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ORIGINAL ARTICLE

Assessment of activation, intensity and duration of positive and negative emotions: psychometric properties of the Polish version of the Perth Emotional Reactivity Scale – Short Form

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BACKGROUND
The Perth Emotional Reactivity Scale – Short Form (PERS-S) is an 18-item self-report questionnaire that assesses emotional reactivity. The PERS-S measures activation, intensity, and duration of negative and positive emotions. The study aims to validate the Polish version of the PERS-S.

PARTICIPANTS AND PROCEDURE
The study was performed on a sample of 675 people aged 18-80 (M = 28.88, SD = 13.17, 56.15% female). The factor structure and measurement invariance across gender, age and educational categories were verified with confirmatory factor analysis. Convergent and divergent validity were assessed based on the relationship between the PERS-S scale and the Emotional Reactivity scale taken from the Formal Characteristics of Behaviour–Temperament Inventory, the Emotion Regulation Questionnaire, the Perceived Stress Scale, the Warwick-Edinburgh Mental Wellbeing Scale and the Subjective Vitality Scale.

RESULTS
The intended 6-factor model was an excellent fit for the data (CFI = .963; TLI = .953; RMSEA = .053, 90% CI [.046; .061]; SRMR = .057) and was invariant across gender, educational level and age groups. All PERS-S subscales correlated with another emotional reactivity questionnaire, stress, emotion regulation strategies, well-being and vitality as expected. The reliability was high for all subscales ($\alpha > .70$); it was slightly lower only for the positive-activation subscale ($\alpha = .68$). Due to gender differences in emotional reactivity traits, group norms (sten scale) were calculated separately for females and males.

CONCLUSIONS
The Polish version of the PERS-S has strong psychometric properties. Its practical applications are discussed.

KEY WORDS
affective style; emotion; emotional reactivity; Perth Emotional Reactivity Scale-Short Form; psychometric properties

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BACKGROUND

Emotional reactivity (ER) is an individual trait that is expressed in the ease/speed of activation, intensity, and duration of emotional response to emotionally exerting stimuli (Becerra & Campitelli, 2013). Since emotions have a specific valence (positive or negative), the construct of ER applies to both negative and positive emotions. In this regard, researchers currently distinguish four properties of ER or affective style: (1) emotional valence; (2) activation, which reflects the speed of the emotional response; (3) intensity; and (4) duration of the emotional response (Becerra & Campitelli, 2013; Preece et al., 2019).

Considering the history of research on ER, it is noteworthy that until recently it was considered as a unidimensional trait in terms of negative emotions. The majority of studies used scales assessing the negative ER, which made it possible to examine the specificity of emotional response to the appearance of stimuli exerting negative emotions (e.g., the Emotion Reactivity Scale by Nock et al., 2008; the Emotional Reactivity subscale from the Formal Characteristics of Behaviour–Temperament Inventory by Cyniak-Cieciura et al., 2018). In contrast, examining the emotional response to the appearance of the stimuli exerting positive emotions was not possible to provide using these scales.

To address the issue of positive ER, Australian researchers developed the 30-item Perth Emotional Reactivity Scale (PERS; Becerra & Campitelli, 2013; Becerra et al., 2019; Preece et al., 2019). The PERS distinguishes the activation, intensity, and duration of an emotional response separately for positive and negative emotions. Based on this questionnaire, the Perth Emotional Reactivity Scale – Short Form (PERS-S) was developed, which repeats the structure of the PERS but consists of 18 items (Preece et al., 2019). The PERS-S consists of six subscales (positive-activation, positive-intensity, positive-duration, negative-activation, negative-intensity, negative-duration) with 3 statements per subscale, and it results in two composite scores (general negative reactivity scale and general positive reactivity scale).

In developing the scale, Preece et al. (2019) tested four models of the PERS-S: (1) a 1-factor model, (2) a 2-factor correlated model composed of two valence-specific first-order factors (negative and positive reactivity), (3) a 6-factor correlated model composed of six intended subscales as first-order factors, and (4) a 6-factor higher-order model where these six first-order factors were specified to load on two valence-specific second-order factors (general negative and general positive reactivity). The analysis of the original factor structure of the PERS-S showed that the 6-factor correlated model and the 6-factor higher-order model were the best solutions (Preece et al., 2019). However, the 6-factor correlated model was a slightly better fit than the 6-factor higher-order model. An unacceptable fit to the data was obtained for the 1-factor and the 2-factor correlated models (Preece et al., 2019).

