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ORIGINAL ARTICLE

Internal consistency, factorial validity, and construct validity of scales for measuring distress and eustress in Mexican workers during the COVID-19 pandemic

Consistencia interna, validez factorial y validez de constructo de escalas para medir distrés y eustrés en trabajadores mexicanos durante la pandemia COVID-19

Consistência interna, validade fatorial e validade de construto de escalas para medir sofrimento e eustresse em trabalhadores mexicanos durante a pandemia de COVID-19

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ABSTRACT

Introduction: occupational psychological well-being is a key factor in workers' productivity and performance. Therefore, it is necessary to have reliable and accurate measuring instruments that help identify the levels of distress and eustress in workers and establish adequate limits for their interpretation. **Objective:** to analyze the internal consistency, factorial validity, and construct validity of scales used to measure distress and eustress in healthcare workers who worked during the COVID-19 pandemic. **Method:** a descriptive, observational, and cross-sectional study was carried out from January 2021 to December 2022, with a sample size of 596 healthcare workers in north-western and central Mexico. Data was collected using Google Forms. Two seven-item scales were applied for distress and eustress, respectively. **Results:** adequate internal consistency was identified (eustress α=0.84, distress α=0.85). Regarding exploratory factorial validity, the factor loadings for each item on both scales were greater than 0.5. A statistically significant positive correlation was observed between eustress and distress (r=.-492, p<0.01). The scales presented an adequate fit to the measurement models: Chi2/df≤5, GFI>0.90, RMSEA<0.08, NNFI>0.90, CFI>0.90, PNFI>0.74. **Conclusions:** it is important to identify cut-off points for the distress and eustress scores obtained. Interventions that maintain moderate levels of distress and high levels of eustress in workers are recommended.

Keywords: validation study; occupational well-being; distress; eustress; occupational health

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RESUMEN

Introducción: el bienestar psicológico ocupacional es un factor clave en la productividad y el rendimiento de los trabajadores, por ello es necesario contar con instrumentos de medición confiables y precisos que ayuden a identificar los niveles de distrés y eustrés en los trabajadores y a establecer límites adecuados para su interpretación. **Objetivo:** analizar la consistencia interna, la validez factorial y la validez de constructo de las escalas para medir distrés y eustrés en trabajadores del sector salud que laboraron durante la pandemia por COVID-19. **Método:** estudio descriptivo, observacional y transversal realizado en el periodo enero 2021 a diciembre 2022, con un tamaño de muestra de 596 trabajadores del sector salud del noroeste y centro de México. La recolección de datos fue a través de Google Forms. Fueron aplicadas dos escalas con siete ítems para distrés y eustrés, respectivamente. **Resultados:** se identificó una adecuada consistencia interna (eustrés α=0,84, distrés α=0,85). Con relación a la validez factorial exploratoria, las cargas factoriales para cada ítem de las dos escalas se mostraron superiores a 0,5. Se observó una correlación positiva estadísticamente significativa entre eustrés y distrés (r=.-492, p<0,01). Las escalas presentaron un adecuado ajuste de los modelos de medición: $Chi^2/gl \leq 5$, GFI>0,90, RMSEA<0,08, NNFI>0,90, CFI>0,90, PNFI>0,74. **Conclusiones:** es importante identificar puntos de corte en el valor obtenido de distrés y eustrés. Se recomienda realizar intervenciones que permitan mantener niveles moderados de distrés y altos niveles de eustrés en los trabajadores.

Palabras clave: estudio de validación; bienestar ocupacional; distrés; eustrés; salud ocupacional

