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RESEARCH

Factor structure of the Depression, Anxiety and Stress Scale among caregivers in Southeastern Europe

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Abstract

Objective: This study aimed to evaluate the factor structure of the Depression Anxiety and Stress Scale (DASS-21) among caregivers of young children in Southeastern Europe.

Background: The DASS-21 is a widely used measure in prevention and intervention research with families. Studies regarding the scale's psychometric properties among caregivers, particularly from non-Western countries, are limited and additional research is required.

Method: The DASS-21 was administered to $N = 835$ primary caregivers from North Macedonia, the Republic of Moldova, and Romania. Competing models were tested with confirmatory factor analysis (CFA). Measurement invariance was assessed using multigroup CFA (MGCFA). Bifactor dimensionality and reliability indices were used to evaluate the validity of the composite and subscale scores.

Results: A tripartite bifactor model with two specific factors (depression and anxiety) and one general factor (negative affectivity) represented the data well. This model showed cross-country configural and partial metric invariance. Dimensionality and reliability indices supported a unidimensional interpretation of the measure, with the general negative affectivity factor accounting for a substantial share of the variance (82%) compared to the specific factors of depression (10%) and anxiety (8%).

Conclusion: The tripartite model best represented the data. Configural and partial metric invariance were verified for this model. Dimensionality and reliability indices,

however, indicate that the DASS-21 functions best as a general measure of negative affectivity.

Implications: Future intervention studies involving caregivers from Southeastern Europe should consider using the DASS-21 as an overall measure of negative affectivity and utilize the composite score instead of the subscale scores.

The current worldwide prevalence of depression (3.4%) and anxiety (3.8%) disorders in adults (Dattani et al., 2021) account for significant economic and health impacts in terms of the global burden of disease (World Health Organization, 2017). However, there is a notable difference in prevalence across countries, with low- and middle-income countries (LMICs) accounting for a larger proportion of mental health disorders overall (Jacob et al., 2007). According to The World Bank (2019), 25% of families in Southeastern European countries including North Macedonia, the Republic of Moldova, and Romania, are affected by poverty or economic hardship, and mental health issues remain a concern in low-resource settings (Lund et al., 2011). Moreover, access to high-quality mental health care for families at risk or in need is limited (Wainberg et al., 2017). Further, LMICs are typically non-Western contexts where depression and anxiety symptoms may vary from high-income countries (HICs), which are usually very Westernized (Haroz et al., 2017). In line with recent calls for the scaling up of these services and the implementation of economic prevention and intervention efforts, psychometrically valid and brief self-report measures are needed to assess mental health in low-resource settings (Chisholm et al., 2016).

Such measures help public health monitoring efforts and intervention research by identifying people with or at risk for mental health problems, including depression and anxiety. Depression (maternal depression in particular) is closely linked to child mental health problems; Goodman et al. (2011) found that children of depressed mothers were more likely to develop emotional and/or behavioral issues. There are also associations between parental anxiety and child mental health (Burstein et al., 2010). According to research, the relationship between parental distress and child mental health is bidirectional (Sanner & Neece, 2018). For these reasons, it is important to measure both adult depression and anxiety as part of interventions to address child mental health problems, as well as the impact of parenting programs on adult mental health (Barlow et al., 2003).

Past research shows that self-report anxiety and depression scales correlate between $r = .40$ to $r = .70$ across clinical and nonclinical samples and often correlate as strongly with each other as with scales assessing the same construct (Clark & Watson, 1991a). Clark and Watson (1991b) attributed the conceptual and empirical overlap of anxiety and depression to a shared component—negative affectivity. In the literature, this model is commonly referred to as the tripartite model of anxiety and depression (Clark & Watson, 1991b).

In accordance with this tripartite interpretation of negative affectivity, S. H. Lovibond and Lovibond (1995) sought to develop a measure that would discriminate more fully between anxiety and depression. To this end, they developed the Depression Anxiety Stress Scales (DASS-42), a 42-item scale divided into three separate but correlated subscales (i.e., depression, anxiety, and stress). In a sample of Australian students, P. F. Lovibond and Lovibond (1995) found that the DASS-42 performed best as a measure with three correlated subscales representing depression, anxiety, and stress (referred to as the three-factor model) as opposed to a measure with two correlated subscales representing anxiety and depression (referred to as the two-factor model) or no subscales representing a measure of overall negative affectivity (referred to as the

one-factor model). The DASS-21 is a short version of the DASS-42 consisting of 21 items instead of 42. It is cost-effective and time efficient, and suitable for screening and investigating general affective syndromes in the broader population (P. F. Lovibond, 2020). As such, the measure has been used in parental intervention programs to monitor changes in symptom severity (Fujiwara et al., 2011; Sanders et al., 2012).