It should be stressed that the 6-factor model fits the intended subscale structure of the PERS-S, and has the best fit indices in most papers, including the research on the original version (Preece et al., 2019) and the Russian version of the scale (Larionov et al., 2021).

Preece et al. (2019) established convergent and divergent validity using scales which measured depression, anxiety and stress, two emotion regulation strategies, as well as difficulties in emotion regulation. However, Preece et al. (2019) did not examine measurement invariance of the PERS/PERS-S across socio-demographic characteristics.

The results reported by Becerra et al. (2019) evidenced that age was not related to ER. Some studies showed that females had more negative ER traits than males (Becerra et al., 2019; Larionov et al., 2021). In a study which used the PERS-S, the researchers Preece et al. (2019) noted that activation, intensity, and duration of negative emotions and general negative ER positively correlated with emotion regulation difficulties as well as with expressive suppression, and negatively correlated with cognitive reappraisal. The opposite trend was typical for general positive ER and its dimensions (Preece et al., 2019). In a study on the Russian version of the PERS-S, it was noted that as the general negative ER increased, a person experienced more stress and negative affect, and less positive affect. In turn, with an increase in general positive ER, a person experienced more positive affect and less negative affect (Larionov et al., 2021).

The above-mentioned findings suggest that high negative ER is related to the development of psychopathology. In contrast, high positive ER may be a protective factor. However, it is worth citing some results regarding the negative role of positive ER traits. Barnhart et al. (2020), who studied the moderating effects of the ER and its characteristics concerning the relationship of positive and negative emotional eating with binge eating, noted that individuals with high activation and intensity of positive emotions have a higher risk of overeating if they tend to eat when positive emotions arise. In contrast, the duration of negative emotions combined with the tendency to eat in response to negative emotions is an important factor underlying binge eating. High and low activation or intensity of negative emotions did not have any moderating effect on the relationship between negative emotional eating and binge eating (Barnhart et al., 2020). Summarizing the above, the PERS/PERS-S subscales show highly specific correlations with other psychological constructs.

RESEARCH AIM AND HYPOTHESES

The main aim of the study is to validate the Polish version of the PERS-S and to present its psychometric properties (factor structure, internal consistency reliability, convergent and divergent validity). Additionally, measurement invariance across age, educational level and gender categories was examined. We predict that the 6-factor correlated model is the best factor structure solution, which is characterised by measurement invariance across gender, age and educational level categories. We predict that high levels of the PERS-S negative reactivity subscales are correlated with higher levels of the other established measure of negative emotional reactivity, stress, expressive suppression and with lower levels of cognitive reappraisal, well-being and vitality. In turn, we predict that the PERS-S positive reactivity subscales are either not correlated or slightly correlated with the other established measure of negative emotional reactivity, that they are also negatively correlated with stress and expressive suppression and are positively correlated with cognitive reappraisal, well-being and vitality. As regards gender differences, we predict that females have a higher level of negative ER traits than males, whereas gender does not influence the level of positive ER traits.

PARTICIPANTS AND PROCEDURE

PARTICIPANTS

The total sample consisted of 675 Polish-speaking adults (379 females and 296 males; 56.15% and 43.85% respectively) with ages ranging from 18 to 80 (M = 28.88, SD = 13.17) in the general population. Among the respondents 50.81% were single, 27.70% were living common-law and 21.48% were married. Individuals with secondary education made up 54.52% of the respondents, those with higher education constituted 39.26%, those with primary education constituted 4.59%, and those with vocational education constituted 1.63%. The majority of the respondents lived in cities (40.74%), villages were the place of residence for 26.07% of the respondents, towns for 21.19% and small towns for 12%.

PROCEDURE

The participants were recruited via social networks (Facebook, Instagram) where there was a link to an online anonymous survey in Google Forms with an appended consent form. The Kazimierz Wielki University Ethics Committee approved the current study (approval number: 3/12.01.2021). All respondents provided their written informed consent before they answered the questions. There was no reimbursement for the participants. Not all respondents completed all the measures to avoid common method bias and stress during filling out the questionnaires.