RESUMO

Introdução: o bem-estar psicológico ocupacional é um fator-chave na produtividade e no desempenho do trabalhador. Portanto, é necessário dispor de instrumentos de medição confiáveis e precisos que auxiliem na identificação dos níveis de sofrimento e euestresse nos trabalhadores e no estabelecimento de limites adequados para sua interpretação. **Objetivo:** analisar a consistência interna, a validade fatorial e a validade de construto de escalas utilizadas para mensurar o sofrimento e o eustresse em profissionais de saúde durante a pandemia de COVID-19. **Método:** estudo descritivo, observacional e transversal realizado de janeiro de 2021 a dezembro de 2022, com amostra de 596 trabalhadores do setor de saúde do noroeste e centro do México. A coleta de dados foi feita através do Google Forms. Foram aplicadas duas escalas com sete itens para distress e eustress, respectivamente. **Resultados:** foi identificada consistência interna adequada (eustress α=0,84, distress α=0,85). Em relação à validade fatorial exploratória, as cargas fatoriais para cada item das duas escalas foram maiores que 0,5. Foi observada uma correlação positiva estatisticamente significativa entre eustress e distress (r=.-492, p<0,01). As escalas apresentaram ajuste adequado aos modelos de mensuração: Chi2/gl≤5, GFI>0,90, RMSEA<0,08, NNFI>0,90, CFI>0,90, PNFI>0,74.**Conclusões:** é importante identificar pontos de corte nos valores obtidos para distress e eustress. Intervenções que mantenham níveis moderados de sofrimento e altos níveis de euestresse nos trabalhadores são recomendadas.

Palavras-chave: estudo de validação; bem-estar ocupacional; angústia; eustresse; saúde ocupacional

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INTRODUCTION

Occupational psychological well-being is a key factor in worker productivity and performance. With the advent of the COVID-19 pandemic, working conditions were drastically transformed, generating significant changes in the perception of work stress and in the way in which employees faced the challenges associated with this health crisis.[1]

In this context, the study of distress and eustress takes on a fundamental relevance for understanding occupational health and designing intervention strategies that promote an appropriate balance between moderate levels of distress and high levels of eustress.[2]

Distress and eustress represent two opposite sides of stress: negative stress, called distress, which has a high stress level; and positive stress, called eustress, which has a moderate stress level.[3] Distress, on the other hand, is a state of psychic tension (discomfort, unpleasantness, sadness). Eustress favors the activation to perform activities that generate pleasure, harmony, gratification, success, among others.[4]

In the workplace, distress is associated with negative experiences that affect the mental and physical health of workers; eustress is a positive type of stress that boosts motivation, engagement, and problem solving. Differentiating the two types of stress is crucial to understanding how they influence job performance and employee quality of life, especially in a period as complex as that experienced during and after the COVID-19 pandemic.[5]

During the COVID-19 pandemic, numerous studies addressed the impact of stress on the mental health of workers, noting increased levels of anxiety, depression and burnout.[6,7,8] However, few studies have systematically explored the relationship between distress and eustress in the work environment and how these constructs can be measured in a valid and reliable manner.[3]

It is necessary to have reliable and precise measurement instruments that help to identify the levels of distress and eustress in workers and to establish adequate limits for their interpretation.[3] There is literature that analyzes the psychometric properties of scales to measure eustress and distress in students.[10]. The present study seeks to fill this gap in the literature through a detailed analysis of the psychometric properties of scales to measure distress and eustress in a representative sample of Mexican workers health sector who work in central and northern Mexico.

The problem analyzed by this research is formulated through the following question: Do the scales for measuring distress and eustress present reliability, factorial validity and construct validity in a sample of 596 health care workers from north-western and southern Mexico?

The aim of the present study was then: to analyze the internal consistency, factorial validity and construct validity of scales to measure distress and eustress in health care workers who worked during the COVID-19 pandemic.

METHOD

The methodological design adopted in this research is cross-sectional, descriptive, observational.[11]

The sample consisted of 596 people working in the health sector. The participants were selected by non-probabilistic convenience sampling. The only inclusion criterion, in addition to voluntary participation, was being employed at the time of the study. Exclusion criteria were considered: not having completed the questionnaire, being under psychiatric treatment or having been identified as a multivariate outlier case.[12]

Data collection was performed in the south and northwest of Mexico, through a link in Google Forms in the period from January 2021 to December 2022.