Although initial studies of the DASS-21 demonstrated sufficient convergent and discriminant validity (S. H. Lovibond and & Lovibond, 1995), several studies have shown varied structures across different cultures and countries, indicating inconsistent support for the three-factor model. For example, a sample of employees from Indonesia, Singapore, Sri Lanka, Malaysia, Taiwan, and Thailand exhibited cross-loading items and overlapping factors (Oei et al., 2013), whereas a clinical sample of adults from Spain showed high correlations among the three factors (Daza et al., 2002). A study of women with young children from low-resource regions in northern Vietnam, however, found support for a one-factor solution (Tran et al., 2013).

Other researchers have also reported difficulties discriminating between depression, anxiety, and stress in a clinical sample of Egyptian illicit drug users (Ali & Green, 2019) and an Australian sample of children and adolescents (Patrick et al., 2010). A two-factor model consisting of anxiety and depression was reported in a sample of Brazilian teenagers (Silva et al., 2016). Henry and Crawford (2005), using a "broadly" representative adult sample from the United Kingdom, proposed a quadripartite bifactor model that includes three specific factors (i.e., depression, anxiety, and stress) as well as a general factor (i.e., negative affectivity). More recently, a study with a clinical and nonclinical sample demonstrated support for a tripartite bifactor model, which includes two specific factors (i.e., anxiety and depression) and a general negative affectivity factor (Mihić et al., 2021).

According to Gomez et al. (2020), findings from studies utilizing the bifactor model have generally supported that structure, and when examined, had a better global fit than the three-factor model. Research conducted by Zanon et al. (2021) also found the bifactor model to be the best fit in nonclinical student samples across eight countries from North America, South America, Europe, and Asia. However, the reasons for this better fit have yet to be determined. According to Bonifay et al. (2017), the bifactor model may perform better because it models not only the important trends in the data but also unwanted noise or "overfitting." A bifactor model is a viable alternative to one factor, two or more correlated factors, or second-order factor models for establishing a scale's dimensionality (i.e., the number of factors in a measure and the nature of their relationship; Reise et al., 2010).

CURRENT STUDY

Given the imperative of addressing the burden of mental health problems among caregivers of young children, it is essential that measurement scales are valid and reliable. The need for this is acute in non-Western and LMIC populations because most measuring instruments have been developed in the West, but the expression of symptoms may differ across cultures (Furr, 2020). Whether the scale measures three distinct factors (i.e., depression, anxiety, and stress) and/or a general factor (i.e., negative affectivity) is of importance as it can affect interpretability and resulting conclusions for research and practice settings (Wu & Fang, 2014). We, therefore, used a study of primary caregivers of young children from three Southeastern European countries (i.e., North Macedonia, the Republic of Moldova, and Romania) to assess the DASS-21.

First, we hypothesized that the DASS-21 would show high levels of internal consistency (>.80), similar to what has been reported in previous studies from HICs. Second, based on prior research conducted by Henry and Crawford (2005), which supported a bifactor model with three specific factors (depression, anxiety, and stress) and one general factor (negative affectivity), we hypothesized that this model would be replicated in the current sample. Third, we hypothesized

that configural, metric, and scalar invariance would be supported for the three countries (North Macedonia, the Republic of Moldova, and Romania) under investigation in this study.

METHOD

Procedure

Data collection was as part of a larger European project, which involved a series of studies testing the Parenting for Lifelong Health for Young Children program among children in North Macedonia and Romania, both upper-middle-income countries, and the Republic of Moldova, a lower-middle-income country (Lachman et al., 2019). The three phases were translation and feasibility testing of the original program (developed for South Africa initially), a factorial study to identify the most cost-effective form of the program, and testing that cost-effective version in a randomized controlled trial. Socioeconomically disadvantaged communities were targeted to recruit low-income families. For detailed information regarding the protocol and sample used for this study, see Lachman et al. (2019). The data set analyzed for the present study is from the baseline assessment of caregivers prior to enrollment in the intervention of the second phase of the project (Lachman et al., 2019).

