ELECTRONCIAL SUPPLEMENT 1 FOR:

On the dimensionality, suitability of sum/mean scores, and cross-country measurement invariance of the Perceived Stress Scale 10 (PSS-10) – Evidence from 41 countries

A systematic review of the dimensionality and factor structure of the Perceived Stress Scale (PSS-10)

Introduction

Review scope

The PSS-10 includes negatively- as well as positively-worded items and is intended to capture a single dimension, i.e., global perceived stress (Cohen et al., 1983). See Table S1 for the wording of the PSS-10 items. The focus of this systematic review was on psychometric studies that investigated the factor structure of the PSS-10. The review aims to clarify, which factor models of the PSS-10 have been mostly applied and which final factor model has been retained in psychometric studies. Lee (2012) conducted a systematic review on the psychometric properties of the PSS (4, 10, and 14 version). However, this review is now more than ten years old, and since then, a substantial number of psychometric studies investigating the PSS-10 factor structure have been carried out since then, adopting more sophisticated analyses and newer factor analytical guidelines.[1] Recently, Yılmaz Koğar and Koğar (2023) conducted a systematic review and a meta-analytic confirmatory factor analysis (CFA) of the PSS-10 and PSS-14. However, they included only studies that provided enough information to conduct the meta-analytic CFA (i.e., 57 with 76 independent samples), thus, leaving many relevant studies for our research question aside.

[1] For instance, none of the studies applied item response theory (IRT), and many of the reviewed studies applied principal component analysis and mistakenly believe that this is a type of exploratory factor analysis (see Fabrigar et al., 1999 who discussed the differences of principal component analysis and exploratory factor analysis in detail).

Table S1. PSS-10 items and possible sources of multidimensionality.

PSS item	In the last week, how often have you . . .	Positive vs negative item formulation
Item 1	… been upset because of something that happened unexpectedly?	negative
Item 2	… felt that you were unable to control the important things in your life?	negative
Item 3	… felt nervous and “stressed”?	negative
Item 4	… felt confident about your ability to handle your personal problems?	positive
Item 5	… felt that things were going your way?	positive
Item 6	… found that you could not cope with all the things you had to do?	negative
Item 7	… been able to control irritations in your life?	positive
Item 8	… felt that you were on top of things?	positive
Item 9	… been angered because of things that were outside of your control?	negative
Item 10	… felt difficulties were piling up so high that you could not overcome them?	negative

Method

The systematic review was conducted in accordance with the preferred reporting items for systematic reviews and meta-analyses PRISMA 2020 guidelines (Page et al., 2021).

Search strategy

A systematic search for peer-reviewed articles published in English through three electronic databases was conducted: Web of Science, Ovid, and Scopus (searches were queried on February 21, 2023; no date limits were applied). The search strategies included PSS-10-related terms (i.e., "perceived stress scale", PSS-10), and factor-structure-related terms (i.e., "factor structure", "factor analysis", "internal structure", "psychometric properties", "item response", "Rasch", "partial credit", "graded response"). The complete search strategies for each database are provided in the Appendix (Table S2). These search parameters yielded 1,175 records (Web of Science: 443, Ovid: 246, Scopus: 486). After the removal of duplicates, 571 records were screened for eligibility (see Figure S1).

Study screening and selection

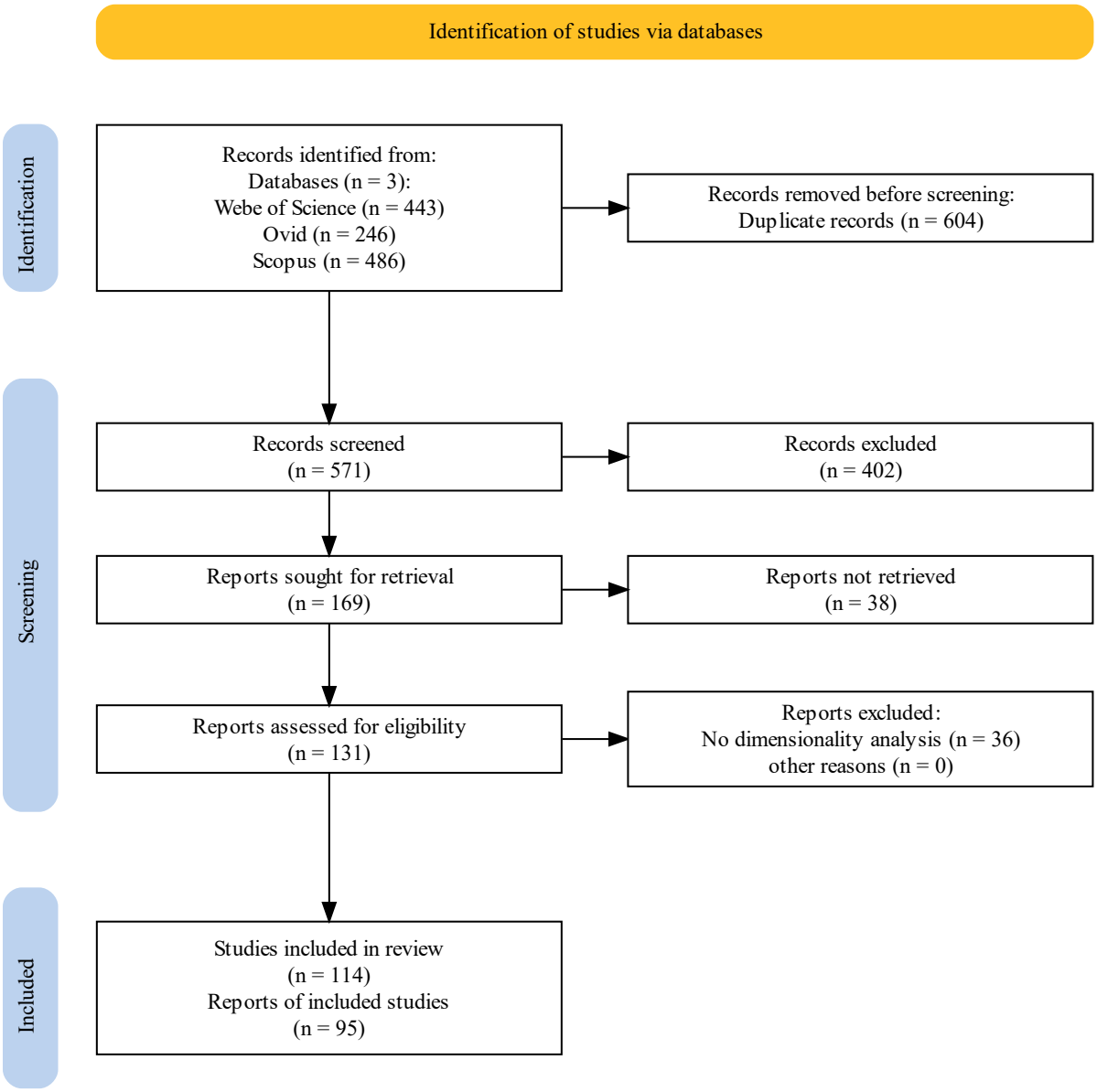
Study screening was carried out by three independent reviewers in CADIMA (Kohl et al., 2018). Each study was screened by two reviewers. Discrepancies were resolved by discussion. In a first step, screening was carried out to exclude articles that did not meet inclusion criteria based on the title and abstract. Studies were included if they explicitly investigated the dimensionality or factor structure of the PSS-10 (Cohen & Williamson, 1988) or a translated version of this scale. The screening resulted in 169 potentially suitable reports, of which 38 were excluded due to missing full text (e.g., only poster presentation), or because the report was not written in English. Thus, 131 reports were assessed for eligibility , of which 36 did not perform any dimensionality analysis of the PSS-10. Therefore, 95 reports met the inclusion criteria that contained 114 independent studies (see Figure S1).[2]