Two scales were used, the eustress scale consisting of seven items (example item: “how often have you been confident about your ability to handle your personal problems?”) and the distress scale consisting of seven items (example item: “how often are you full of tension or stress”). The items were evaluated using a five-grade frequency scale ranging from 1 (Never) to 5 (Very often: every day), with one case corresponding to 3 (Occasionally).[13]

All data from the distress and eustress scales were recorded in Excel; any discrepancies were identified and corrected by reference in the original instrument. The data were exported to the Jamovi Version 2.3 program, and internal consistency, item correlation of the two scales, and factorial validity were calculated.[14]

Construct validation was carried out using LISREL software version 8.30. In the confirmatory factor analysis (CFA), several indices were used to assess the fit of the model to the observed data. The established Chi-square index, which measures the fit taking into account overfitting, was considered, accepting values up to 5.

The GIF index estimates the goodness of fit through the variance explained by the model. The NNFI index, which represents the unnormalized fit, evaluates the relative fit of the model.

On the other hand, the CFI index compares the model with a null model, with values above .90 indicating an adequate fit in the GIF, NNFI and CFI.

The RMSEA index estimates the overall quadratic approximation error, where values between 0.03 and 0.09 suggest a satisfactory fit. Finally, the PNFI index, which measures the parsimony of the model, is considered appropriate when it exceeds .50, as long as the NNFI is greater than 0.90, Figure 1 shows AFC.[15]

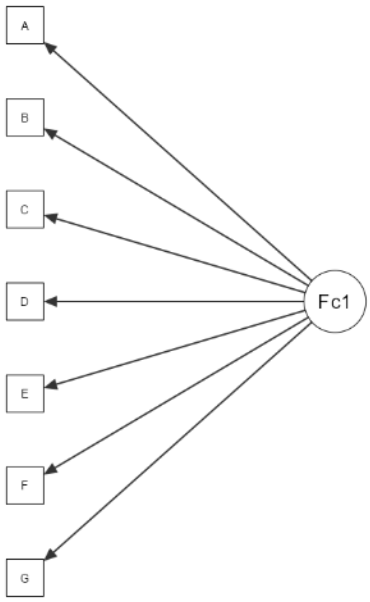

Fig 1: Expected Confirmatory Factor Analysis for the distress and eustress scales

The confidentiality of the workers' responses was guaranteed. The informed consent form was presented to them for their approval, and they were informed of their autonomy not to answer any question if they so wished. Likewise, the personnel who carried out the capture mask and database conformation did not know the formulation of the study question. In other words, the personnel who participated in the research did not plan or control the production of the phenomenon or its results.

RESULTS

Regarding the sociodemographic profile of the workers, 71% were women, with an average age of 36 years (SD=8.7), with minimum and maximum age of 20 and 66 years respectively.

Internal consistency and factorial validity

Table 1 show that the reliability was favorable in the scales on distress and eustress. Table 2 and Table 3 show that reliability was favorable even with the elimination of each of the items of the distress and eustress scales.[16,17]

Table 1: Reliability statistics of the distress and eustress scale

Scale	Mean	SD	Cronbach's alpha	McDonald's ω
Distress	3,09	,706	0,846	0,848
Eustress	3,92	0,558	0,839	0,843

Table 2: Reliability statistics of the items of the distress scale

Item	Mean	SD	Correlation of the item with other items	If the element is discarded	
				Cronbach's alpha	McDonald's ω
1 Affected by what happened	3,07	0,944	0,593	0,827	0,828
2 Unable to show control of things	2,75	0,971	0,653	0,818	0,819
3 Full of tension	3,48	1,013	0,654	0,817	0,819
4 Unable to cope with everything	2,92	0,981	0,512	0,839	0,840
5 Angry about things	3,08	0,967	0,616	0,823	0,826
6 Thinking about things you haven't finished	3,66	0,979	0,521	0,837	0,839
7 Not overcoming difficulties	2,68	0,997	0,676	0,814	0,816

Table 3: Reliability statistics of the eustress scale items

Item	Mean	SD	Correlation of the item with other items	If the element is discarded	
				Cronbach's alpha	McDonald's ω
1 Handling irritating problems	3,99	0,773	0,582	0,818	0,823
2 Coping effectively with change	4,05	0,758	0,665	0,806	0,810
3 Handling your personal problems	4,10	0,790	0,690	0,801	0,806
4 Feeling that things are going well for you	3,99	0,777	0,631	0,811	0,817
5 Managing life's difficulties	4,10	0,742	0,628	0,812	0,818
6 Feeling in control	3,45	0,830	0,485	0,834	0,838
7 Controlling the way you organize your time	3,78	0,801	0,473	0,835	0,840

