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Original Article

The Structure of the Emotional Processing Scale (EPS-25)

An Exploratory Structural Equation Modeling Analysis Using Medical and Community Samples

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Abstract: The Emotional Processing Scale (EPS) assesses emotional processing in terms of suppression, signs of unprocessed emotion, controllability of emotions, avoidance of emotional triggers, and impoverished emotional experience. Previous confirmatory factor analyses (CFA) yielded insufficient fit and questioned the EPS factors' discriminant validity. The present study aimed to test unidimensional, five-factor, and bifactor models using exploratory structural equation modeling (ESEM) and CFA. We administered the scale to 350 Italian participants in good health and 346 gastrointestinal patients referred for endoscopy because of mild-to-severe gastrointestinal symptoms. ESEM models outperformed corresponding CFA models. The bifactor ESEM model was a good fit in single group analyses and achieved metric and scalar invariance in multigroup analyses. The inspection of latent mean differences revealed a consistent trend for patients to avoid emotional triggers and have less general emotional processing difficulties. The study clarified the EPS factor structure and supported its use to assess the emotional processing of medical patients and community participants.

Keywords: emotional processing, factor structure, exploratory structural equation modeling, measurement invariance, gastrointestinal patients

Rachman (1980) introduced the concept of emotional processing as a person's ability to absorb or assimilate distressing emotional events to the point where there were no longer any signs of emotional disturbance, such as intrusive preoccupation with the event. He operationally defined it as "a process whereby emotional disturbances are absorbed and decline to the extent that other experiences and behavior can proceed without disruption" (p. 51). It was essentially a behavioral definition and did not specify what psychological mechanisms might be involved in "processing." Foa and Kozak (1986) proposed that in the context of fear, new information had to be integrated into the fear information network for emotional change to occur and aligned emotional processing with psychotherapy by regarding it as a process that constitutes the essence of recovery or change (Foa et al., 2006). Using the illustration of PTSD, Baker and colleagues showed how cognitive appraisal, memory, behavior, emotional experience, physiological habituation, and conceptual integration are all involved in the processing of trauma. They suggested emotional processing to be an umbrella term referring to multiple mechanisms and processes which allow the person to move from emotional disturbance to resolution (Baker et al., 2013).

Baker and his team aimed to develop an assessment scale that might reflect this complex multi-layered conception to apply to a wide range of clinical and research scenarios. A model was constructed of the inter-relationships of proposed mechanisms involved in the emotional processing of emotional disturbance, drawing on constructs from emotional theory, cognitive theory and therapy, behavior therapy, psychosomatics, experiential theory and therapy, psychoanalysis, and neuropsychology (Baker et al., 2015 for a review). Thus, emotional processing overlaps with other concepts such as alexithymia, emotion regulation, emotional intelligence, emotional focusing, emotional awareness, and emotional expression. However, two distinct features are that emotional processing is primarily about a change and that specified emotional processing styles can inhibit or facilitate change (Baker et al., 2015).

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Along with qualitative information from individuals about their emotions, various emotional concepts formed 302 ideas for assessment items (Baker et al., 2007, 2015). Over 15 years and through 4 iterations with a range of mental health, psychosomatic, medical illness, and healthy individuals (n = 8,400), a 25-item scale was developed (Baker et al., 2010). The Emotional Processing Scale (EPS) is based on a person's reactions to life events in the last 7 days. There are five subscales: suppression, signs of unprocessed emotion, controllability of emotion, avoidance, and impoverished emotional experience plus a total score. The scales are significantly correlated and reflect a mixture of trait and state characteristics, strongly associated with both recognized trait scales such as the TAS-20, and state scales, such as the state items from STAXI and measures of psychiatric symptoms (Baker et al., 2012; Gay et al., 2019).

The EPS is both a clinical and research tool. Several validity studies have been conducted for different uses of the scale. Every mental disorder group tested so far (e.g., substance abuse, eating disorder, social phobia) showed highly elevated scores on at least two subscales (Kemmis et al., 2017; Lotfi et al., 2014; Torres et al., 2020). Likewise, people suffering from medical (e.g., breast cancer, cardiomyopathy, cardiomyopathy, ischaemic heart disease) and psychogenic conditions (e.g., psychogenic epilepsy, functional neurological symptoms) showed elevated scores but to a lesser degree than mental disorders (Compare et al., 2018; Kharamin et al., 2018; Novakova et al., 2015; Ogińska-Bulik & Michalska, 2020; Reynolds et al., 2014).

Wilkins et al. (2009) tested the scale's ability to predict a psychological disorder's initial development, following up a cohort of 974 women from the 13th to 34th week of their pregnancy. Using logistic regression and controlling for established risk factors for depression, the EPS made a strong, unique contribution to post-natal depression prediction. The validity of the EPS as a measure of the change in symptoms and behavior has been reported for community delivered Cognitive Behavioural Therapy (CBT; Baker et al., 2012), CBT for obesity and binge eating (Torres et al., 2020), and Psychodynamic Interpersonal therapy for functional neurological symptoms (Williams et al., 2018). A variety of studies also highlighted how the EPS subscales mediated or moderated other variables in clinical samples, such as child abuse, trauma, and pain, to cite a few (Chung & Chen, 2017; Horsham & Chung, 2013).