[2] Many of the articles conducted a split-half analysis, where one half of the sample was used to conduct an exploratory factor analysis or principal component analysis, whereas the second half was used to conduct a confirmatory factor analysis.

Data extraction and quality assessment

We extracted demographic (e.g., sample size, country of the study, study population), dimensionality assessment method (principal component analysis [PCA], exploratory factor analysis [EFA], confirmatory factor analysis [CFA], item response theory [IRT], exploratory graph analysis [EGA], exploratory structural equation modeling [ESEM]), tested factor model (e.g., unidimensional, correlated two-factor model, bifactor model), retained factor model, correlation of the two factors within the correlated two-factor model, and whether (and for which groups) measurement invariance or differential item/test functioning analysis was conducted.

Figure S1. Study selection flow diagram for the systematic review of the factor structure of the PSS-10.



Results

Demographic information

For study details see Table S3 in the Appendix. Sample size of the studies varied considerably and ranged between 42 and 32,374 (*M* = 1,245; *SD* = 3,401). The psychometric studies were conducted worldwide. Twenty studies were conducted in the U.S., 9 in China, 6 in Hong Kong, 6 in Germany, 5 in South Korea, 5 in Bangladesh, 4 in Mexico, and 4 in Brazil

among others. 80 studies used non-clinical samples, 32 studies used clinical samples, and 2 used non-clinical as well as clinical samples.

Dimensionality assessment method and tested models

Most of the 95 articles reported results of a CFA (i.e., *n* = 76), followed by EFA (*n* = 26), PCA (*n* = 21), IRT (*n* = 8), EGA (*n* = 1), and ESEM (*n* = 1). The majority of the 114 studies tested a one-dimensional factor model (*n* = 66), and most studies tested a correlated two-factor model (*n* = 84), whereas three studies also tested a correlated three-factor model. In 20 studies (17 articles), a bifactor model with two specific factors (specific factor 1: items 1, 2, 3, 6, 9, 10; specific factor 2: 4, 5, 7, 8) were tested. A bifactor model with one specific factor for items 4, 5, 7, 8 was tested in five studies and a bifactor model with one specific factor for items 1, 2, 3, 6, 9, 10 was tested in three studies. Six studies investigated some other bifactor models such as an *exploratory* bifactor model with one, two, or three specific factors (Reis et al., 2019, study 1), a bifactor model with two specific factors (specific factor 1: items 1, 2, 3, 9; specific factor 2: 4, 5, 7, 8; Reis et al., 2019, study 2 and study 3), a bifactor model with two specific factors (specific factor 1: items 1, 2, 3, 6, 9, 10; specific factor 2: 4, 5, 7, 8) that were allowed to be correlated (Cole et al., 2019), a bifactor model with a *random content* specific factor (items 2, 4, 6, 7, 8, 10; Juarez-Garcia et al., 2023), a bifactor model with one specific factor (items 5: 6, 7, 8, 9; Park & Colvin, 2019), or a bifactor model with two specific factors (specific factor 1: items 1, 2, 3, 4, 10; specific factor 5: 6, 7, 8, 9; Park & Colvin, 2019)[3]. Four studies investigated a second-order factor model with two first-order factors (factor 1: items 1, 2, 3, 6, 9, 10; factor 2: 4, 5, 7, 8). See Figure S2 for details and Figure S3 for a graphical representation of the most employed factor models.