To evaluate the factorial validity of both scales, it was taken into account that each was made up of seven items. An item was considered part of the scale if its factor load was greater than 0.50. The correlation between the items was moderate; a minimum value of 0.30 was established as a criterion of correlation strength. The results showed that the data were sufficiently correlated to justify the application of an exploratory factor analysis to the distress and eustress scales (Figure 2 and Figure 3).

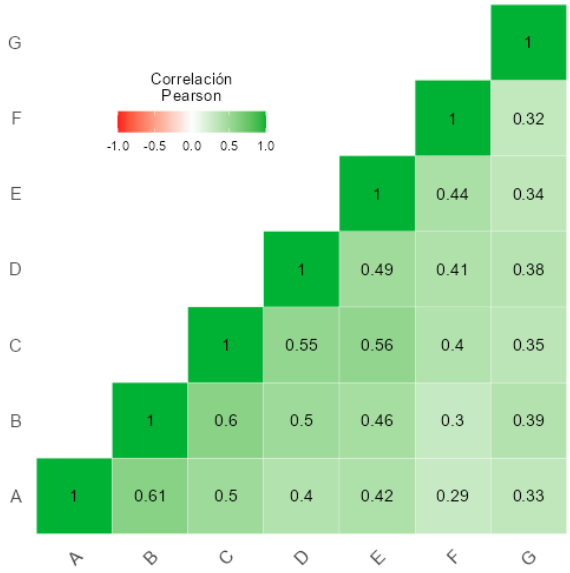

Fig. 3: Heat map of correlation of the elements of the distress scale

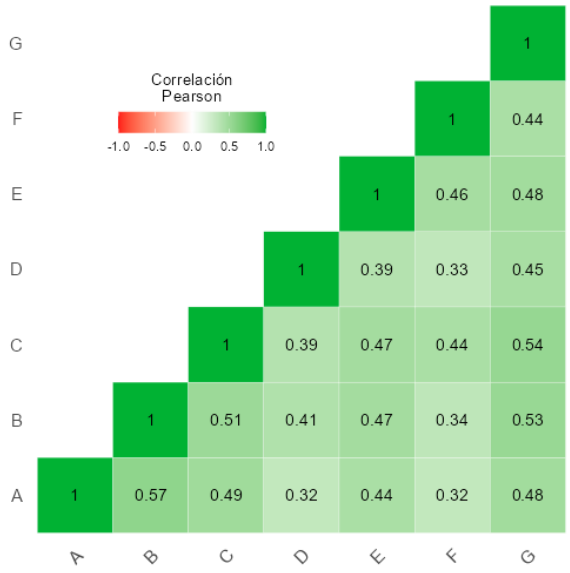

Fig. 2: Correlation heat map of the eustress scale elements

An exploratory factor analysis (EFA) was carried out by applying various statistical tests. First, the Kaiser-Meyer-Olkin test (KMO) was used, obtaining values of 0.87 for eustress and 0.89 for distress. In addition, Bartlett's sphericity statistic was considered, with results of 1427 (Df=21; p=0.000) for eustress and 1393 (Df=21; p=0.000) for distress.

Since the scale data were recorded in an ordinal format with Likert-type responses from 1 to 5, the principal components method was used for factor extraction. This approach facilitates the identification of more general and reproducible factors by avoiding overestimation of variance.[19] Regarding the number of factors, the factor structure analysis of the eustress scale indicated the presence of only one factor, which explained 52% of the variance.

Similarly, in the distress scale, a single factor was identified with the same percentage of variance explained. The factor loadings of the items in both scales were greater than 0.5. It was necessary to apply rotation in the solution using Simplimax.[20] In both cases, a single component was obtained (Table 4 and Table 5).