In sum, the literature supports the utility of the scale in research and clinical practice, but the internal structure of the complex interlocking constructs embedded in the scale requires clarification. Surprisingly, only five studies were conducted to address this issue, some of which provided insufficient reports. Baker and colleagues (2010) carried out an Exploratory Factor Analysis (EFA) with five oblique factors using a sizeable British sample including individuals referred to a psychologist for a range of mental health problems, medical patients suffering from chronic pain or attending at their local medical practice, and healthy controls. Another EFA study carried out on a French sample, including community adults and people with a range of medical conditions, yielded a factor structure similar to that obtained for the English sample (Gay et al., 2019). Both studies reported medium-large correlations among the five factors and large-to-very large correlations between each subscale and the EPS total score.

The only published Confirmatory Factor Analysis (CFA) was carried out using the Spanish language version (Orbegozo et al., 2017). Kwaśniewska et al. (2014) reported that a simultaneous CFA was carried out using the Polish and British versions, but no further details were given but that the two samples did not differ significantly. Another CFA study appears in a dissertation comparing English and Australian data (Spaapen, 2015). This study concluded that the five-factor model was a poor fit in both samples. Likewise, Orbegozo and colleagues (2017) showed that neither the five-factor model nor a three-factor model yielded an acceptable fit to the data. That study retested a second-order model whose fit was acceptable after two items were dropped out. It remains unclear whether the hierarchical structure improved the model's fit or whether item removal was crucial.

Prior CFA studies provided insufficient fit to the data, and the factor correlations questioned the discriminant validity of the measured constructs (Orbegozo et al., 2017; Spaapen, 2015). Because EFA studies (Baker et al., 2010; Gay et al., 2019) have reported several cross-loadings, which, if restrained to zero in CFA, can result in misfit and biased factor correlations, we aim to test the factorial structure of the EPS using Exploratory Structural Equation Modeling (ESEM; Asparouhov & Muthén, 2009). The ESEM approach was developed to overcome the limitations of CFA regarding restrained cross-loadings that might inflate the covariance among latent factors and may lead to the rejection of a structural model that may approximate a simple structure, but that does not satisfy the strict assumption of absent cross-loadings. According to methodological papers showing the superiority of ESEM over CFA in the presence of substantial cross-loadings (e.g., Marsh et al., 2014), we hypothesized better support for ESEM models (e.g., five-factor and bifactor models) over corresponding CFA models. The EPS scale was built to assess the overall level of emotional processing using the total score and the emotional processing profile based on the five subscales. Accordingly, we hypothesized greater support for the bifactor model as it is more in line with the hierarchical multifaceted approach to scale construction and practical use.

Empirical support for any factor model is improved if one can test the external validity for the measured constructs.

The EPS has been widely applied to patients suffering from organic diseases or medically unexplained symptoms (Compare et al., 2018; Kharamin et al., 2018; Novakova et al., 2015; Ogińska-Bulik & Michalska, 2020; Reynolds et al., 2014) revealing failures in emotional processing among the ill. Similarly, difficulties in emotion regulation, like reduced ability to identify and describe feelings and distinguish among them, were noted in patients with gastrointestinal organic conditions and functional disorders (Kano et al., 2018; Lauriola et al., 2011). However, previous research used alexithymia scales, overlooking the broader concept of emotional processing. Moreover, chronic medical conditions require stressful procedures that increase the psychological distress associated with the disease. For instance, digestive endoscopy evokes fears in those undergoing it, and it is a significant stressor for most patients (Trevisani et al., 2014). Since gastrointestinal patients have difficulties in emotion regulation, and the endoscopy situation can be stressful to them, we expect patients to show more emotional processing difficulties than community participants in relatively good health.

As one of the uses of the EPS is to assess how medical patients emotionally adjust to health problems and their treatment, the present study also aims to establish the measurement invariance of the scale. If measurement invariance is not supported, any group comparison involving the latent means is questionable, and any mean differences at the level of observed scores can be biased because of violations of the invariance rather than reflecting substantive differences in the measured constructs.

Methods

Participants

This research used data from a multidisciplinary study approved by the Institutional Review Board for Psychological Research at the Department of Dynamic and Clinical Psychology, and Health Studies, "Sapienza" University of Rome. Sample 1 included 346 medical patients (184 women, 138 men, 24 undisclosed genders) aged 20–88 years (M = 52.4; SD = 16.7) referred for endoscopy either from their General Practitioner because of mild-to-severe gastrointestinal symptoms or after medical treatments. We collected the data on the day of the endoscopy. Sample 2 consisted of 350 community participants (174 women, 175 men, 1 undisclosed gender) aged 25–79 years (M = 49.5; SD = 16.74). Age (t = 2.48; df = 668; p = .013) and gender (χ^2 = 3.30; df = 1; p = .069) were marginally statistically significant between groups. Compared against effect sizes that one can typically find in psychological research (Gignac & Szodorai, 2016), the two groups differed in age and gender composition with an effect size medium (d = 0.19) and small (r_ϕ = .07), respectively. We excluded eligible participants admitted to a hospital during the past year, referred for specialistic medical examinations, or in ostensible poor health status. We assessed the exclusion criteria using filter questions.

Instruments

The Emotional Processing Scale (EPS) is a 25-item questionnaire developed to assess the suppression of negative emotional states and their expression (*suppression*); signs of unprocessed emotions (*unprocessed*); the failure or inability to control powerful negative, externally oriented emotions (*controllability*); experiential or internal avoidance of emotional triggers (*avoidance*); and an impoverished (detached and disconnected) emotional experience (*experience*). Each item uses a 10-point visual analog rating scale, from 0 (= *completely disagree*) to 9 (= *completely agree*). The subscale scores are calculated by averaging the five items that belong to each scale. The EPS also yields a total score of emotional processing. Higher scores represent greater emotional processing difficulties.