Retained models

[3] It should be noted that the Korean version of the PSS-10 that was investigated by Park and Colvin (2019) contains five positive and five negative items, and, thus, slightly differ compared to the original version of the PSS-10 (Cohen & Williamson, 1988).

The majority of the 95 articles either retained a correlated two-factor model (54), or an uncorrelated two-factor model (n = 10), followed by a one-dimensional (n = 9), a bifactor with two specific factors (n = 9), a bifactor with one specific factor (4, 5, 7, 8) (n = 3), and a second-order factor (n = 3). Two studies retained another bifactor model: Reis et al. (2019) and Park and Colvin (2019), both retained a bifactor model with two different specific factors (i.e., Reis et al., 2019: specific factor 1: items 1, 2, 3, 9; specific factor 2: 4, 5, 7, 8; Park & Colvin, 2019: specific factor 1: items 1, 2, 3, 4, 10; specific factor 5: 6, 7, 8, 9. Finally, five studies (Islam et al., 2020; Martinez-Garcia et al. 2020; Miranda et al., 2020; Nielsen & Dammeyer, 2019) did not clearly recommend a measurement model. Some (e.g., Islam et al., 2020) concluded that there exists no clear favored model whereas others (e.g., Nielsen & Dammeyer, 2019) only rejected the unidimensional model and conducted an IRT analysis for both subscales separately.

The reported inter-factor correlations varied strongly between the studies. Those studies that employed a correlated two-factor model on the PSS-10 reported inter-factor correlations between .08 (Ng, 2013) and .85 (Schneider et al., 2020).

Previous research employing a bifactor modeling approach

All studies employing some form of bifactor model found that it fits better compared to other measurement models (e.g., unidimensional, correlated two-factor). However, studies differ regarding the conclusion on whether the PSS-10 items can be regarded as essentially unidimensional and whether subscale scores (e.g., perceived stress and perceived coping) reflect reliable variance that is independent from the general stress factor. Some studies concluded that the general factor was strong and well defined whereas the subscale(s) were less reliable based on strong factor loadings on the general factor and weaker loadings on the specific factors or based on respective bifactor indices (e.g., omega hierarchical, reliability index H, explained common variance; Rodriguez et al., 2016) supporting the use of a total score (Denovan et al., 2019; Lee & Jeong, 2019; Michaelides et al., 2016; Reis et al., 2019;

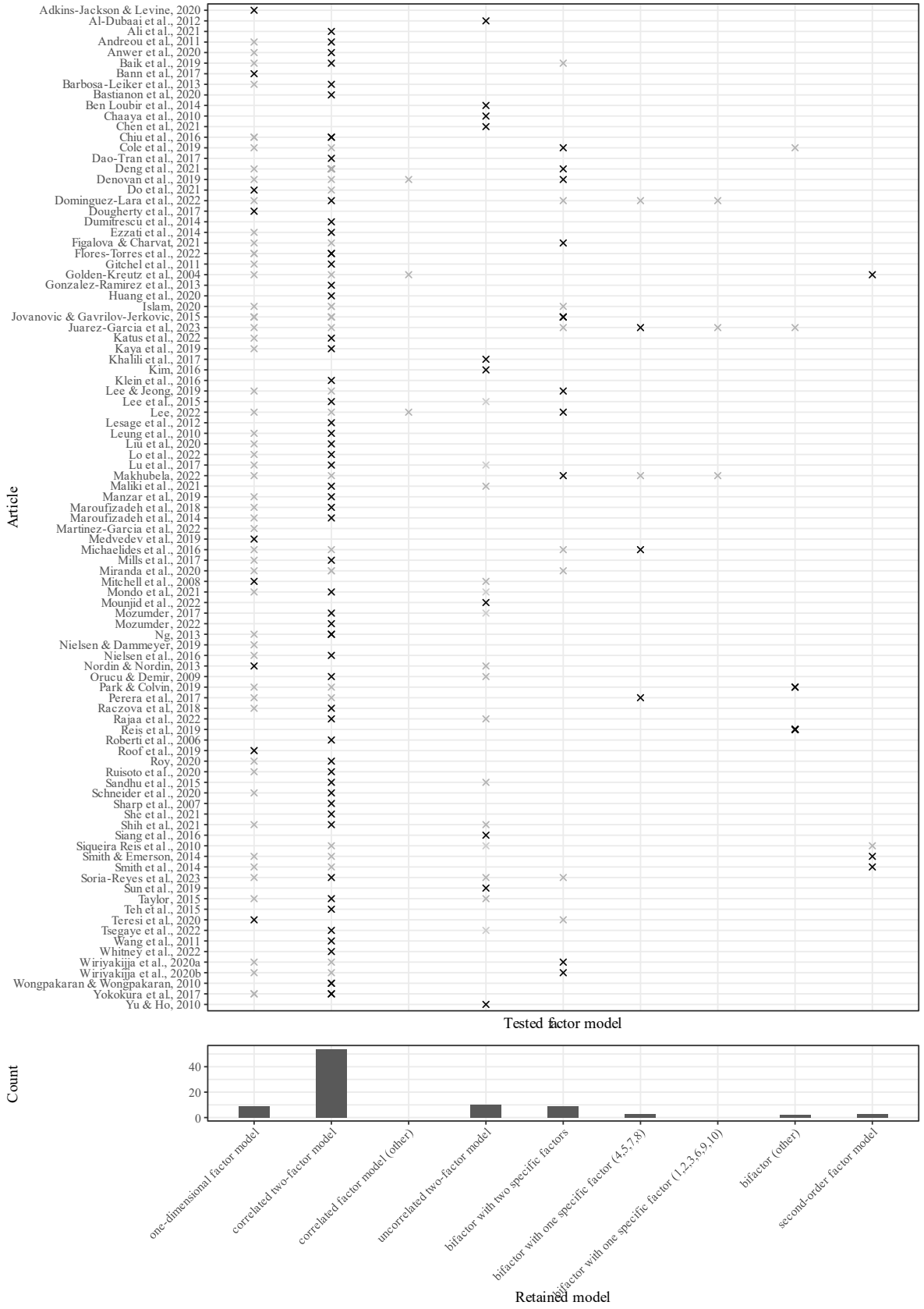
Wiriyakijja et al., 2020a/b; Wu & Amtmann, 2013). Other studies (Juárez-García et al., 2023; Perera et al., 2017) found that the specific factor (for the positively worded items 4, 5, 7, 8) indeed reflects reliable variance, and, thus, concluded that the variance of the reverse-coded items needs to be taken into account before interpreting the total score. Thus, previous research has provided mixed results on whether the PSS-10 items can be regarded as essentially unidimensional. This might be due to different investigated countries, different investigated populations (e.g., clinical populations [Wiriyakijja et al., 2020a/b] vs. non-clinical populations [Perera et al., 2017]), and different language versions (e.g., Spanish [Juárez-García et al., 2023], Greek [Michaelides et al., 2016]). Notably, although investigating factor loadings and bifactor indices can give a rough indication of whether the PSS-10 is "essentially unidimensional", they do not tell us the detailed degree of misspecification of the person score when a sum/mean score is used as scoring method.[4]