Table 4: Exploratory Factor Analysis of the eustress scale

Items	Component
1 Handling irritating problems	0,714
2 Coping effectively with change	0,784
3 Handling your personal problems	0,804
4 Feeling that things are going well for you	0,749
5 Managing life's difficulties	0,745
6 Feeling in control	0,608
7 Controlling the way you organize your time	0,595

In favor of control (α=0.87); Total variance explained52 %; *p < 0.01

Table 5: Exploratory Factor Analysis of the Distress Scale

Items	Component
1 Affected by what happened	0,717
2 Unable to show control of things	0,768
3 Full of tension	0,766
4 Unable to cope with everything	0,635
5 Angry about things	0,731
6 Thinking about things you haven't finished	0,644
7 Not overcoming difficulties	0,784

Loss of control (α = 0.77); Total variance explained 52 %.

The existence of a single dimension was supported by the asymptotic shape observed in the two graph of sedimentation (Figure 4 and Figure 5)

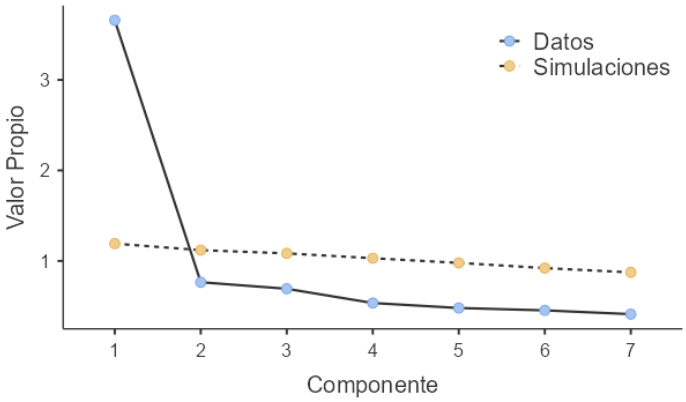

Fig. 4: Sedimentation graph of the distress scale

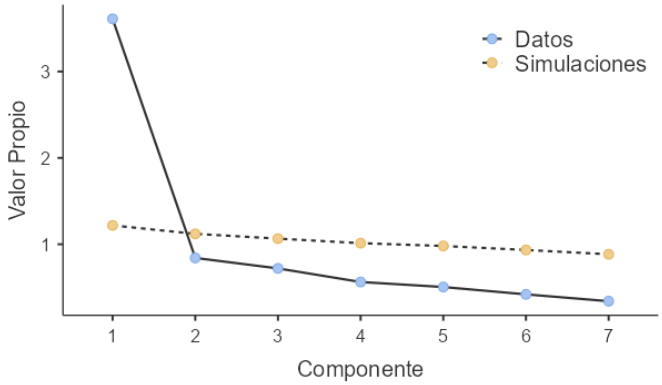

Fig. 5: Eustress scale sedimentation graph.

Construct validity of distress

In relation to the measurement model, an adequate fit was obtained for the sample when considering the following indexes: GIF, NNFI, CFI, PNFI and RMSEA.[21] (Table 6)

Table 6: Distress scale measurement model

Chi^2	Gl	Chi^2/gl	P	GFI	RMSEA	NNFI	CFI	PNFI
39,14	14	2,79	0,000	0,96	0,06	0,99	0,99	0,.66

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The factor loadings were significant. The lowest LAMBDA parameter was obtained for scale item D6: D6 λ=0.60 (Figure 6).

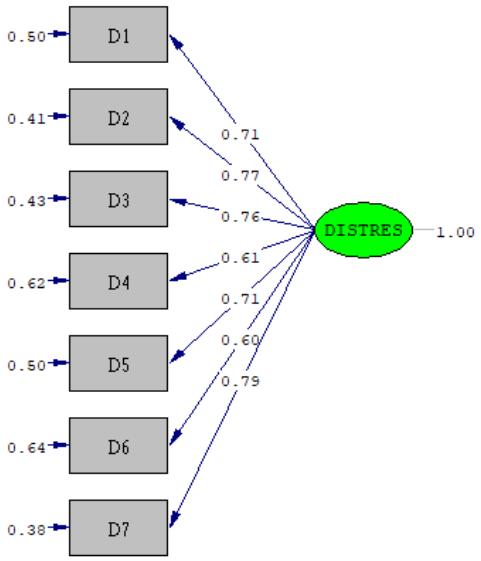

Fig.6: Confirmatory factor analysis of the distress scale

Construct validity of eustress

Regarding the measurement model, it obtained an adequate fit for the sample considering several indexes.[21] (Table 7).