Statistical Analyses

Preliminary Analyses

We checked data for univariate and multivariate normality (see Electronic Supplementary Materials, ESM 1). Although the Shapiro-Wilk's test was significant (all ps < .001), the skewness and kurtosis were below the recommended critical values for factor analysis to proceed (i.e., 3 and 10, respectively; Kline, 2011). Multivariate skewness and kurtosis were also statistically significant at p < .001. Sporadic missing data were observed, ranging from a low of 0% for four items to a high of 1.3% for one item. The missing data pattern did not suggest missingness not at random, and the Little's MCAR test was not significant at p < .01 (χ^2 = 596.59, df = 536, p = .036). Each model was fitted to the data using the MLR estimator with full-information maximum likelihood (FIML) to cope with missing values and multivariate normality violations.

Factor Structure

The analyses were conducted using *Mplus* (Version 8.4). Unidimensional, five-factor, and bifactor models were estimated using CFA and ESEM. The unidimensional model was the same in both CFA and ESEM. In CFA, we specified correlated factors for the five-factor model, each corresponding to one of the EPS subscales. The bifactor model assumed uncorrelated factors, including one general and five specific group factors. In ESEM, we used oblique and orthogonal target rotations for the five-factor and bifactor models, respectively. The target matrix was specified in a way that the items loaded the most on the corresponding factor(s) (e.g., suppression items loaded on the suppression factor and the general factor). Cross-loadings were freely estimated but targeted to be as close to zero as possible. In CFA, each item was only loaded on the factor(s) it was assumed to measure, and there were no cross-loadings.

The model's fit was assessed using the MLRχ^2 and other descriptive indices. CFI and TLI values > .95 indicate a good fit, while values > .90 are acceptable; an RMSEA of 0.06 or less is a good fit, while values < .08 are acceptable (Kline, 2011). A cut-off value of .08 for the SRMR supports a good fit between the model and the data. Nested models were compared using a scaled chi-square difference test. Descriptive model selection criteria (AIC, BIC, and SABIC) were also used to choose the best fitting model for subsequent multigroup analyses.

Reliability Analyses

The standardized factor loading matrix was analyzed using Dueber's (2020) bifactor indices calculator package for R to derive the following indexes. The Explained Common Variance (ECV) assesses the proportion of variance in EPS items explained by the general factor relative to the total amount of common variance explained. The coefficient ω reflects the overall proportion of reliable variance in the total score due to both general and group factors. The ω_h reflects the proportion accounted for by the general factor only. Small differences between ω and ω_h support the use of the total score instead of subscale scores. The same logic applies to group factors, whereby ω_s reflects the overall proportion of reliable variance in a subscale score, while ω_{sh} reflects the reliable variance common to specific groups of items.

Measurement Invariance

We investigated the measurement invariance for the best fitting model retained from single group analyses. First, we tested the configural invariance, namely, equality in factor structure between endoscopy patients and community participants (Model 1). Next, we tested the metric invariance hypothesis, whether the factor loadings were equal between groups (Model 2). A subsequent analysis constrained both the factor loadings and the intercepts to be equal between groups, thus testing scalar invariance (Model 3). We used the scaled chi-square difference test to assess whether a more restrictive model (e.g., Model 2) was statistically different from a less restrictive one (e.g., Model 1). However, because negligible differences between models might yield statistically significant differences with relatively large samples, Cheung and Rensvold (2002) recommended a CFI difference to be smaller than or equal to .010 to support substantial equivalence in relative model fit.

Results

Table 1 reports descriptive statistics and correlations for endoscopy patients and community participants. We observed medium-large correlations among the five subscales, and large-to-very large correlations between each subscale scale and the EPS total score, in most cases indicating substantial overlap. After correcting the inflation of correlations due to items shared between each scale and the total score, we obtained the following results. In the community sample, the coefficients were .64, .72, .60, .64, and .73 for the total score with suppression, unprocessed, controllability, avoidance, and experience, respectively. Likewise, for endoscopy patients the corrected correlations were .71, .75, .65, .74, and .72. These results confirmed a substantial degree of overlap between the EPS scales.

Table 2 reports the global fit indices for unidimensional, five-factor, and bifactor models, each estimated using ESEM and CFA. The unidimensional model was a poor fit, regardless of the approach used. It was apparent that only the multidimensional models were able to achieve an acceptable fit to the data. However, CFI values were barely acceptable for the five-factor CFA and the bifactor CFA models. Although both CFA models achieved the close-fit, and the SRMR was good, the TLI values indicated poor fit. Moreover, the five-factor-CFA and bifactor-CFA models did not differ statistically ($\Delta\chi^2$ = 16.8817; *df* = 15; *p* = .326). Using ESEM, the CFI values were acceptable for the five-factor and bifactor-CFA models, approaching a good fit for the latter model. The TLI was acceptable only for the bifactor-ESEM, and the corresponding RMSEA and SRMR were good. Moreover, the five-factor ESEM showed a significant loss of fit compared to the bifactor ESEM ($\Delta\chi^2$ = 101.81; *df* = 20; *p* = .000). This latter also outperformed the CFA models on two out of three model selection criteria (i.e., AIC and SABIC). Because of its consistently better performance across different indices of fit, the bifactor-ESEM was retained for subsequent tests of measurement invariance.