Assessment of measurement invariance

Measurement invariance was mostly tested across gender (n = 15), whereas five studies evaluated measurement invariance across age groups. Three studies tested measurement invariance across language, three studies across ethnicity, and two studies across education. Another two studies evaluated whether the measurement model of the PSS-10 was stable across time. Other studies tested measurement invariance across clinical vs. non-clinical (Schneider et al., 2020), occupation status (Juarez-Garcia et al., 2023), marital status (Ali et al., 2021), migrant vs. non-migrant (Bastianon et al., 2020), literacy (Sharp et al., 2007), athletes vs non-athletes (Chiu et al., 2016), and country (Katus et al., 2022), among other groups.

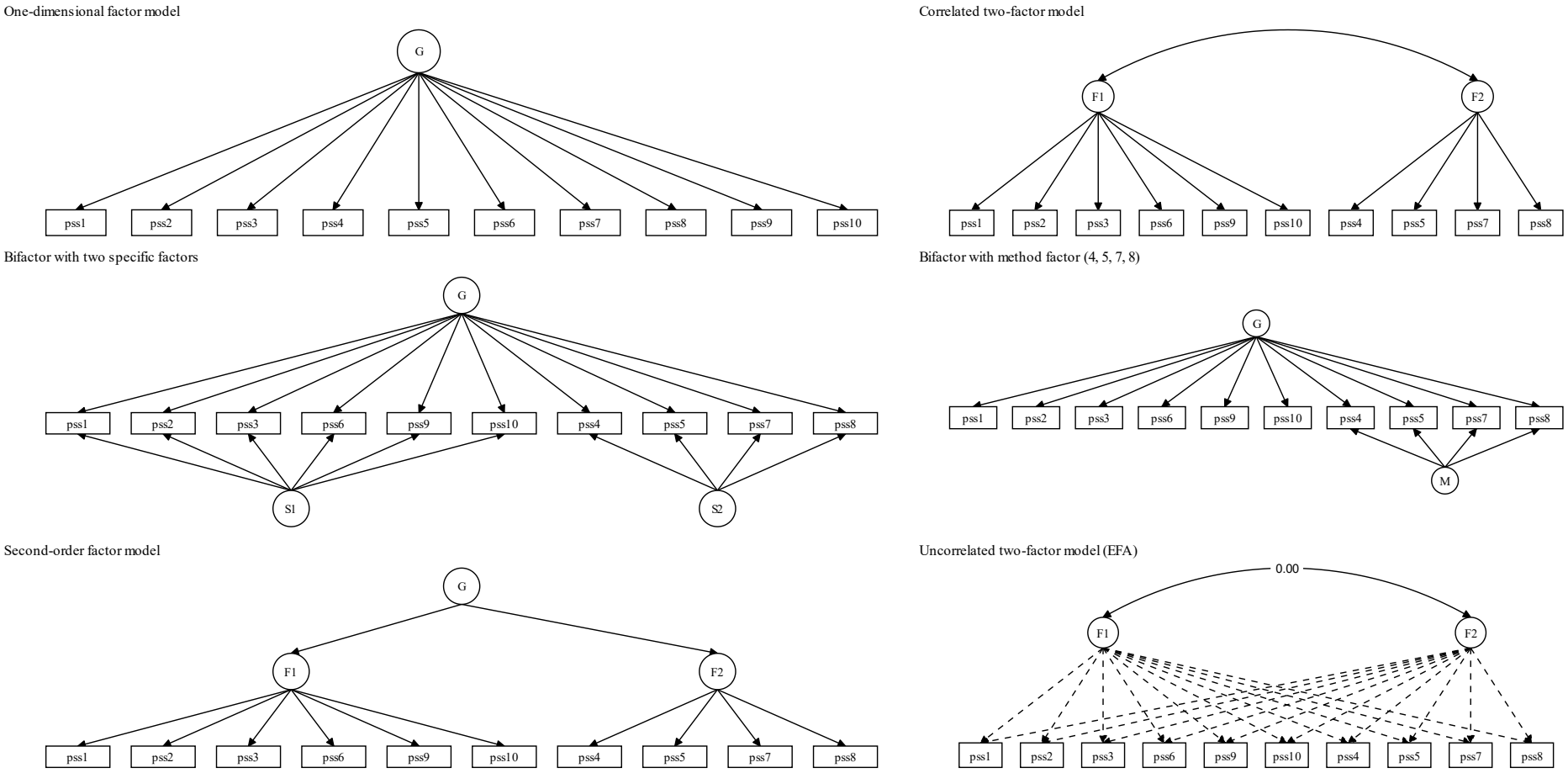
[4] Especially, the ECV for the general dimension is often considered as an index of "essential unidimensionality". However, its relationship with parameter bias that is due to multidimensionality is moderated by additional factors, e.g., percentage of uncontaminated correlations (Rodriguez et al., 2016b). Thus, the effects of multidimensionality cannot be easily evaluated by considering single indices but should be evaluated in tandem with other bifactor indices (e.g., Reise et al., 2013). Moreover, *omega hierarchical* does not provide an answer regarding the dimensionality of the data but "informs on the percent of variance in a unit-weighted composite that can be attributable to a general factor" (Rodriguez et al., 2016a, p. 144).