Recruitment took place at child-related services, nongovernment organizations (NGOs), and government-related organizations and included advertising campaigns on social media. Eligible participants needed to be primary caregivers (18 years and older) of children (aged from 2 to 9) exhibiting behavioral problems as assessed by the oppositional defiant disorder subscale of the Child and Adolescent Behavior Inventory (CABI; Burns et al., 2015). Participants provided informed consent prior to the 60-minute assessment, during which the DASS-21 was administered together with a number of other measures concerning child and adult mental health; for a complete list of the measures administered, see Lachman et al. (2019). This assessment was conducted by trained data assessors using computer-assisted self-interviewing (CASI). The ethics committee at the University of Klagenfurt and local ethics committees in North Macedonia, the Republic of Moldova, and Romania approved the project's study protocol.

Participants

Overall, 835 caregivers (North Macedonia $n = 289$, the Republic of Moldova $n = 284$, and Romania $n = 262$) participated in the current study, with the majority being women (96.0%) with an average age of 36.3 years ($SD = 6.5$). The average age of the child was 5.7 years ($SD = 2.0$ years), and 60.0% were male. See supplemental table "Sample Characteristics by Country" in the supplemental materials, which includes more detailed country-level demographic data, such as education, employment, marital status, caregiver ethnicity, and relationship to child.

Measures

UNICEF Multiple Indicators Cluster Survey household survey

The Multiple Indicators Cluster Survey (MICS) is a UNICEF-developed international survey that documents key indicators (such as child safety, health, and education) for women and children worldwide (UNICEF, 2015). A shortened version of the MICS (Carletto et al., 2013) was used to collect family-related demographic data relevant to caregivers and their children, which

included information such as age, gender, educational attainment, literacy levels, marital status, and job status.

DASS-21

This 21-item measure is comprised of three subscales: depression, anxiety, and stress. A total score indicates psychological distress or negative affectivity (P. F. Lovibond, 2020), which is characterized by nonspecific symptoms of tension, anxiety, and depression and is considered an emotional state. In a study conducted by Crawford and Henry (2003) with a nonclinical adult sample from the United Kingdom, convergent and discriminant validity were investigated using Pearson product-moment correlations to examine the relationship between the DASS-21 subscales and other validated measures of depression and anxiety. Using the same sample, Henry and Crawford (2005) reported the following internal consistencies for the scales: .88 (95% confidence interval [CI] [.80, .83]) for depression, .82 (CI [.80, .83]) for anxiety, .90 (CI [.89, .91]) for stress, and .93 (CI [.93, .94]) for the total.

For the current study, response options were adapted from *Did not apply to me at all* = 0, *Applied to me to some degree, or some of the time* = 1, *Applied to me to a considerable degree, or a good part of the time* = 2, and *Applied to me very much, or most of the time* = 3 to *Never* = 0, *Sometimes* = 1, *Often* = 2, and *Almost always* = 3 to reduce complexity based on feedback in piloting the measure in the respective countries; for more information regarding the pilot phase, see the paper by Jansen et al. (2022). Participants were asked to respond to the following question: "Please say how often in the past week you have felt this way." Twenty-one items assessed the frequency of symptoms in the previous week. The scales were scored using the instructions provided in the DASS manual (S. H. Lovibond & Lovibond, 1995), which advises that scale items be averaged or summed and then multiplied by 2. By multiplying by 2, it is possible to compare results to those from other research that employs the full 42-item version. Using the sum scores, the three subscales (scores ranging from 0 to 42) were computed independently to measure symptoms of stress (i.e., "I found it hard to wind down"), anxiety (i.e., "I felt I was close to panic"), and depression (i.e., "I felt that life was meaningless"). The sum score approach was also used to calculate a total score comprised of all 21 items (scores ranging from 0 to 126). For all scales, higher scores indicate more severe symptoms.

For the translation process, the teams from North Macedonia, the Republic of Moldova, and Romania, comprising researchers or practitioners familiar with psychological research and fluent in English, translated the measures and checked them with back-translation. Additionally, staff from the University of Klagenfurt, comprised of native English speakers and a native Romanian speaker, compared both English versions (before and after translation) to confirm that the original intended meaning of the measure items had not been altered as a result of the process. Following minor revisions, both the country and assessment teams judged the translations to be satisfactory.