As shown in Table 3, the bifactor-ESEM solution resulted in fairly defined factors (five-factor-ESEM solution in ESM 2). All items significantly loaded on the general factor (λ = .30–.69, *M* = .56). At least three items identified the hypothesized group factors except for suppression, in which case only two out of five items were significant on the corresponding group factor (λ = .37–.55, *M* = .46). This is what we have found for unprocessed emotions (λ = .36–.40,

Table 1. Descriptive analyses and correlations

	1.	2.	3.	4.	5.	6.	*M*	*SD*
1. Suppression	–	.61***	.47***	.66***	.62***	.81***	3.64	2.00
2. Unprocessed	.56***	–	.65***	.61***	.60***	.85***	3.69	2.17
3. Controllability	.41***	.64***	–	.52***	.54***	.78***	2.84	2.09
4. Avoidance	.51***	.53***	.42***	–	.65***	.84***	3.97	2.04
5. Experience	.61***	.59***	.50***	.63***	–	.82***	2.83	1.92
6. EPS Total	.78***	.84***	.75***	.78***	.83***	–	3.40	1.68
M	3.88	4.14	3.16	3.95	2.99	3.62		
SD	1.91	2.11	1.86	1.87	1.86	1.53		

Note. Intercorrelations for endoscopy patients (n = 346) are presented above the diagonal, and intercorrelations for adult community participants (n = 350) are presented below the diagonal. Means and standard deviations for endoscopy patients are presented in the vertical columns and means and standard deviations for adult community participants are presented in the horizontal rows. ***p < .001.

Table 2. Fit indices for the exploratory structural equation modeling (ESEM) and confirmatory factor analysis (CFA) models of the EPS

	ESEM			CFA		
	1F	5F	BF	1F	5F	BF
MLR χ^2	1,154.72	515.35	414.06	1,154.72	734.94	727.20
df	275	185	165	275	265	250
p-value	.000	.000	.000	.000	.000	.000
CFI	.817	.931	**.948**	.817	.902	.901
TLI	.801	.889	**.906**	.801	.890	.881
RMSEA	.068	.051	**.047**	.068	.050	.052
ULCI	.064	.045	**.041**	.064	.046	.048
LLCI	.072	.056	**.052**	.072	.055	.057
p-close	.000	.409	**.839**	.000	.421	.185
SRMR	.059	.027	**.023**	.059	.045	.046
AIC	79,335.67	78,567.72	**78,499.70**	79,335.67	78,801.42	78,802.21
BIC	79,676.58	79,317.70	79,340.59	79,676.58	**79,187.77**	79,256.74
SABIC	79,438.44	78,793.80	**78,753.19**	79,438.44	78,917.88	78,939.22

Note. 1F = Unidimensional Model; 5F = Five-Factor Model; BF = Bifactor; MLRχ^2 = Maximum Likelihood Robust Chi-Square; *df* = Degrees of Freedom; *p*-value = Probability of the MLRχ^2; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; ULCI = Upper Limit for RMSEA confidence Interval; LLCI = Lower Limit for RMSEA Confidence Interval; *p*-close = Probability of the Close-Fit Test; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample-Size Adjusted BIC.

M = .39). Four items significantly identified the group factor for controllability (λ = .21–.40, M = .34) and experience (λ = .29–.38, M = .32). Last, all five controllability items were significant (λ = .33–.43, M = .32). Although the bifactor-ESEM yielded 24 statistically significant cross-loadings (out of 100), none of them was large enough to threaten the factor definition ($|\lambda|$ = .13–.29, M = .16). All were lower than the target loadings on the general factor, and – with few exceptions – never exceeded the target loadings on the group factor (Table 3).

The general factor explained about two-thirds of the common variance (ECV = .67), while the remaining one-third was accounted for by group factors. The proportion of reliable variance in the total score accounted for by the general factor (ω_h = .88) was high compared to the total reliable variance (ω = .94). The ω_s coefficients were .79, .84, .78, .74, and .78 for suppression, unprocessed, controllability, avoidance, and experience, respectively. However, partialling out the general factor variance, the coefficients became very small for experience (ω_{sh} = .13) and unprocessed (ω_{sh} = .16), barely sizeable for suppression (ω_{sh} = .20) and avoidance (ω_{sh} = .18), and low for controllability (ω_{sh} = .25).

Fit indices and hypothesis tests for measurement invariance analyses are reported in Table 4. The configural invariance model achieved an overall good fit. Although the metric invariance model differed from the configural invariance model (p = .013), the change in CFI was below the recommended threshold (i.e., ΔCFI $\leq$ .010). The scalar invariance model also showed a marginally significant loss

Table 3. Standardized factor loadings from the bifactor exploratory structural equation modeling solution of the EPS including five group-factors and one general factor