MEASURES

The Perth Emotional Reactivity Scale – Short Form is an 18-item self-report questionnaire designed to measure three characteristics of ER, namely activation, intensity, and duration of positive and negative emotions separately (Preece et al., 2019). The PERS-S consists of six subscales and two composite scores. Positive-activation (e.g., "I tend to get happy very easily"), positive-intensity (e.g., "When I'm joyful, I tend to feel it very deeply"), positive-duration (e.g., "When I'm happy, the feeling stays with me for quite a while") are three subscales that form the composite score of the general positive reactivity scale. In turn, negative-activation (e.g., "I tend to get upset very easily"), negative-intensity (e.g., "If I'm upset, I feel it more intensely than everyone else") and negative-duration (e.g., "Once in a negative mood, it's hard to snap out of it") are the three subscales of the general negative reactivity scale. The statements are scored on a 5-point scale ranging from 1 (*very unlike me*) to 5 (*very like me*).

The Emotional reactivity (ER) subscale from the Formal Characteristic of Behaviour–Temperament Inventory [FCB-TI(R)] was developed by Cyniak-Cieciura et al. (2016) to measure ER, which is defined as a tendency to react intensely to emotion-generating stimuli. The subscale consists of 15 statements (e.g., "I often break down in difficult moments"), which are scored on a 4-point Likert scale. A higher score indicates a higher level of ER.

The Emotion Regulation Questionnaire (ERQ) developed by Gross and John (2003) in the Polish translation by Śmieja et al. (2011) was used. The questionnaire was designed to measure the usage of two emotion regulation strategies: cognitive reappraisal (e.g., "I control my emotions by changing the way I think about the situation I'm in") and expressive suppression (e.g., "I keep my emotions to myself"). The ERQ consists of 10 statements, which are scored on a 7-point Likert scale. Higher scores indicate more extensive usage of the two separate above-mentioned emotion regulation strategies.

The Perceived Stress Scale-10 (PSS-10) developed by Cohen et al. (1983) in the Polish version by Juczyński and Ogińska-Bulik (2009) was used for measuring the level of perceived stress during the previous month. The PSS-10 has 10 statements (e.g., "In the last month, how often have you felt nervous and stressed?"), which are due to be evaluated on a 4-point Likert scale. A higher score indicates a higher level of perceived stress.

The Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS) developed by Tennant et al. (2007) in the Polish version by Konaszewski et al. (2021) was used. The scale was designed to measure the level of mental well-being. The WEMWBS consists of 14 statements (e.g., "I've been feeling good about myself"), which are scored on a 5-point Likert scale. A higher score indicates a higher level of mental well-being.

The Subjective Vitality Scale (SVS) developed by Ryan and Frederick (1997) in the Polish version by Mudło-Głagolska (2021) was used for assessing vitality as a trait. The SVS consists of 5 statements (e.g., "I feel alive and vital"), which are scored on a 7-point Likert scale. A higher score indicates higher vitality.

ANALYTIC STRATEGY

Statistical analysis was carried out using Statistica and such statistical packages as *lavaan* and *semTools* (for confirmatory factor analysis, CFA) as well as *MVN* (for testing multivariate normality by the Henze-Zirkler test) in the R software. The data were screened for accuracy (minimum and maximum range of each variable). There were no missing data.

TRANSLATION OF THE SCALE

The original version of the PERS-S was translated into Polish by three independent translators. Based on their translations a common Polish translation of the scale was developed. Then it was translated into English (back translation procedure) by an independent translator who was not familiar with the original version of the PERS-S. David Preece, who was one of the authors of the PERS-S, and the authors of this paper compared the back translation with the original version of the scale. The necessary minor corrections were made. The authors of the manuscript concluded that the final Polish version of the scale was consistent with the original version.

AGE AND GENDER DIFFERENCES

ER scores gained by females and males were compared (*t*-test) and the effect size (Cohen's *d*) was evaluated. Pearson correlations between PERS-S scales and age were calculated.

FACTOR STRUCTURE AND MEASUREMENT INVARIANCE

A condition of multivariate normality for conducting CFAs was assessed by the Henze-Zirkler multivariate normality test. Considering the results indicating the absence of multivariate normality ($HZ = 1.10$, $p < .001$), CFA with robust maximum-likelihood estimation (MLM estimator in the *lavaan* package in R software) was carried out. The following fit measures were taken into account while conducting CFA: root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), Tucker-Lewis index (TLI) and Akaike information criterion (AIC). RMSEA and SRMR values below .05 indicate a good fit to the data, values below .08 indicate a satisfactory fit, and values above .10 indicate a poor fit of the model. The CFI and TLI indices take values from 0 to 1, where values greater than .9 indicate an acceptable fit to the data (Hu & Bentler, 1999). The PERS-S factor models were compared using the AIC. The lower the AIC value is, the better the model is in terms of its fit to the data (Byrne, 2010).