Data analysis

Data were analyzed in R (R Core Team, 2021). Overall, very low levels of missingness (<0.1%) were found for the assessment point utilized in the current study. Based on previous research studies, four models were selected to evaluate the factor structure of the DASS-21, and confirmatory factor analysis (CFA) was used to test them. The models examined were as follows: a one-factor model (Patrick et al., 2010) with all items specified to load on one factor only; a correlated three-factor model (depression, anxiety, and stress; P. F. Lovibond & Lovibond, 1995) with items specified to load on their intended subscales; a tripartite bifactor model

(Szabó, 2010) with items specified to load on a general factor (negative affectivity) and two specific factors (depression and anxiety); and a quadripartite bifactor model with items set to load on a general factor (negative affectivity) and three specific factors (depression, anxiety, and stress; Henry & Crawford, 2005). Shapiro–Wilk test and Mardia's coefficient indicated that univariate and multivariate normality were not supported; as such, maximum likelihood estimation with robust standard errors (MLR) was used (Muthén & Muthén, 1998-2017). The Tucker–Lewis index (TLI) .95, comparative fit index (CFI) .95, standardized root-mean-square residual (SRMR) .08, and root-mean-square error of approximation (RMSEA) .06 were used to assess model fit (Hu & Bentler, 1999). The parsimonious goodness-of-fit index (PGFI) and parsimonious normed fit index (PNFI) were used to compare model complexity and model fit (Belhekar, 2019). The internal consistency was evaluated using Cronbach's alpha (α).

Additional statistical indices were calculated using a bifactor-related calculator to investigate scale dimensionality and reliability (Dueber, 2017). These included explained common variance (ECV), coefficient omega (ω), omega hierarchical (ω$_H$), omega hierarchical subscale (ω$_{HS}$), relative omega (PRV), percent uncontaminated correlations (PUC), construct reliability (H), and factor score determinacy (FD). Recommended cutoffs for these indices were ECV > .60, ω$_H$ > .80, PRV > .75, PUC > .70, H > .80, FD > .90 (Gorsuch, 1983; Hancock & Mueller, 2001; Reise, Bonifay, & Haviland, 2013; Reise, Scheines, et al., 2013). When ECV > .60, PUC < .80, and ω$_H$ > .70, the scale can be interpreted as unidimensional (Reise, Scheines, et al., 2013). According to Hancock and Mueller (2001), H values greater than .80 indicate distinct latent factors.

Multigroup CFA (MGCFA) was performed to examine whether the best-fitting model from the previously performed CFA demonstrated measurement invariance across the three countries. In particular, we tested for configural (i.e., whether the same items measure the same constructs across groups by leaving loadings and intercepts unconstrained), metric (i.e., tests the degree to which differences in responses arise from differences in the way constructs are interpreted by participants and consists of constraining factor loadings), and scalar (i.e., tests whether observed and latent constructs are so that latent scores are comparable across countries and consists of constraining factor loadings and intercepts) invariance. Measurement invariance was evaluated using Δgoodness of fit indices, ΔCFI > .01 paired with ΔRMSEA > .015 and ΔSRMR > .030 (for metric) and > .015 (for scalar; Chen, 2007). Partial invariance was assessed using a sequential search method (Yoon & Kim, 2014).

RESULTS

Summary and reliability statistics

Item wording, related constructs, and corresponding abbreviations for the DASS-21 are provided in Table 1. Summary statistics, including Cronbach's α values for the total as well as the three subscales of the DASS-21, are provided in a supplemental table "Summary and Reliability Statistics" in the supplemental materials.

Model testing

Fit indices for the following four models tested are displayed in Table 3. The parameter estimates for the one-factor model, in which all 21 items were specified to load on that factor alone, were all significant and loaded saliently (>0.4). Significance levels and standardized factor loadings for this and the proceeding analyses are presented in Table 2, with item-specific wording available in Table 1. For the three-factor model, standardized factor loadings, each of which

TABLE 1 Item wording, related construct, and corresponding abbreviations for the DASS-21

Item	Question	Construct (Abbreviation)
1	I found it hard to wind down.	Stress (DASS1_S)
2	I was aware of dryness of my mouth.	Anxiety (DASS2_A)
3	I couldn't seem to experience any positive feeling at all.	Depression (DASS3_D)
4	I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).	Anxiety (DASS4_A)
5	I found it difficult to work up the initiative to do things.	Depression (DASS5_D)
6	I tended to over-react to situations.	Stress (DASS6_S)
7	I experienced trembling (e.g., in the hands).	Anxiety (DASS7_A)
8	I felt that I was using a lot of nervous energy.	Stress (DASS8_S)
9	I was worried about situations in which I might panic and make a fool of myself.	Anxiety (DASS9_A)
10	I felt that I had nothing to look forward to.	Depression (DASS10_D)
11	I found myself getting agitated.	Stress (DASS11_S)
12	I found it difficult to relax.	Stress (DASS12_S)
13	I felt down-hearted and sad.	Depression (DASS13_D)
14	I was intolerant of anything that kept me from getting on with what I was doing.	Stress (DASS14_S)
15	I felt I was close to panic.	Anxiety (DASS15_A)
16	I was unable to become enthusiastic about anything.	Depression (DASS16_D)
17	I felt I wasn't worth much as a person.	Depression (DASS17_D)
18	I felt that I was over sensitive about things.	Stress (DASS18_S)
19	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).	Anxiety (DASS19_A)
20	I felt scared without any good reason.	Anxiety (DASS20_A)
21	I felt that life was meaningless.	Depression (DASS21_D)