		G		F1		F2		F3		F4		F5	
EPS scale	Item content	λ	*p*	λ	*p*	λ	*p*	λ	*p*	λ	*p*	λ	*p*
Suppression	Smothered feelings	**.53**	(.000)	**.19**	(.166)	−.09	(.206)	*−.15*	*(.007)*	*−.19*	*(.005)*	−.11	(.217)
	Could not express feelings	**.64**	(.000)	**.20**	(.238)	*−.14*	*(.021)*	*−.16*	*(.007)*	−.04	(.545)	.00	(.987)
	Kept quiet about feelings	**.42**	(.000)	**.37**	(.031)	−.11	(.084)	−.02	(.869)	.06	(.552)	.00	(.969)
	Bottled up emotions	**.61**	(.000)	**.29**	(.082)	.06	(.440)	−.09	(.340)	−.09	(.281)	*.14*	*(.041)*
	Tried not to show feelings	**.52**	(.000)	**.55**	(.023)	.14	(.067)	.08	(.111)	*.22*	*(.018)*	−.01	(.893)
Unprocessed	Unwanted feelings kept intruding	**.61**	(.000)	−.04	(.659)	**.16**	(.147)	.00	(.974)	−.08	(.307)	*−.20*	*(.012)*
	Emotional reactions lasted more than a day	**.60**	(.000)	−.08	(.279)	**.20**	(.154)	.05	(.481)	−.05	(.431)	*−.18*	*(.011)*
	Repeatedly experienced the same emotion	**.58**	(.000)	.00	(.967)	**.36**	(.003)	.06	(.376)	.03	(.733)	−.06	(.370)
	Overwhelmed by emotions	**.69**	(.000)	−.02	(.773)	**.40**	(.000)	*.15*	*(.010)*	−.07	(.214)	.11	(.180)
	Thinking about same emotion again and again	**.66**	(.000)	.09	(.270)	**.40**	(.000)	*.12*	*(.031)*	.07	(.204)	.06	(.397)
Controllability	When upset difficult to control what I said	**.52**	(.000)	−.04	(.404)	−.13	(.103)	**.43**	(.000)	−.03	(.674)	−.15	(.069)
	Reacted too much to what people said or did	**.60**	(.000)	*−.15*	*(.010)*	−.02	(.860)	**.33**	(.000)	−.04	(.659)	*−.15*	*(.030)*
	Wanted to get own back on someone	**.30**	(.000)	.05	(.410)	.08	(.325)	**.36**	(.000)	−.07	(.321)	.07	(.349)
	Felt urge to smash something	**.39**	(.000)	.03	(.666)	*.14*	*(.019)*	**.41**	(.000)	−.03	(.604)	.14	(.054)
	Hard to wind down	**.62**	(.000)	−.03	(.706)	*.29*	*(.000)*	**.40**	(.000)	.03	(.693)	.10	(.279)
Avoidance	Avoided looking at unpleasant things	**.42**	(.000)	−.05	(.450)	−.06	(.444)	−.06	(.373)	**.39**	(.000)	−.04	(.433)
	Talking about negative feelings made them worse	**.58**	(.000)	.03	(.820)	*−.17*	*(.025)*	.03	(.744)	**.08**	(.402)	.05	(.657)
	Tried to talk only about pleasant things	**.33**	(.000)	*.19*	*(.009)*	*−.14*	*(.019)*	*−.16*	*(.043)*	**.40**	(.000)	.08	(.254)
	Could not tolerate unpleasant feelings	**.64**	(.000)	−.06	(.288)	*.14*	*(.020)*	*.10*	*(.039)*	**.21**	(.009)	.12	(.061)
	Tried to avoid things that might make me upset	**.55**	(.000)	.08	(.372)	*.14*	*(.003)*	.03	(.654)	**.36**	(.000)	.08	(.365)
Experience	Emotions felt blunt/dull	**.53**	(.000)	.05	(.462)	*−.14*	*(.016)*	−.14	(.058)	.07	(.245)	**.04**	(.710)
	Feelings did not seem to belong to me	**.60**	(.000)	−.05	(.611)	*−.16*	*(.007)*	.03	(.669)	.05	(.608)	**.29**	(.041)
	Hard to work out if I felt ill or emotional	**.54**	(.000)	−.01	(.816)	.00	(.946)	.01	(.809)	.05	(.379)	**.38**	(.000)
	Seemed to be a big blank in feelings	**.67**	(.000)	.07	(.220)	.11	(.070)	−.02	(.662)	−.01	(.926)	**.28**	(.000)
	Strong feelings but not sure if emotion	**.52**	(.000)	.05	(.376)	.00	(.961)	.03	(.609)	*.13*	*(.043)*	**.32**	(.000)

Note. G = General Emotional Processing Factor; F1 = Suppression; F2 = Unprocessed; F3 = Controllability; F4 = Avoidance; F5 = Experience; λ = factor loading; *p* = *p*-level. Target factor loadings are shown in bold; Significant non-target loadings are italicized.

of fit compared to the metric invariance one (p = .025). However, the change in CFI still supported the scalar invariance hypothesis (see ESM 3 for the standardized factor solution).

Next, we investigated whether patients and community participants had the same mean on the general emotional processing factor and the five group factors. Because we set to 0 the latent factor means (with a unit variance) for community participants and set them free to vary for patients, the latent means estimated for the latter group represent standardized mean differences (SMD). The critical ratio tests (CR) indicated that patients were significantly lower than community participants on the general emotional processing factor (SMD = −0.21; CR = −2.48; p = .013). Conversely, the patients were higher than community participants on avoidance (SMD = 0.26; CR = 1.78; p = .076).

The two groups differed in age and gender composition. In subsequent analyses, we controlled for demographic variables to assess whether the latent mean differences were robust to potential confounder factors. Controlling for age did not alter the statistical significance of the latent mean differences on the general emotional processing factor (SMD = −0.23; CR = −2.43; p = .015) and avoidance (SMD = 0.23; CR = 1.68; p = .076). When controlling for age and gender, the adjusted latent mean differences were reduced and turned out insignificant; smaller effect sizes were still consistent with previous analyses (SMD-s = −0.11 and 0.18 for the general and avoidance factors, respectively).

