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COVID-19 PERITRAUMATIC DISTRESS INDEX EXPLORATORY FACTOR ANALYSIS RESULTS USING A BRAZILIAN SAMPLE

Alberto Abad[1]

Abstract

We conducted an exploratory factor analysis (EFA) to empirically derive the COVID-19 Peritraumatic Distress Index (CPDI) factor structure. Data (peri-traumatic stress during the COVID-19). We used data from the Physical and Psychological Reactions as Health Indicators Research (Virtual Laboratory of Affective, Cognitive and Behavioral Neuropsychometry – LAVINACC). EFA was implemented using a Polychoric Matrix and Robust Diagonally Weighted Least Squares (RDWLS) extraction method. We used the Parallel Analysis with random permutation, and as a rotation technique, we used the Robust Promin. The adequacy of the model was evaluated using the Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) fit indices. The Ratio Communality Index (RCI) reported (*RCI* = 0.998452) showed both subsamples have a similar amount of common variance. Results showed adequacy of the polychoric correlation matrix measured by Bartlett's sphericity (21116.6, (*df* = 276; *p* < 0.00001) and *KMO* = 0.939. The overall assessment (*UniCo* = 0.918; *ECV* = 0.85), *MIREAL* = 0.200), suggested that CPDI can be treated as a two-factor structure: first factor (internal stressors), second factor (external stressors). Replication studies to verify further validity and reliability should be undertaken.

Keywords: Peritraumatic Distress Index; Stress; Factor Analysis.

ANÁLISE FATORIAL DO ÍNDICE DE ESTRESSE PERI-TRAUMÁTICO COVID-19 USANDO UMA AMOSTRA BRASILEIRA

Resumo

Realizamos uma análise fatorial exploratória (EFA) para derivar empiricamente a estrutura fatorial do Índice de Estresse Peri-traumático COVID-19 (CPDI). Foram utilizados dados da Pesquisa de Reações Físicas e Psicológicas como Indicadores de Saúde (Laboratório Virtual de Neuro-psicometria Afetiva, Cognitiva e Comportamental – LAVINACC). A EFA foi implementada usando um método de extração de Matriz Policórica e Robust Diagonally Weighted Least Squares (RDWLS). Utilizou-se a Análise Paralela com permutação aleatória, e como técnica de rotação, utilizou-se Promin. A adequação do modelo foi avaliada por meio dos índices de ajuste Root Mean Square Error of Approach (RMSEA), Tucker-Lewis Index (TLI) e Comparative Fit Index (CFI). O Índice de Comunalidade da Razão (RCI) relatado (RCI = 0,998452) mostrou que ambas as sub-amostras têm uma quantidade semelhante de variância comum. Os resultados mostraram adequação da matriz de correlação policórica medida pela esfericidade de Bartlett (21116,6, (*df* = 276; *p* < 0,00001) e *KMO* = 0,939. A avaliação global (*UniCo* = 0,918); (*ECV* = 0,85), *MIREAL* = 0,200), sugeriu que o CPDI pode ser tratada como uma estrutura de dois fatores: primeiro fator (estressores internos), segundo fator (estressores externos). Estudos de replicação para verificar mais validade e confiabilidade devem ser realizados.

Palavras-Chave: Índice de Estresse Peri-traumático; Estresse; Análise Fatorial.

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ANÁLISIS FACTORAL DEL ÍNDICE DE ESTRÉS PERITRAUMÁTICO COVID-19 UTILIZANDO UNA MUESTRA BRASILEÑA

Resumen

Realizamos un análisis factorial exploratoria (AFE) para derivar empíricamente la estructura factorial del índice de estrés peritraumático (CPDI) de COVID-19. Se utilizaron datos de la Investigación sobre Reacciones Físicas y Psicológicas como Indicadores de Salud (Laboratorio Virtual de Neuropsicometría Afectiva, Cognitiva y Conductual – LAVINACC). El EFA se implementó utilizando un método de extracción de matriz policórica y mínimos cuadrados ponderados diagonalmente robustos (RDWLS). Se utilizó el Análisis Paralelo con permutación aleatoria, y como técnica de rotación se utilizó Promin. La idoneidad del modelo se evaluó utilizando los índices de ajuste Raíz del error cuadrático medio de aproximación (RMSEA), Índice de Tucker-Lewis (TLI) e Índice de ajuste comparativo (CFI). El índice de similitud (RCI) informado (RCI = 0.998452) mostró que ambas submuestras tienen una cantidad similar de varianza común. Los resultados mostraron adecuación de la matriz de correlación policórica medida por la esfericidad de Bartlett (21116.6, (df = 276; $p < 0.00001$) y KMO = 0.939. La evaluación global (UniCo = 0.918); (ECV = 0.85), MIREAL = 0.200), sugirió que el CPDI puede ser tratado como una estructura de dos factores: primer factor (estresores internos), segundo factor (estresores externos). Se deben realizar estudios de replicación para verificar una mayor validez y confiabilidad.

Palabras clave: Índice de Estrés Peritraumático; Estrés; Análisis factorial.