Note. A = anxiety; D = depression; S = stress: the three subscales of the Depression Anxiety and Stress Scales (DASS-21).

were salient (>0.4) on their respective factors (depression, anxiety, and stress), and parameter estimates were all significant (see Table 2). Interfactor correlations were as follows: stress with anxiety, $r = .87$; stress with depression, $r = .84$; and anxiety with depression, $r = .85$.

The quadripartite bifactor model parameter estimates for items set to load on the general factor (negative affectivity) were all in the positive direction and statistically significant; standardized factor loadings are provided in Table 2. The parameters for the stress specific factor were all positive, though just three of seven items loaded significantly on the factor. These were DASS6_S ("over-react"), DASS8_S ("nervous energy"), and DASS11_S ("agitated"); see Table 1 for exact item wording. For the anxiety specific factor, six of seven items had positive parameters and loaded significantly on their respective factor. The one item in this scale that was nonsignificant and negative was DASS9_A ("worried about situations"). For the depression specific factor, five of seven items had positive parameters and loaded significantly on their specific factor; the two items that did not were DASS5_D ("initiative to do things") and DASS13_D ("down-hearted and sad"). Bifactor indices (ECV = .79, PUC = .70, ω_H = .87, and H = .92; see Table 4) for scale reliability and dimensionality for this model indicate that the scale would function best as a 21-item measure of negative affectivity.

The tripartite bifactor model parameter estimates for the general factor (negative affectivity) were all positive and statistically significant, and standardized factor loadings are shown in

TABLE 2 CFA factor structure for the DASS-21 (one-, three-, tripartite, and quadripartite models)

Item	One factor	Three factor			Tripartite			Quadripartite			
	NA	Stress	Anxiety	Depression	NA	Anxiety	Depression	NA	Stress	Anxiety	Depression
DASS1_S	.65**	.67**			.66**			.65**	.13		
DASS6_S	.52**	.56**			.55**			.50**	.31*		
DASS8_S	.64**	.69**			.67**			.62**	.37**		
DASS11_S	.67**	.71**			.69**			.64**	.33*		
DASS12_S	.66**	.69**			.68**			.66**	.15		
DASS14_S	.52**	.54**			.54**			.52**	.13		
DASS18_S	.55**	.57**			.56**			.54**	.12		
DASS2_A	.48**		.50**		.45**	.23**		.46**		.21*	
DASS4_A	.51**		.57**		.45**	.47**		.47**		.43**	
DASS7_A	.60**		.64**		.56**	.29**		.57**		.26*	
DASS9_A	.61**		.62**		.61**	.04		.63**		-.01	
DASS15_A	.67**		.70**		.66**	.17**		.67**		.14*	
DASS19_A	.58**		.64**		.53**	.53**		.54**		.55*	
DASS20_A	.56**		.59**		.53**	.24**		.54**		.23**	
DASS3_D	.62**			.65**	.59**		.24**	.61**			.19*
DASS5_D	.53**			.53**	.55**		.01	.56**			-.03
DASS10_D	.54**			.57**	.47**		.41**	.49**			.39**
DASS13_D	.72**			.74**	.72**		.14*	.73**			.09
DASS16_D	.65**			.71**	.62**		.34**	.64**			.29**
DASS17_D	.57**			.63**	.52**		.41**	.55**			.37**
DASS21_D	.51**			.57**	.42**		.58**	.45**			.59**

Note. A = anxiety; D = depression; S = stress: the three subscales of the Depression Anxiety and Stress Scales (DASS-21); CFA = confirmatory factor analysis; NA = negative affectivity. Standardized factor loadings reported.

*$p < .05$. **$p < .001$.