Discussion

Previous research has reported mixed results concerning the factor structure of the EPS. Our study confirmed the poor fit of the unidimensional model. As in previous studies (Orbegozo et al., 2017; Spaapen, 2015), the five-factor-CFA model was an insufficient fit, and the resulting factors were

Table 4. Fit indices for the measurement invariance analysis of the EPS

	1. Configural invariance	2. Metric invariance	3. Scalar invariance
MLR χ^2	599.94	742.34	775.06
df	330	444	463
p-value	.000	.000	.000
CFI	.946	.940	.938
TLI	.902	.919	.919
RMSEA	.048	.044	.044
ULCI	.042	.038	.039
LLCI	.055	.049	.049
p-close	.650	.966	.967
SRMR	.028	.036	.037
AIC	78,463.73	78,428.36	78,423.38
BIC	80,145.51	79,591.97	79,500.63
SABIC	78,970.69	78,779.12	78,748.11
ΔMLRχ^2	–	149.98[a]	32.84[b]
df	–	114	19
p-value	–	.013	.025
ΔCFI	–	.006	.002

Note. MLRχ^2 = Maximum Likelihood Robust Chi-Square; *df* = Degrees of Freedom; *p*-value = Probability of the MLRχ^2 or ΔMLRχ^2; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; ULCI = Upper Limit for RMSEA Confidence Interval; LLCI = Lower Limit for RMSEA Confidence Interval; *p*-close = Probability of the Close-Fit Test; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample-Size Adjusted BIC. [a]Metric against Configural; [b]Scalar against Metric.

highly inter-correlated. We hypothesized that unsatisfactory fit and inflation of factor correlations could be the by-product of an independent cluster specification in CFA, which unrealistically implies that the items load only the target factor, and the cross-loadings are zero (Asparouhov & Muthén, 2009). In fact, EFA studies have reported several cross-loadings for EPS items (Baker et al., 2010; Gay et al., 2019). Allowing cross-loadings using ESEM improved the fit of the five-factor and bifactor models compared to corresponding CFA models. However, the bifactor ESEM was a better fit than the five-factor ESEM. In contrast, the two models' fit was not distinguishable and below acceptable standards using a CFA approach.

Recently, Morin et al. (2016) claimed that cross-loadings on non-target factors depend not only on the fallible nature of the items but also on the entanglement of general and specific variance components in the context of hierarchically-ordered constructs. Because the EPS was built to reflect an overarching emotional processing construct and five separate emotional processing functions, the items included in this scale are likely to exhibit several cross-loadings on non-target factors, which impaired the fit of CFA models. Consistent with this view, the ESEM bifactor model approached the good fit allowing a general factor and five specific factors to coexist. The general factor was of a much higher magnitude than the group factors. The factor loadings of the group factors were, in some cases, low, questioning their validity, and the small difference between ω and ω_h supported the use of the total score instead of subscale scores. While these findings represent a limitation of the study, it is worth noting that the group factors were still quite well defined (except, perhaps, suppression) and preserved reliable information that would have been lost, forcing the items into a unidimensional structure (which fitted the data poorly). Future research is needed to examine more closely the validity of the group factors.

In this line, we aimed to compare gastrointestinal patients to a community-based sample. Gastrointestinal patients are known to have difficulties in emotion regulation (Kano et al., 2018; Lauriola et al., 2011). Accordingly, we expected the patients to score higher on the EPS factors relative to community participants. Contrary to our expectations, however, gastrointestinal patients reported lower levels of unprocessed emotions and controllability using the EPS subscale scores. This result would seem to imply less difficulty in emotional processing: that is, the patients reported to be less overwhelmed by emotions and more capable of controlling the expression of emotions than healthy adults. The bifactor model, which parsed the shared and unique variance components entangled in the subscale scores, revealed that endoscopy patients were higher on the latent avoidance factor while obtaining a lower score on the general factor. Because avoidance restricts emotional processing at a very initial stage (Baker et al., 2007), we interpreted these findings as reflecting an emotional coping reaction that helped patients deal with procedural distress, cutting down emotions the day the endoscopy. However, asking participants to which extent they were processing their emotions could be associated with self-report biases, like self-presentation, low insight, or inaccurate recall. For instance, Koval and colleagues (2020) have underlined a limited correspondence between global self-reports of emotion regulation (as used in the current study) and averages of momentary self-reports or specific responses to emotions. Common method variance encompassed in the general factor could explain why endoscopy patients have scored lower than the healthy population on this factor, notwithstanding emotion regulation problems and the need to face procedure-related distress.

In subsequent analyses, we controlled for demographic variables. The latent mean differences were robust to age differences between samples. Controlling for gender made the two groups not statistically different, but the trend of latent means was in the same direction of unadjusted estimates. Undoubtedly, these results call for further evaluations regarding the interplay of general and specific variance components in clinical assessment and in relation to gender differences. Returning to the validity of group factors, the consistent trend for the latent mean of avoidance suggested that even a small proportion of specific variance could be useful in highlighting an important psychological outcome in evaluating clinical patients.