Figure S2. Tested and retained factor models by article.



Notes. Grey = tested models, black = retained models. The *correlated two-factor model*, the *bifactor with two specific factors model*, and the *second-order factor model* all specified the items 1, 2, 3, 6, 9, 10 to load onto (specific, first-order) factor 1, and items 4, 5, 7, 8 to load onto (specific, first-order) factor 2.

Figure S3. Different factor models of the PSS-10.



Notes. The most employed factor models according to the systematic review (ESM 1) are shown.

Discussion

The systematic review showed that the correlated two-factor model is the most tested and most retained model within psychometric studies on the PSS-10. Within the last years, few studies also tested and retained different bifactor models with the bifactor model with two specific factors (specific factor 1: items 1, 2, 3, 6, 9, 10; specific factor 2: 4, 5, 7, 8) as the most prominent among them. As the application of a bifactor modeling approach offers some advantages compared to a correlated two-factor model, more psychometric studies should adopt this modeling strategy. Furthermore, future psychometric studies should conduct more sophisticated dimensionality analyses such as IRT (e.g., Houts et al., 2022; Toland et al., 2017), ESEM (Asparouhov & Muthén, 2009), and EGA (Jiménez et al., 2023), and adopt newer factor analytical guidelines (e.g., Fabrigar et al., 1999; Sellbom & Tellegen, 2019). Moreover, although measurement invariance (or differential item/test functioning) has been quite often studied across gender and age, fewer studies have tested whether the factor structure of the PSS-10 is stable across clinical and non-clinical populations. Additionally, only one study (e.g., Katus et al., 2022) investigated measurement invariance of the PSS-10 factor structure across cultures/countries. Katus and colleagues (2022), tested measurement invariance across eight low- and middle-income countries (i.e., Ghana, Jamaica, Pakistan, the Philippines, Romania, South Africa, Sri Lanka, Vietnam) within samples of expectant mothers. Thus, we still hardly know whether a common factor model of the PSS-10 can be generalized to a broader range of cultures/countries.

Appendix

Table S2. Databases, search terms, and records identified.

Database	Search terms	Records identified
Web of Science	(TI=(((perceived NEAR/2 stress NEAR/2 scale) OR PSS-10))) OR (AB=(((perceived NEAR/2 stress NEAR/2 scale) OR PSS-10) AND ((factor NEAR/2 structure) OR (factor NEAR/2 analysis) OR (factor NEAR/2 model) OR (internal NEAR/2 structure) OR psychometric OR (item NEAR/2 response) OR Rasch OR (partial NEAR/2 credit) OR (graded NEAR/2 response))))	443
Ovid	(((perceived ADJ1 stress ADJ1 scale) OR PSS-10)).ti OR (((perceived ADJ1 stress ADJ1 scale) OR PSS-10) AND (($factor ADJ1 structure) OR ($factor ADJ1 analysis) OR ($factor ADJ1 model) OR (internal ADJ1 structure) OR psychometric OR (item ADJ1 response) OR Rasch OR (partial ADJ1 credit) OR (graded ADJ1 response))).ab	246
Scopus	TITLE((perceived W/2 stress W/2 scale) OR PSS-10) OR ABS(((perceived W/2 stress W/2 scale) OR PSS-10) AND ((*factor W/2 structure) OR (*factor W/2 analysis) OR (*factor W/2 model) OR (internal W/2 structure) OR psychometric OR (item W/2 response) OR Rasch OR (partial W/2 credit) OR (graded W/2 response)))	486

Table S3. Study details.