TABLE 3   Goodness-of-fit indicators of models for the DASS-21 ($N = 835$)

Model	χ^2 (df)	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC
One factor	621.851** (189)	.900	.888	.052 [.049, .056]	.048	28340.469	28539.021
Three factor	462.136** (186)	.936	.928	.042 [.038, .046]	.042	28116.317	28329.051
Tripartite	348.160** (175)	.960	.952	.034 [.030, .039]	.035	27966.950	28231.687
Quadripartite	321.147** (168)	.964	.956	.033 [.028, .038]	.031	27932.159	28229.987

Note. AIC = Akaike's information criteria; BIC = Bayesian information criteria; CE = correlated errors, CFI = comparative fit index; CI = confidence interval; DASS-21 = Depression Anxiety and Stress Scales; *df* = degrees of freedom; RMSEA = root-mean-square error of approximation; SRMR = standardized root-mean-square residual; TLI = Tucker–Lewis index.
**Statistically significant at *p* < .001.

TABLE 4   Bifactor indices for the DASS-21 (model-based reliability and dimensionality)

Factors	ECV	ω	$ω_H$	$ω_{HS}$	PRV	PUC	H	FD
Quadrapartite model								
Negative affectivity	.792	.927	.872	–	.941	.700	.918	.944
Depression	.086	.836		.151	.180	–	.500	.731
Anxiety	.076	.815	–	.145	.178	–	.461	.714
Stress	.046	.825	–	.100	.121	–	.314	.583
Tripartite model								
Negative affectivity	.816	.925	.875	–	.945	.800	.918	.950
Depression	.101	.834	–	.193	.231	–	.530	.750
Anxiety	.083	.813	–	.171	.210	–	.473	.718

Note. ω = coefficient omega; $ω_H$ = omega hierarchical; $ω_{HS}$ = omega hierarchical subscale; DASS-21 = Depression Anxiety and Stress Scales; ECV = explained common variance; FD = factor score determinacy; H = construct reliability; PRV = relative omega; PUC = percent uncontaminated correlations.

Table 2. For the anxiety specific factor, all parameters were positive with six of seven items, excluding DASS9_A ("worried about situations"), loading significantly on their specific factor (see Table 1 for exact item wording). This was also the case for the depression specific factor, with all parameters being positive and six of seven items loading significantly on their specific factor, excluding DASS5_D ("initiative to do things"). Bifactor indices (ECV = .82, PUC = .80, $ω_H$ = .88, and H = .95; see Table 4) for this model suggest that the scale would function best as a 21-item measure of negative affectivity. The results from the CFA showed that model fit indices for the quadripartite bifactor model (CFI = 964, TLI = .956, RMSEA = .033, 95% CI [.028, .038]) and the tripartite bifactor model (CFI = 960, TLI =.052, RMSEA =.034, CI [.030, .039]) were both similarly good. However, comparatively, the tripartite model (PGFI = .72, PNFI = .77) was more parsimonious than the quadripartite model (PGFI = .69, PNFI = .75). As such, the tripartite bifactor model in which items were set to load on a general factor (negative affectivity) and two specific factors (depression and anxiety) was selected for further analysis with measurement invariance testing across countries.

Configural invariance tests revealed that the anxiety item DASS19_A ("aware of the action of my heart"), in the Republic of Moldova, had a nonsignificant negative residual variance. Examination of the factor loadings for this item showed a higher loading on the specific factor compared to the general factor. As the negative error variance was nonsignificant, the value in the Republic of Moldova was fixed to 0 (Chen et al., 2001). Model fit indices (see supplemental table "Measurement Invariance Testing" in the supplemental materials) indicated that

configural invariance was supported. Metric invariance was not established as demonstrated by ΔCFI (>.01). Partial metric invariance was examined to ascertain which specific item(s) were responsible for the misfit. Items identified with noninvariant loadings were DASS19_A ("aware of the action of my heart") on the anxiety specific factor (the Republic of Moldova = .81, Romania = .34, and North Macedonia = .64), DASS16_D ("unable to become enthusiastic") on the depression specific factor (Republic of Moldova = .24, Romania = .37, and North Macedonia = .61) and DASS10_D ("nothing to look forward to") on the general negative affectivity factor (the Republic of Moldova = .61, Romania = .33, and North Macedonia = .54). When these indicators were released sequentially in the order they appear above, partial metric invariance was confirmed, ΔCFI < .01 paired with ΔRMSEA < .015 and ΔSRMR < .030. Scalar invariance for this model was not established (ΔCFI > .01).