Our study is not exempt from limitations. First, the type of medical patients is not representative of the population of patients who took the EPS in previous research. Likewise, the community-based sample used for comparison was not a probabilistic one. Future research should test the factor structure of the EPS and its invariance with more diverse medical conditions, for which the emotional burden is more severe and demands prompt intervention. Second, although an ESEM bifactor model reconciled mixed findings regarding the factor structure of the EPS, statistical evidence regarding the superior fit of a model over another is not enough to assert a psychological scale is construct-valid (e.g., Fried, 2020). A measure is construct-valid if changes in the construct produce noticeable differences in the corresponding measure. Therefore, one crucial future direction might be that emotional processing should optimally be studied in process-oriented research using intensive longitudinal data (e.g., Johansson et al., 2013). Last, the interpretation of the general factor is challenging. For instance, it might be worth examining whether a common method bias could have inflated the correlations observed in the present study.

Notwithstanding these limitations, the present study clarified the EPS factor structure and provided insights into the use and interpretation of EPS scores. Researchers and clinicians are advised to compute and use the total score alongside the subscale scores and study the EPS relationships with clinical outcomes using a bifactor model. Deriving hierarchical scores is also strongly advised for practical applications.

Electronic Supplementary Materials

The electronic supplementary material is available with the online version of the article at https://doi.org/10.1027/1015-5759/a000631

ESM 1. Item descriptive statistics

ESM 2. Standardized factor loadings and Factor Correlations from the Five-Factor Exploratory Structural Equation Modeling solution of the EPS

ESM 3. Standardized factor loadings from the Scalar Invariant Multigroup Bifactor Exploratory Structural Equation Modeling solution of the EPS including five group-factors and one general factor

References

Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling, 16*(3), 397–438. https://doi.org/10.1080/10705510903008204

Baker, R., Gale, L., Abbey, G., & Thomas, S. (2013). Emotional Processing Therapy for post traumatic stress disorder. *Counselling Psychology Quarterly, 26*(3–4), 362–385. https://doi.org/10.1080/09515070.2013.816840

Baker, R., Owens, M., Thomas, S., Whittlesea, A., Abbey, G., Gower, P., Tosunlar, L., Corrigan, E., & Thomas, P. W. (2012). Does CBT facilitate emotional processing? *Behavioural and Cognitive Psychotherapy, 40*(1), 19–37. https://doi.org/10.1017/S1352465810000895

Baker, R., Thomas, P., Thomas, S., Santonastaso, M., & Corrigan, E. (2015). *Emotional Processing Scale*. Hogrefe.

Baker, R., Thomas, S., Thomas, P. W., Gower, P., Santonastaso, M., & Whittlesea, A. (2010). The Emotional Processing Scale: Scale refinement and abridgement (EPS-25). *Journal of Psychosomatic Research, 68*(1), 83–88. https://doi.org/10.1016/j.jpsychores.2009.07.007

Baker, R., Thomas, S., Thomas, P. W., & Owens, M. (2007). Development of an Emotional Processing Scale. *Journal of Psychosomatic Research, 62*(2), 167–178. https://doi.org/10.1016/j.jpsychores.2006.09.005

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Chung, M. C., & Chen, Z. S. (2017). Child abuse and psychiatric comorbidity among Chinese adolescents: Emotional processing as mediator and PTSD from past trauma as moderator. *Child Psychiatry and Human Development, 48*(4), 610–618. https://doi.org/10.1007/s10578-016-0687-7

Compare, A., Brugnera, A., Spada, M. M., Zarbo, C., Tasca, G. A., Sassaroli, S., Caselli, G., Ruggiero, G. M., & Wittstein, I. (2018). The role of emotional competence in Takotsubo cardiomyopathy. *Psychosomatic Medicine, 80*(4), 377–384. https://doi.org/10.1097/PSY.0000000000000564

Dueber, D. (2020). *BifactorIndicesCalculator: Bifactor indices calculator R package version 0.2.1*. https://cran.r-project.org/package=BifactorIndicesCalculator

Foa, E. B., Huppert, J. D., & Cahill, S. P. (2006). Emotional processing theory: An update. In B. O. Rothbaum (Ed.), *Pathological anxiety: Emotional processing in etiology and treatment* (pp. 3–24). Guilford Press.

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear. Exposure to corrective information. *Psychological Bulletin, 99* (1), 20–35. https://doi.org/10.1037/0033-2909.99.1.20

Fried, E. I. (2020). *Lack of theory building and testing impedes progress in the factor and network literature*, 1–50. https://doi.org/10.31234/osf.io/zg84s

Gay, M. C., Baker, R., Vrignaud, P., Thomas, P., Heinzlef, O., Haag, P., Banovic, I., & Thomas, S. (2019). Cross-cultural validation of a French version of the Emotional Processing Scale (EPS-25). *Revue Européenne de Psychologie Appliquée, 69*(3), 91–99. https://doi.org/10.1016/j.erap.2019.05.002

Gignac, G. E., & Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. *Personality and Individual Differences, 102*, 74–78. https://doi.org/10.1016/j.paid.2016.06.069

Horsham, S., & Chung, M. C. (2013). Investigation of the relationship between trauma and pain catastrophising: The roles of emotional processing and altered self-capacity. *Psychiatry Research, 208*(3), 274–284. https://doi.org/10.1016/j.psychres.2012.11.031

Johansson, R., Björklund, M., Hornborg, C., Karlsson, S., Hesser, H., Ljótsson, B. L., Rousseau, A., Frederick, R. J., & Andersson, G. (2013). Affect-focused psychodynamic psychotherapy for depression and anxiety through the Internet: a randomized controlled trial. *PeerJ, 1*, e102. https://doi.org/10.7717/peerj.102

Kano, M., Endo, Y., & Fukudo, S. (2018). Association between alexithymia and functional gastrointestinal disorders. *Frontiers in Psychology, 9*, Article 599, 1–6. https://doi.org/10.3389/fpsyg.2018.00599

Kemmis, L. K., Wanigaratne, S., & Ehntholt, K. A. (2017). Emotional processing in individuals with substance use disorder and posttraumatic stress disorder. *International Journal of Mental Health and Addiction, 15*(4), 900–918. https://doi.org/10.1007/s11469-016-9727-6

Kharamin, S., Malekzadeh, M., Aria, A., Ashraf, H., & Ghafarian Shirazi, H. R. (2018). Emotional processing in patients with ischemic heart diseases. *Open Access Macedonian Journal of Medical Sciences, 6*(9), 1627–1632. https://doi.org/10.3889/oamjms.2018.325

Kline, R. B. (2011). *Principles and practice of structural equation modeling*. Guilford Press.