Table 7: Eustress scale measurement model

Chi²	Gl	Chi²/gl	P	GFI	RMSEA	NNFI	CFI	PNFI
44,63	14	3,18	0,000	0,92	0,08	0,98	0,98	0,65

The factor loadings were significant. The lowest LAMBDA parameter was obtained for scale items E6 and E7: E6 λ=0.56, E7 λ=0.56 (Figure 7).

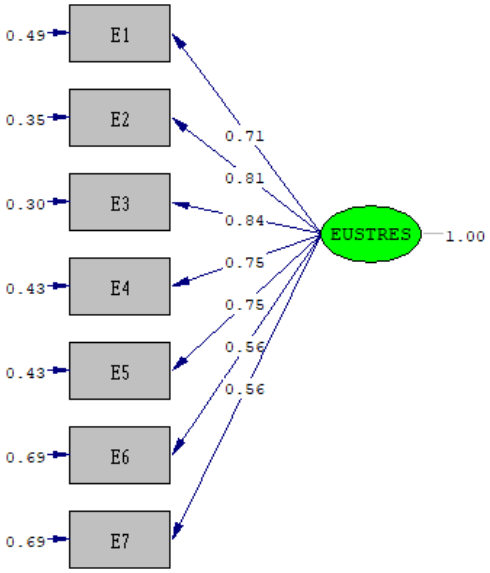

Figure 7: Confirmatory Factor Analysis of the eustress scale.

DISCUSSION

The findings of this study confirmed the reliability and factorial validity of the scales used to measure distress and eustress in a sample of Mexican workers. The internal consistency of both scales was favorable, suggesting that the items used are adequate to assess these constructs in the work context. These results coincide with previous studies in which similar psychometric properties have been identified in student populations, which supports the application of these instruments in samples of workers.[13]

Confirmatory factor analysis showed that both the distress and eustress scales presented a one-dimensional structure, each explaining 52% of the variance. These findings reinforced the relevance of the models used and made it possible to establish that the scales evaluated were adequate for measuring the psychological factors distress and eustress in workers. In addition, the results of the fit indices suggested that the proposed models have a good level of fit with empirical reality, which allows their application in different work contexts.[22]

It is important to note that the factor loadings obtained for the items indicated an adequate relationship between the items and the theoretical construct measured. Nevertheless, some items showed lower factor loadings than other items, but an adequate validity of the measurement instruments on distress and eustress was observed.[23]

These findings have relevant practical implications, since having valid and reliable scales allows occupational health professionals to evaluate accurately the levels of distress and eustress in workers.

It should be noted that the subjects who made up the sample were people working in the health sector, who performed their work during the COVID-19 pandemic that exposed them to long working hours that favored an increase in the levels of distress.[24]. This evaluation is key for the design of intervention strategies that favor occupational well-being and reduce the negative effects of distress.[25].

CONCLUSIONS

The present study was able to demonstrate that the distress and eustress scales have satisfactory levels of reliability and validity in Mexican workers. Through confirmatory factor analysis, it was verified that both scales have a one-dimensional structure, with adequate fit indices and significant factor loadings in the items.

These results are fundamental for research in occupational health, since they validate tools that can be used in the detection and monitoring of distress and eustress in the workplace. The application of these instruments could contribute to the implementation of preventive and intervention programs aimed at improving the quality of life of workers.

Future research could focus on the application of these scales in different sectors and in diverse work populations, as well as on the longitudinal analysis of these constructs to evaluate their evolution over time. Likewise, it is recommended to explore possible adjustments in the items with lower factor loadings to optimize the precision of the measurement and its applicability in different organizational contexts.

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