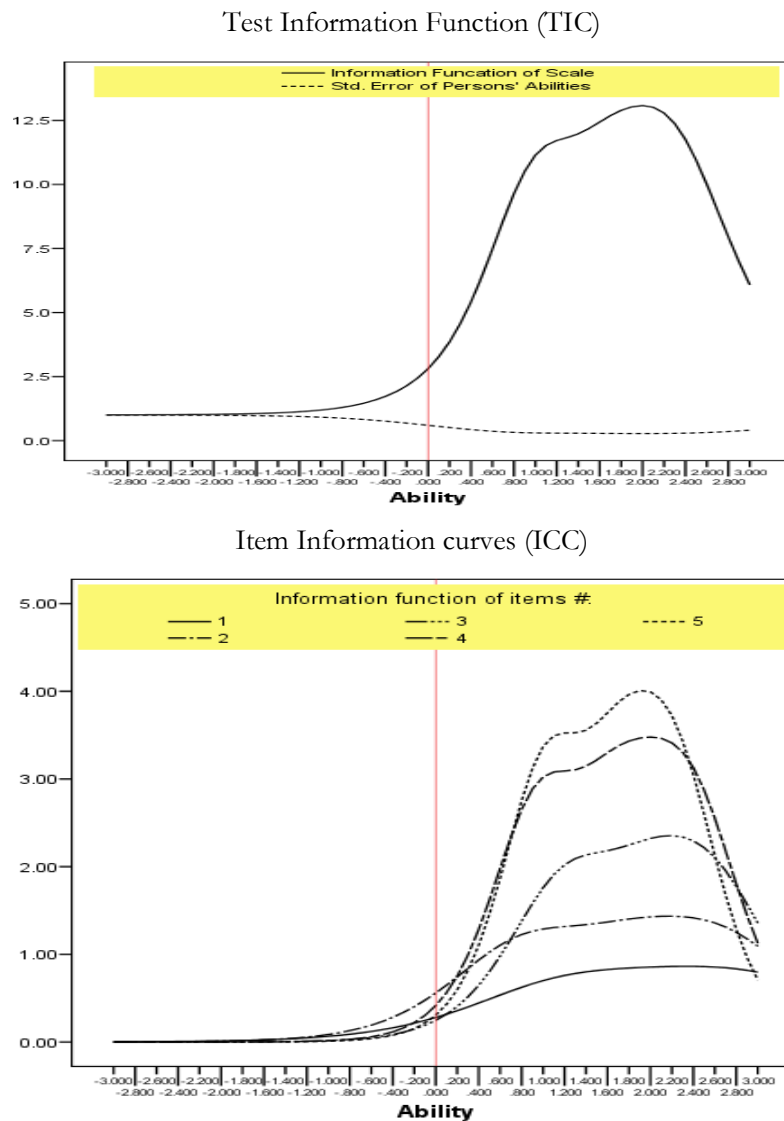


Figure 2. Item and test information curves for the scale

Discussion

This study examined the psychometric properties of the Arabic version of the Corona Virus Anxiety Scale using the graded response model in order to determine the differential item functions based on gender, age, and infection status.

In general, EFA allows for a one-dimensional model presence. Additionally, the items exhibit high and good factorial load reliability in terms of internal consistency. The scale also possesses sufficient psychometric qualities, a strong component structure, and sufficient markers of the construct—dysfunctional anxiety associated with the coronavirus—in each of the items. These results are nearly the

same as those found in other studies (Ahmed et al., 2020; Choi et al., 2020; Evren et al., 2020; Kubb & Foran, 2020) and the original study (Lee et al., 2020a).

The first or second response option will probably be chosen by someone who is not very anxious about the COVID-19; as his anxiety level rises, he will choose a higher response option. Furthermore, when the CAS's dimensionality was determined, IRT models were calculated, and the findings show that every item has increasing monotonic difficulty parameter values. Because every item on the CAS has a high discriminating value, it will be easy to use the CAS to distinguish between a person who has high anxiety and one who has moderate. Total scores represent the general evaluation of the latent variable.

This is a predicted and good behavior in the instrument since it demonstrates that the content highlighted in each item permits participants to utilize the answer possibilities provided and that the measurement instrument's methodology does not result in information loss.

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