Koval, P., Kalokerinos, E., Greenaway, K., Medland, H., Kuppens, P., Nezlek, J. B., Hinton, J., & Gross, J. (2020). *Emotion regulation in everyday life: What can we learn from global self-reports?* https://psyarxiv.com/cav54/

Kwaśniewska, A., Thomas, K., & Baker, R. (2014). Are there cross-cultural differences in emotional processing and social problem-solving? *Polish Psychological Bulletin, 45*(2), 205–210. https://doi.org/10.2478/ppb-2014-0026

Lauriola, M., Panno, A., Tomai, M., Ricciardi, V., & Potenza, A. E. (2011). Is alexithymia related to colon cancer? A survey of patients undergoing a screening colonoscopy examination. *Journal of Clinical Psychology in Medical Settings, 18*(4), 410–415. https://doi.org/10.1007/s10880-011-9267-y

Lotfi, S., Abolghasemi, A., & Narimani, M. (2014). A comparison of emotional processing and fear of positive/negative evaluations in women with social phobia and normal women. *Knowledge & Research in Applied Psychology, 14*(53), 101–111.

Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2014). Exploratory structural equation modeling: An integration of the best features of exploratory and confirmatory factor analysis. *Annual Review of Clinical Psychology, 10*(1), 85–110. https://doi.org/10.1146/annurev-clinpsy-032813-153700

Morin, A. J. S., Arens, A. K., & Marsh, H. W. (2016). A bifactor exploratory structural equation modeling framework for the identification of distinct sources of construct-relevant psychometric multidimensionality. *Structural Equation Modeling: A Multidisciplinary Journal, 23*(1), 116–139. https://doi.org/10.1080/10705511.2014.961800

Novakova, B., Howlett, S., Baker, R., & Reuber, M. (2015). Emotion processing and psychogenic non-epileptic seizures: A cross-sectional comparison of patients and healthy controls. *Seizure, 29*, 4–10. https://doi.org/10.1016/j.seizure.2015.03.007

Ogińska-Bulik, N., & Michalska, P. (2020). The relationship between emotional processing deficits and posttraumatic stress disorder symptoms among breast cancer patients: The mediating role of rumination. *Journal of Clinical Psychology in Medical Settings, 27*(1), 11–21. https://doi.org/10.1007/s10880-019-09606-6

Orbegozo, U., Matellanes, B., Estévez, A., & Montero, M. (2017). Adaptación al castellano del Emotional Processing Scale-25 [Spanish adaptation of the Emotional Processing Scale-25]. *Ansiedad y Estrés, 24*(1), 24–30. https://doi.org/10.1016/j.anyes.2017.10.006

Rachman, S. (1980). Emotional processing. *Behaviour Research and Therapy, 18*(1), 51–60. https://doi.org/10.1016/0005-7967(80)90069-8

Reynolds, H. R., Jones, L. A., & Rickards, H. E. (2014). Emotional processing in adults with functional neurological symptoms. *Journal of Neurology, Neurosurgery & Psychiatry, 85*(8), e3–e3. https://doi.org/10.1136/jnnp-2014-308883.33

Spaapen, D. (2015). *Emotion processing: Relevance to psychotic-like symptoms*. Unpublished master thesis. https://api.research-repository.uwa.edu.au/files/4905820/Spaapen_Devon_2015.pdf

Torres, S., Sales, C. M. D., Guerra, M. P., Simões, M. P., Pinto, M., & Vieira, F. M. (2020). Emotion-focused cognitive behavioral therapy in comorbid obesity with binge eating disorder: A pilot study of feasibility and long-term outcomes. *Frontiers in Psychology, 11*, Article 343, 1–13. https://doi.org/10.3389/fpsyg.2020.00343

Trevisani, L., Zelante, A., & Sartori, S. (2014). Colonoscopy, pain and fears: Is it an indissoluble trinomial? *World Journal of Gastrointestinal Endoscopy, 6*(6), 227–233. https://doi.org/10.4253/wjge.v6.i6.227

Wilkins, C., Baker, R., Bick, D., & Thomas, P. (2009). Emotional processing in childbirth: A predictor of postnatal depression? *British Journal of Midwifery, 17*(3), 154–159. https://doi.org/10.12968/bjom.2009.17.3.40077

Williams, I. A., Howlett, S., Levita, L., & Reuber, M. (2018). Changes in emotion processing following brief augmented psychodynamic interpersonal therapy for functional neurological symptoms. *Behavioural and Cognitive Psychotherapy, 46*(3), 350–366. https://doi.org/10.1017/S1352465817000807

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Open Data

The electronic supplementary materials, software syntax, outputs, and data can be found at https://osf.io/856xe/files/

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