Introduction

The coronavirus (SARS-CoV-2) pandemic is one of the most significant health challenges on a global scale this century. By 2022, two years after the outbreak in China in late 2019, there had been more than 62 million deaths worldwide from COVID-19. As no one can predict how the pandemic will evolve, this can lead the population to experience stress, fear, and anguish for a long time (Danese et al. 2020). Previous research has revealed a profound and wide range of psychosocial impacts on people at the individual levels during the outbreak of infection (Abad et al. 2020). People are likely to experience fear of falling sick or dying, feelings of helplessness, and stigma (Wang et al. 2020).

Through 2020 and 2021, the Virtual Laboratory of Affective, Cognitive, and Behavioral Neuropsychometry – LAVINACC – conducted the *Physical and Psychological Reactions as Health Indicators throughout the COVID-19 Pandemic research*. Among other indicators, they researched the peri-traumatic stress during the COVID-19 pandemics in Brazil using the Peri-Traumatic Distress Scale (CPDI) (Qiu et al. 2020) to a sample of 1844 participants (Abad et al. 2020).

According to Qiu et al. (2020), CPDI inquired about the frequency of 22 factors (Anger; Anxiety; Negative Mood; Irritableness; Exhaustion; Sluggishness; Helplessness; Avoidance;

Indecisiveness; Sleeplessness; Poor Appetite; Distrust; Physical Symptoms; Bladder and Bowel; Obsessive Behavior; Insecurity; Fear; Sadness; Spread Negative News; Social function; Lack of Judgement; Attention Deficit). Shanghai Mental Health Center Psychiatrists verified the CPDI content validity. The Cronbach's alpha of CPDI is 0.95 ($p<0.001$) (Qiu et al. 2020). This research aims to empirically derive the factor structure of the COVID-19 Peritraumatic Distress Index (CPDI).

Method

Research Design

Exploratory factor analysis (EFA) was conducted to empirically derive the factor structure of the COVID-19 Peritraumatic Distress Index (CPDI) (Qiu et al. 2020). We used FACTOR, a program developed to fit the EFA model using a variety of procedures (e g., number of factors/components to be retained, factor and component analysis, rotation methods) (Lorezo-Seva e Ferrando 2013). As a preliminary analysis, the program performed SOLOMON (splitting a sample into subsamples in factor analysis) to assess if both subsamples have a similar common variance amount (Lorenzo-Seva 2021).

We implemented EFA using a Polychoric Matrix and Robust Diagonally Weighted Least Squares (RDWLS) extraction method. RDWLS is advised when the univariate distributions of ordinal items are asymmetric) (Asparouhov e Muthén 2010). We used the Parallel Analysis with random permutation as an improved method to asses dimensionality. We based the decision of dimensionality on the percentage of common explained variance (Timmerman e Lorenzo-Seva 2011). As a rotation technique, we used the Robust Promin (Ferrando e Lorenzo-Seva 2018).

We evaluated the adequacy of the model using the Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) fit indices. According to Brown (2015), RMSEA values must be less than 0.08, with confidence intervals not reaching 0.10. TLI and CFI values must be above 0.90, or preferably 0.95.

Additionally, We use the *H index* to assess how well a set of items represents a common factor – factor stability – (Ferrando e Lorenzo-Seva 2018). *H values* range from 0 to 1, showing the latent variable strength across different studies (High *H values* (> 0.80) suggest a well-defined latent variable, low *H values* suggest an ill-defined latent variable) (Ferrando e Lorenzo-Seva 2018).

Results

As a preliminary approach – the sample was over 400 observations (n = 1844) – FACTOR performed the SALOMON splitting method (Lorenzo-Seva 2021). The Ratio Communality Index (RCI) reported (*RCI* = 0.998452) showed both subsamples have a similar amount of common variance (the closer its value to 1, the most comparable subsamples are) (Lorenzo-Seva 2021). We have a kurtosis ($p < 0.05$), which indicates our data do not have a normal distribution. Therefore, the Diagonally Weighted Least Squares (RDWLS) extraction method is suitable for categorical data that do not have a normal distribution (Asparouhov e Muthén 2010).

Adequacy of the polychoric correlation matrix measured by Bartlett's sphericity 21116.6, ($df = 276$; $p < 0.00001$) and *KMO* = 0.939 tests suggested the interpretability of the items' correlation matrix. Parallel analysis suggested two factors as being the most representative of the data (See Table 1).

Table 1.
Parallel Analysis (PA) based on minimum rank factor analysis

Factors	Real-data % of the variance	95 percentiles of random % of the variance
1	44.6815**	9.4304
2	8.7260*	8.8866
3	6.4460	8.4607
4	5.6986	7.9157
5	4.8193	7.3931
6	3.8661	7.0071
7	3.4960	6.6178
8	3.2895	6.2075
9	2.6277	5.8782
10	2.3598	5.5255
11	2.1117	5.1638
12	1.9076	4.8240
13	1.6978	4.4734
14	1.6292	4.1910
15	1.4929	3.8892
16	1.3169	3.5129
17	1.0860	3.2503
18	0.8568	2.8530
19	0.7091	2.5205
20	0.5451	2.1513
21	0.4249	1.7944
22	0.1339	1.3336
23	0.0776	0.9004

Note: *The number of factors to retain is one, as these factors from real data have a higher % explained variance than random data. **Advised number of dimensions when 95 percentiles are considered: 2

We present item factor loadings in Table 2. We also report the estimates of replicability of factor scores (H-index). This index evaluates how well a set of items represents a common factor (Ferrando e Lorenzo-Seva 2018). High *H values* (>.80) suggest a well-defined latent

variable, which is more likely to be stable across studies; low *H values* indicate a poorly defined latent variable, which is likely to change across studies (Ferrando e Lorenzo-Seva 2018).