Autors, year	Study	Country	Language	Population	Sample size	Dim. assessment	Tested model(s)	Retained model	Inter-factor correlation (two-factor model)	Invariance testing	Notes
Adkins-Jackson & Levine, 2020		USA (California)	English	Black/African American women	223	IRT	one-dimensional factor model;	one-dimensional factor model			
Al-Dubaai et al., 2012		Malaysia	Malay	students	242	PCA	uncorrelated two-factor mode	uncorrelated two-factor model			
Ali et al., 2021		United Arab Emirates	Arabic	female students	379	EFA, CFA	correlated two-factor model	correlated two-factor model	.28 (EFA)	age, marital status, monthly expenditure	
Andreou et al., 2011		Greece	Greek	general population	941	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.66		
Anwer et al., 2020		Saudi Arabia	English	male students	192	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.12		
Baik et al., 2019		USA	English	Hispanic Americans	436	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	correlated two-factor model	.25	language	Bifactor model did not converge for the Spanish language preference group
Bann et al., 2017		USA	English, Spanish	pregnant women	10002	CFA	one-dimensional factor model;	one-dimensional factor model			
Barbosa-Leiker et al., 2013		USA	English	community dwelling sample	309	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	ranged betw. .73 and .82	gender, longitudinal	
Bastianon et al., 2020		Germany	German	migrants and native	2527	EFA, CFA	correlated two-factor mode	correlated two-factor model		migrants vs. non-migrants	
Ben Loubir et al., 2014		Morocco	Arabic	students, employees, non-active persons	1099	PCA	uncorrelated two-factor mode	uncorrelated two-factor model			
Chaaya et al., 2010		Lebanon	Arabic	women (pregnant and postpartum)	268	PCA	uncorrelated two-factor mode	uncorrelated two-factor model			
Chen et al., 2021		Hong Kong	English	students	267	PCA	uncorrelated two-factor mode	uncorrelated two-factor model			
Chiu et al., 2016	1	Taiwan	Chinese	students	601	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model		athletes vs non-athletes	
	2	Taiwan	Chinese	students	196	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.24		Correlated error terms between Item 6 and 10 and between item 9 and 10.
Cole et al., 2019		USA	English	adults	1388	CFA	one-dimensional factor model; correlated two-	bifactor with two specific factors			

							factor model; bifactor with two specific factors; bifactor (other);			
Dao-Tran et al., 2017		Vietnam	Vietnamese	women aged 60 and over	473	EFA	correlated two-factor mode	correlated two-factor model	.56	
Deng et al., 2021	1	China	Chinese	patients with periodontitis	230	PCA	correlated two-factor mode	correlated two-factor model		
	2	China	Chinese	patients with periodontitis	230	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors		
Denovan et al., 2019		United Kingdom	English	students	524	CFA	one-dimensional factor model; correlated two-factor model; correlated factor model (other); bifactor with two specific factors;	bifactor with two specific factors		gender
Do et al., 2021		Vietnam	Viet-namese	pregnant women	148	PCA, CFA	one-dimensional factor model; correlated two-factor model;	one-dimensional factor model	.83 (CFA)		Merged response category “never” and “almost never”
Dominguez-Lara et al., 2022		Peru	Spanish	nursing professionals	2848	ESEM	one-dimensional factor model; correlated two-factor model; bifactor with one specific factor (1,2,3,6,9,10); bifactor with one specific factor (4,5,7,8); bifactor with two specific factors;	correlated two-factor model	.32		
Dougherty et al., 2017		U.S.	English	patients with age-related macular degeneration	137	IRT	one-dimensional factor model;	one-dimensional factor model		gender, age, visual acuity of the better eye	removed item 4 based on fit statistic
Dumitrescu et al., 2014		Romania	Romanian	students	528	EFA, CFA	correlated two-factor mode	correlated two-factor model			
Ezzati et al., 2014	1	USA	English	nondemented adults over the age of 70 years	768	EFA, CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.28 (EFA)		
Figalova & Charvat, 2021		Czech Republic	Czech	general population	1725	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors			
Flores-Torres et al., 2022	1	Mexico	Mexican	women	655	EFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.51		
	2	Mexico	Mexican	women	655	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.54		

Gitchel et al., 2011		USA	English	adults with Multiple Sclerosis	1310	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model		gender	Extracted the PSS-10 version based on other items from the PSS-14
Golden-Kreutz et al., 2004		USA	English	Cancer patients	111	EFA	one-dimensional factor model; correlated two-factor model; correlated factor model (other); second-order factor model;	second-order factor model			
Gonzalez-Ramirez et al., 2013		Mexico	Spanish	students, parents, housewives, women with breast cancer	1990	EFA, CFA	correlated two-factor mode	correlated two-factor model	ranged between .19 and .43 (depending on age and gender group) (CFA)		
Huang et al., 2020		China	Chinese	adults	9507	CFA	correlated two-factor mode	correlated two-factor model			
Islam, 2020	1	Bangladesh	Bangla	adults	150	EFA	correlated two-factor mode	-	.49		
	2	Bangladesh	Bangla	adults	150	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	-	.47	gender	
Jovanovic & Gavrilov-Jerkovic, 2015	1	Serbia	Serbian	psychiatric outpatients	157	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors	.30		
	2	Serbia	Serbian	adults	165	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors	.28		
	3	Serbia	Serbian	students	283	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors	.19		
Juarez-Garcia et al., 2023		Mexico	Spanish	adults	1149	CFA, EGA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors; bifactor with one specific factor (4,5,7,8); bifactor with	bifactor with one specific factor (4,5,7,8)		sex, occupational status	

							one specific factor (1,2,3,6,9,10); bifactor (other)				
Katus et al., 2022		Ghana, Jamaica, Pakistan, Philippines, Romania, South Africa, Sri Lanka, Vietnam	translated into most common languages, guided by TRAPD method	expectant mothers	1208	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model		country, birth parity	Different response categories: “not at all”, “several days”, “more than half the days”, “nearly every day”. Responses were dichotomized. Removal of item 1 because of floor effect
Kaya et al., 2019		Turkey	Turkish	students	231	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model			
Khalili et al., 2017		Iran	Persian	patients with chronic headache	100	EFA	uncorrelated two-factor mode	uncorrelated two-factor model			
Kim, 2016		South Korea	Korean	students	650	EFA	uncorrelated two-factor mode	uncorrelated two-factor model			
Klein et al., 2016		Germany	German	adults (representative sample)	2463	CFA	correlated two-factor mode	correlated two-factor model	.47		
Lee, 2022		South Korea	Korean	students	582	CFA	one-dimensional factor model; correlated two-factor model; correlated factor model (other); bifactor with two specific factors;	bifactor with two specific factors		gender	
Lee & Jeong, 2019		South Korea	Korean	students	250	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors			
Lee et al., 2015	1	South Korea	Korean	patients with chronic disease	201	EFA	uncorrelated two-factor mode				
	2	South Korea	Korean	patients with chronic disease	201	CFA	correlated two-factor mode	correlated two-factor model	.17		Heywood case occurred for the residual error variance associated with a factor (negative subscale), which was resolved by constraining the negative error variance to near zero
Lesage et al., 2012		France	French	workers (occupational	501	PCA	correlated two-factor mode	correlated two-factor model	.50		