DISCUSSION

This is the first study to examine the DASS-21's factor structure in a sample of caregivers of young children with elevated levels of behavioral difficulties and at risk of poor long-term outcomes in three countries in Southeastern Europe. As would be anticipated for participants who had been recruited because of reporting significant levels of child behavior problems, the sample had higher DASS-21 levels of negative affectivity ($M = 23.39$, $SD = 16.61$) compared to normative nonclinical samples in the United States ($M = 17.80$, $SD = 20.18$; Sinclair et al., 2012) and the United Kingdom ($M = 18.38$, $SD = 18.82$; Henry & Crawford, 2005).

CFA was utilized to test and compare four competing models identified from the literature. The one-factor model (Patrick et al., 2010) demonstrated acceptable model fit, though it did not meet the recommended cut-off criteria set for the current study regarding TLI ($\geq$.95) and CFI ($\geq$.95. The correlated three-factor model (depression, anxiety, and stress) proposed by P. F. Lovibond and Lovibond (1995) resulted in an improved model fit, ranging from acceptable to good. However, CFI and TLI values fell short of the cut-off criteria. This model also had high factor intercorrelations, indicating the possibility of a shared underlying factor structure (Brown, 2015), such as a general negative affectivity factor underpinning the three specific factors of depression, anxiety, and stress.

The quadripartite bifactor model demonstrated excellent model fit. However, similar to previous studies, several of the stress subscale items (four of seven) failed to assess the specific factor (stress) as well as the general negative affectivity factor (Gomez et al., 2020; Szabó, 2010).

For the tripartite bifactor model, the model fit was marginally lower than the quadripartite bifactor model. However, the tripartite bifactor model was a more parsimonious solution as evidenced by the higher parsimony-corrected fit indices and furthermore, in this model, the item DASS13_D ("down-hearted and sad") now loaded significantly on the specific factor of depression as well as the general negative affectivity factor. The tripartite bifactor model's factor loadings showed that items loaded more strongly on the general negative affectivity factor than the group-specific factors (depression and anxiety), indicating that the general factor explained much of the variation. The ECV was high, with 82% of the variance in all the items being explained by the general factor. In contrast to Mihić et al.'s (2021) study, which found support for the tripartite bifactor model in Serbian clinical and nonclinical samples, several item loadings for both specific factors (depression and anxiety) were low. For example, the anxiety specific factor included four items with loadings less than 0.3 (DASS2_A, "dry mouth"; DASS9_A, "worried about situations"; DASS15_A, "close to panic"; and DASS20_A, "scared without reason"), for actual item wording, see Table 1. Regarding the depression specific factor, three items showed loadings less than 0.3 (DASS3_D, "positive feeling"; DASS5_D, "initiative to do things"; and DASS13_D, "down-hearted and sad"). For the general negative affectivity

factor, all 21 items loaded 0.4 and above (factor loadings are listed in Table 2). Although a tripartite bifactor model may best approximate the data in the current study, this preliminary evidence suggests that a robust general negative affectivity factor is present, with only a small amount of unique variation contributable to the depression and anxiety factors (10% and 8%, respectively). As such, in the current sample, the measure is better conceptualized as a 21-item measure of negative affectivity.

Our findings align with past research showing that anxiety and depression are related and thus share common symptoms, such as negative affectivity (Watson & Clark, 1984), which may account for the psychometric overlap of the respective subscales. Such findings indicate that it might be more accurate to view the related domains of anxiety and depression as being enveloped within a bifactor framework of negative affectivity (Clark & Watson, 1991b) or general psychological distress (Chen et al., 2006).

In contrast to Lovibond's (2020) assertion that the factor structure of the DASS-21 should be similar across groups, findings by Ali and Green (2019) and Tran et al. (2013) indicated that the DASS-21 subscales did not differentiate significantly. As a result, they concluded that the scale was more suitable for use as an overall measure of negative emotions common to anxiety and depression. Indeed, the symptomology of the emotional constructs assessed by such scales may show different associations among people from different backgrounds (Bhugra et al., 2021). Inconsistencies in results across different samples, therefore, suggest that caution be advised when drawing conclusions from DASS-21 scales from members of one group based on norms or associations drawn from other groups (Norton, 2007).

The tripartite bifactor model demonstrated configural invariance, indicating that the factor structure is comparable across countries. Additionally, partial metric invariance was observed, indicating that the factors are interpreted similarly across countries. The absence of full metric invariance, however, suggests that there may be differences in how participants understood and responded to certain items (Byrne & van de Vijver, 2010), particularly regarding the items DASS19_A ("aware of the action of my heart") on the anxiety specific factor, DASS16_D ("unable to become enthusiastic") on the depression specific factor, and DASS10_D ("nothing to look forward to") on the general negative affectivity factor. As such, future studies may profit from exploring cultural, linguistic, or contextual issues in greater detail, which may add to a more comprehensive understanding of the DASS-21 from a psychometric perspective. Such studies could consider utilizing item-response-theory techniques (Reise & Revicki, 2015) to, for instance, identify potential issues in wording and identify items that are most or least informative for assessing the general negative affectivity factor as well as specific factors of depression, anxiety, and stress.