Table 2.

Factor Structure of COVID-19 Peritraumatic Distress Index (CPDI)

	ITEM	FACTOR 01	FACTOR 02
1	Compared to usual, I feel more nervous and anxious	0.702	
2	I feel insecure and bought a lot of masks, medications, sanitizer, gloves and/or other home supplies		0.570
3	I can't stop myself from imagining myself or my family being infected and feel terrified and anxious about it		0.599
4	I feel empty and helpless no matter what I do	0.653	
5	I feel sympathetic to the COVID-19 patients and their families. I feel sad about them.		
6	I feel helpless and angry about people around me, governors, and media		
7	I am losing faith in the people around me	0.340	
8	I collect information about COVID-19 all day. Even if it's not necessary, I can't stop myself		0.744
9	I will believe the COVID-19 information from all sources without any evaluation		0.665
10	I would rather believe in negative news about COVID-19 and be skeptical about the good news		0.532
11	I am constantly sharing news about COVID-19(mostly negative news)		0.779
12	I avoid watching COVID-19 news, since I am too scared to do so	0.374	
13	I am more irritable and have frequent conflicts with my family	0.623	
14	I feel tired and sometimes even exhausted	0.881	
15	Due to feelings of anxiety, my reactions are becoming sluggish.	0.959	
16	I find it hard to concentrate	1.102	
17	I find it hard to make any decisions	1.055	
18	During this COVID-19 period, I often feel dizzy or have back pain and chest distress	0.594	
19	During this COVID-19 period, I often feel stomach pain, bloating, and other stomach discomfort	0.601	
20	I feel uncomfortable when communicating with others	0.553	
21	Recently, I rarely talk to my family		
22	I cannot sleep well. I always dream about myself or my family being infected by COVID-19		0.498
23	I lost my appetite	0.456	
24	I have constipation or frequent urination	0.427	
	H-Latent	0.964	0.871
	H-Observed	0.949	0.826

Unidimensional Congruence (*UniCo* = 0.918) suggested data cannot be treated as essentially unidimensional (Ferrando e Lorenzo-Seva 2018). Nevertheless, Explained Common Variance (*ECV* = 0.85) was within the limit, as values larger than 0.85 suggests that data can be treated as essentially unidimensional. Finally, the Mean of Item Residual Absolute Loadings (MIREAL) value (*MIREAL* = 0.200), lower than 0.300 suggests that data can be treated as essentially unidimensional. Additionally, the adjustment indexes which assess whether the obtained factor structure is suitable for the database show strong criteria indexes

attesting to the plausibility of this model: Root Mean Square Error of Approximation (*RMSEA* = 0.067); Non-Normed Fit Index (*NNFI* = 0.976).

The Measure of Sampling Adequacy (MSA) proposed to remove one item (21 Recently, I rarely talk to my family) (*MSA* = 0.55089) (Lorenzo e Ferrando 2021). Nevertheless, Pratt's relative importance indicator that measures how much each of the factors explains the item's variance showed item #21 is significant for the first factor, therefore the decision was to retain the item.

The quality and Effectiveness of Factor Score estimates (Ferrando e Lorenzo-Seva 2018) showed: Factor Determinacy Index (*FDI* = 0.982) for factor 1, and (*FDI* = 0.933) for factor 2; ORION marginal reliability showed (*ORION* = 0.964) for factor 1 and (*ORION* = 0.871) for factor 2 as factorial score reliability indicators. Finally, the Sensitivity ratio (SR) score was for the first factor (*SR* = 5.200) and (*SR* = 2.597) for the second factor.

Discussion

Our results point out a two-factor structure of the CPDI (Qiu et al. 2020) that could be congruent if we consider stress as the physiological or psychological response to internal or external stressors (VandenBos 2015). The first factor, internal stressors (items 1, 4, 7, 12, 13, 14, 15, 16, 17, 18, 19. 20, 23, and 24) is suitable for inner manifestations [e g., palpitations, sweating, dry mouth, shortness of breath, fidgeting, accelerated speech, augmentation of negative emotions, longer duration of stress fatigue (VandenBos 2015)]. The second factor – external stressors (items 2, 3, 8, 9, 10, 11, and 22) [e g., any event, force, or condition that results in physical or emotional stress (VandenBos 2015)]. Probably, it is advisable to reformulate items (5, 6, and 21). Since the present findings are preliminary, further replication studies for validity and reliability should be conducted.

Data Availability

The datasets generated during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

We have no conflicts of interest to disclose.

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