				health, random sample)							
Leung et al., 2010		Hong Kong	Chinese	cardiac patients who smoked	1800	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.57		
Liu et al., 2020		China	Chinese	adoloscents	1574	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.46	gender	
Lo et al., 2022		USA	English	students	351	EFA, IRT	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.61 (EFA)	gender	
Lu et al., 2017	1	China	Chinese	students	548	PCA	uncorrelated two-factor mode				
	2	China	Chinese	students	548	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.37 (manifest scores)		
Makhubela, 2022		South Africa	English	students	862	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors; bifactor with one specific factor (4,5,7,8); bifactor with one specific factor (1,2,3,6,9,10);	bifactor with two specific factors	.42	gender, race	
Maliki et al., 2021		Morocco	Arabic	adults	263	EFA, CFA	uncorrelated two-factor mode correlated two-factor model;	correlated two-factor model	.61 (EFA)		
Manzar et al., 2019		Ethiopia	English	students	387	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model			
Maroufizadeh et al., 2018		Iran	Iranian	infertile women	240	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model			
Maroufizadeh et al., 2014		Iran	Persian	adults with Asthma	106	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.84		
Martinez-Garcia et al., 2022		Spain	Spanish	students	399	IRT	one-dimensional factor model;	-		gender, age, course attended, degree year, basis for admission	IRT-based dimensionality test rejected unidimensionality of the complete PSS-10 scale
Medvedev et al., 2019		New Zealand and USA	English	general population, New Zealand students, US students	1960	IRT	one-dimensional factor model;	one-dimensional factor model		gender, age, ethnic groups, education level	

Michaelides et al., 2016		Cyprus	Greek	adults (representative sample)	320	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors; bifactor with one specific factor (4,5,7,8);	bifactor with one specific factor (4,5,7,8)	.54	
Mills et al., 2017		U.S.	English	patients with systemic lupus erythematosus	138	EFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model		
Miranda et al., 2020	1	Argentina	Latin American Spanish	Public Sector Workers	267	PCA	correlated two-factor mode	-		
	2	Argentina	Latin American Spanish	public sector workers	268	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	-		Correlated residual between item 4 and 7
Mitchell et al., 2008		USA	English	survivors of suicide	60	PCA	one-dimensional factor model; uncorrelated two-factor model;	one-dimensional factor model		
Mondo et al., 2021	1	Italy	Italian	workers	325	EFA	uncorrelated two-factor mode			
	2	Italy	Italian	workers	324	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model		
Mounjid et al., 2022		Morocco	Moroccan dialect	women with Breast cancer	100	PCA	uncorrelated two-factor mode	uncorrelated two-factor model		
Mozumder, 2017	1	Bangladesh	Bengali	LGBT participants	296	PCA	uncorrelated two-factor mode			
	2	Bangladesh	Bengali	LGBT participants	296	CFA	correlated two-factor mode	correlated two-factor model		
Mozumder, 2022		Bangladesh	Bengali	adults	350	CFA	correlated two-factor mode	correlated two-factor model	.23	Correlated residual between item 6 and 10
Ng, 2013	1	Hong Kong	Chinese	elderly service workers	491	EFA	correlated two-factor mode		.08	
Ng, 2013	2	Hong Kong	Chinese	elderly service workers	501	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.08	
Nielsen & Dammeyer, 2019		Denmark	Danish	students	1552	IRT	one-dimensional factor model;	-		IRT-based dimensionality test rejected unidimensionality of the complete PSS-10 scale
Nielsen et al., 2016		Denmark	Danish	adults (representative sample)	32374	CFA, IRT	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.69	