Strengths and limitations

The findings should be interpreted with caution because the data are from three countries only, and more testing in other countries among caregivers is required. In addition, because the study was cross-sectional, the data could not be used to determine test–retest reliability over time. Furthermore, the study's generalizability is limited because the sample consisted of primary caregivers of children with elevated levels of behavioral difficulties, most of whom were female. Notwithstanding these limitations, the study had a number of strengths: it was the first study in Southeastern European countries to evaluate and compare competing DASS-21 models, the sample size was relatively large, and the data came from participants from a variety of linguistic and cultural backgrounds, including minority groups, which aligns with recommendations to reach diverse samples (Muthukrishna et al., 2020).

CONCLUSION

The current study analyzed data collected as part of a trial of the Parenting for Lifelong Health for Young Children program implemented in North Macedonia, the Republic of Moldova, and Romania. We hypothesized high levels of internal consistency in a quadripartite bifactor model, with configural, metric, and scalar invariance supported between the countries. The DASS-21 scales demonstrated good to excellent internal consistency. However, contrary to the second hypothesis, a tripartite bifactor model was most applicable, with items loading more heavily on the general factor (negative affectivity) than the specific factors (depression and anxiety). Our third hypothesis, concerning measurement invariance, was similarly shown to be incorrect, as full metric invariance was not demonstrated, suggesting that participants understood and reacted to certain items differently across countries, that is, DASS19_A ("aware of the action of my heart") on the anxiety specific factor, DASS16_D ("unable to become enthusiastic") on the depression specific factor, and DASS10_D ("nothing to look forward to") on the general negative affectivity factor. The absence of full metric (similar factor loadings) and scalar (similar factor loadings as well as intercepts) invariance suggests that it may not be prudent to compare mean scores across countries (Byrne, 2012).

Implications

The current study shows that the DASS-21 is better conceived as a unidimensional measure, where the 21 items are added together to reflect an overall score (negative affectivity), rather than utilizing the three 7-item subscales representing depression, anxiety, and stress. The results of this study should be applicable to caregivers from Southeastern Europe who report caring for young children with elevated behavioral difficulties, but further research with comparable samples is needed to substantiate these findings and to further investigate the scale's measurement invariance properties across North Macedonia, the Republic of Moldova, and Romania. Such research could improve our understanding of how caregivers from similar populations experience negative affectivity, its impact on intervention outcomes, and its assessment in non-Western contexts.

Neurologically and physiologically, emotional disorders have many commonalities across people of different backgrounds. Nevertheless, these disorders are also cognitive and interpretive constructs, and how they manifest and are experienced can be highly influenced by cultural views (Good & Kleinman, 1985; Norton, 2007). One might expect such findings in the current sample as caregivers seeking support for managing challenging child behavior may experience nondifferentiation of symptoms related to depression, anxiety, and stress. This fits with the theoretical notion of negative affectivity as characterized by the nonspecific symptoms of stress, anxiety, and depression, which Lazarus (1993) referred to as an emotional state.

Researchers using this measure with samples of a similar nature are therefore advised to use the overall sum score instead of the three separate subscales until further research determines whether the three subscales adequately differentiate between symptoms. Future research could also focus on identifying possible shared contextual factors across samples wherein the DASS-21 has been found to measure a unidimensional construct (negative affectivity) rather than three independent constructs (depression, anxiety, and stress). For example, it could be that stress, anxiety, and depression are statistically indistinguishable in circumstances wherein these three conditions are experienced in reaction to external events as opposed to internal physiological, cognitive, and emotional events.

For practitioners, the shorter, easier to administer DASS-21 may be used to identify general negative affectivity, which could then be further delineated through the use of the DASS-42, wherein the extra items may discriminate more clearly between depression, anxiety, and stress.

If necessary, additional evaluation via clinical assessment could then be used to inform individual targeted interventions. Alternatively, and in keeping with the growing trend for transdiagnostic treatments in HICs, the DASS-21 could be used to monitor the severity of general subclinical negative affectivity over time, and where necessary, interventions could be tailored to address the common elements of affective disorders that share genetic, familial, and environmental risk factors (Harvey, 2004).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.