Nordin & Nordin, 2013		Sweden	Swedish	adults (representative sample)	3406	EFA	one-dimensional factor model; uncorrelated two-factor model;	one-dimensional factor model			
Orucu & Demir, 2009		Turkey	Turkish	students	508	PCA, CFA	uncorrelated two-factor mode correlated two-factor model;	correlated two-factor model			
Park & Colvin, 2019		South Korea	Korean	military personnel (air force soldiers)	373	CFA, IRT	one-dimensional factor model; correlated two-factor model; bifactor (other); bifactor (other);	bifactor (other)	.36 (manifest scores)		The Korean version has five positive and five negative items, that deviates from most language versions.
Perera et al., 2017		USA	English and Spanish	Hispanics/Latinos	5176	CFA	one-dimensional factor model; correlated two-factor model; bifactor with one specific factor (4,5,7,8);	bifactor with one specific factor (4,5,7,8)		language	
Raczova et al., 2018		Slovakia	Slovak	employees of social facilities	483	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.43 (manifest scores)		
Rajaa et al., 2022		India	Tamil	patients with diabetes	117	PCA, CFA	uncorrelated two-factor mode correlated two-factor model;	correlated two-factor model	.69 (manifest scores)		
Reis et al., 2019	1	Germany	German	adults	5938	EFA	bifactor (other bifactor (other); bifactor (other);	bifactor (other)			
	2	Germany	German	adults	6001	CFA	bifactor (other	bifactor (other)		gender	
	3	Germany	German	adults	1862	CFA	bifactor (other	bifactor (other)		longitudinal	
Roberti et al., 2006		USA	English	students	281	EFA, CFA	correlated two-factor mode	correlated two-factor model	.65 (EFA)		
Roof et al., 2019	1	Qatar	Qatari Arabic	women waiting for prenatal appointments	336	EFA	one-dimensional factor model;				Dropped items 4 and 7
	2	Qatar	Qatari Arabic	women waiting for prenatal appointments	331	CFA	one-dimensional factor model;	one-dimensional factor model			CFA without items 4 and 7. Correlated residual between item 5 and 8
Roy, 2020		India	/	professors	100	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model			
Ruisoto et al., 2020		Ecuador	Ecuadorian Spanish	students	7905	PCA, CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.52 (PCA)		
Sandhu et al., 2015		Malaysia	Malay	nurses	229	PCA, CFA	uncorrelated two-factor mode correlated two-factor model;	correlated two-factor model	.12 (CFA)		
Schneider et al., 2020		Germany	German	non-clinical and clinical subjects	1823	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.85	clincal vs. non-clinical	Correlated residuals between item 1 and

										3 and between item 1 and 9
Sharp et al., 2007		USA	English	African American Adults with Asthma and Low Literacy	312	CFA	correlated two-factor mode	correlated two-factor model		ethnicity, literacy	
She et al., 2021		China	Chinese	general population	1133	CFA	correlated two-factor mode	correlated two-factor model	.52		
Shih et al., 2021		Hong Kong	Chinese	participants with common mental disorders	252	PCA, CFA	uncorrelated two-factor mode one-dimensional factor model;l; correlated two-factor model;	correlated two-factor model	.41 (CFA)		
Siang et al., 2016		Malaysia	Malay	workers	42	PCA	uncorrelated two-factor mode	uncorrelated two-factor model			
Siqueira Reis et al., 2010	1	Brazil	Brazilian-Portuguese	University teachers	393	PCA	uncorrelated two-factor mode	-	.66 (manifest scores)		
	2	Brazil	Brazilian-Portuguese	University teachers	400	CFA	correlated two-factor mode second-order factor model;	-	.68		
Smith & Emerson, 2014		USA	English	public accounting sample	305	CFA	one-dimensional factor model; correlated two-factor model; second-order factor model;	second-order factor model		Gender	Cross-loadings were specified for the correlated two-factor and the second-order factor model (i.e., items 2, 3, 6, 10 were allowed to cross-load on both factors).
Smith et al., 2014		USA	English	students	557	CFA	one-dimensional factor model; correlated two-factor model; second-order factor model;	second-order factor model		gender	Cross-loadings were specified for the correlated two-factor (i.e., item 9 was allowed to cross-load on both factors)
Soria-Reyes et al., 2023		Spain	Spanish	breast cancer patients	215	CFA	one-dimensional factor model; uncorrelated two-factor model; correlated two-factor model; bifactor with two specific factors;	correlated two-factor model	.50		Bifactor model did not converge
Sun et al., 2019		China	Chinese	systemic lupus erythematosus patients	205	EFA	uncorrelated two-factor mode	uncorrelated two-factor model			
Taylor, 2015		USA	English	adults (representative sample)	1236	CFA	one-dimensional factor model; uncorrelated two-factor model;	correlated two-factor model	.76		

Teh et al., 2015		Singapore	English	students	200	EFA, CFA	correlated two-factor model; correlated two-factor mode	correlated two-factor model	.57 (EFA)		Dropped item 7 due to low factor loading
Teresi et al., 2020		USA	English and Spanish	Hispanic caregivers	453	PCA	one-dimensional factor model; bifactor with two specific factors;	one-dimensional factor model		age, education, language	
Tsegaye et al., 2022	1	Ethiopia	Ethiopian Amharic	students	379	EFA	uncorrelated two-factor mode	uncorrelated two-factor model			
	2	Ethiopia	Ethiopian Amharic	students	379	CFA	correlated two-factor mode	correlated two-factor model	.57		
Wang et al., 2011		China	Chinese	policewomen	240	EFA, CFA	correlated two-factor mode	correlated two-factor model	.62 (CFA)		
Whitney et al., 2022		Canada	English	youth with mental illness	67	CFA	correlated two-factor mode	correlated two-factor model	.75		
Wiriyakijja et al., 2020a		United Kingdom	English	patients with recurrent aphthous stomatitis	120	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors			
Wiriyakijja et al., 2020b		United Kingdom	English	patients with oral lichen planus	260	CFA	one-dimensional factor model; correlated two-factor model; bifactor with two specific factors;	bifactor with two specific factors			
Wongpakaran & Wongpakaran, 2010	1	Thailand	Thai	patients	111	EFA	correlated two-factor mode	correlated two-factor model	.51		
	2	Thailand	Thai	students	368	CFA	correlated two-factor mode	correlated two-factor model			
Yokokura et al., 2017	1	Brazil	Brazilian Portuguese	pregnant women	1447	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.76		
	2	Brazil	Brazilian Portuguese	pregnant women	1400	CFA	one-dimensional factor model; correlated two-factor model;	correlated two-factor model	.78		
Yu & Ho, 2010		Hong Kong	Chinese	postmenopausal women	509	PCA	uncorrelated two-factor mode	uncorrelated two-factor model			

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