Measurement equivalence analysis was performed at configural, metric and scalar levels. While testing metric invariance in small research groups ($N \leq 300$) with unequal sample sizes, the equivalence can be confirmed when the change in CFI is ≤ .005 and RMSEA is ≤ .010. In contrast, when testing scalar invariance, this condition is satisfied when the change in CFI is ≤ .005 and RMSEA is ≤ .010 (Chen, 2007).

INTERNAL CONSISTENCY RELIABILITY

Cronbach's α coefficients were calculated for assessing the reliability of the PERS-S.

CONVERGENT AND DIVERGENT VALIDITY

The focus was on assessing convergent and divergent validity, identifying relationships between PERS-S scales and constructs with which, according to the theory, they should show a significant correlation or no correlation. In this regard, the relationships between PERS-S subscales as well as the composite scores and the ER subscale from the FCB-TI(R), the two emotion regulation strategies (cognitive reappraisal and expressive suppression), stress, wellbeing as well as vitality were examined.

GROUP NORMS

The group norms were calculated using the sten scale (standard ten scoring system) and based on empirical data. Sten scores were calculated from *Z*-scores using the formula: sten = (*Z*-score × 2) + 5.5 (Eatwell, 1997).

RESULTS

Table 1 presents descriptive statistics for all the variables in the study. Skewness scores for the PERS-S

subscales ranged from −.50 to −.16, whereas kurtosis ranged from −.84 to −.06, indicating that the distribution of scores was normal.

GENDER DIFFERENCES

It was found that in females, positive-intensity ($t(673) = 2.11$, $p = .040$, $d = .16$), general negative reactivity ($t(673) = 4.03$, $p < .001$, $d = .31$), negative-activation ($t(673) = 3.49$, $p < .001$, $d = .27$), negative-intensity ($t(673) = 4.06$, $p < .001$, $d = .32$), and negative-duration ($t(673) = 3.29$, $p < .001$, $d = .26$) were higher than in males. After using Bonferroni correction and establishing a new p-level (.05/8 comparisons = .00625), gender did not influence the positive-intensity score.

AGE

Pearson correlations between age and PERS-S subscales were calculated in the groups of females and males separately. In the group of females ($n = 379$) age was not correlated with general positive reactivity ($r = .02$, $p = .641$), positive-activation ($r = -.03$, $p = .591$) or positive-intensity ($r = -.04$, $p = .416$), but age was positively correlated with positive-duration ($r = .13$, $p = .015$) and negatively with general negative reactivity ($r = -.28$, $p < .001$), negative-activation ($r = -.28$, $p < .001$), negative-intensity ($r = -.21$, $p < .001$) and negative-duration ($r = -.27$, $p < .001$).

A similar pattern was observed in the group of males ($n = 296$). The correlations between age and general positive reactivity ($r = .01$, $p = .917$), posi-

Table 1

Descriptive statistics and Cronbach's α internal reliability coefficients for the PERS-S, the ER subscale from the FCB-TI(R), ERQ, PSS-10, WEMWBS and SVS

Scale/subscale	Total sample			Females		Males	
	α	*M*	*SD*	*M*	*SD*	*M*	*SD*
PERS-S (*N* = 675, 56.15% females)							
General positive reactivity	.87	30.10	6.93	30.53	6.88	29.55	6.97
Positive-activation	.68	10.69	2.46	10.81	2.37	10.54	2.55
Positive-intensity	.83	9.92	2.89	10.13	2.91	9.66	2.84
Positive-duration	.83	9.49	2.89	9.59	2.81	9.35	2.98
General negative reactivity	.91	29.68	8.51	30.84	8.35	28.21	8.51
Negative-activation	.74	9.77	3.09	10.13	3.07	9.30	3.05
Negative-intensity	.85	10.07	3.27	10.52	3.18	9.50	3.30
Negative-duration	.81	9.84	3.10	10.19	3.02	9.40	3.14
The ER subscale from the FCB-TI(R) (*N* = 199, 55.78% female)							
Negative ER	.88	40.73	8.32	43.32	7.84	37.47	7.79
ERQ (*N* = 79, 83.54% female)							
Cognitive reappraisal	.84	27.37	6.40	28.00	5.91	24.15	7.96
Expressive suppression	.77	13,44	5.27	12.85	4.89	16.46	6.28
PSS-10 (*N* = 79, 83.54% female)							
Stress (PSS-10 total score)	.87	21.01	6.23	20.88	6.19	21.69	6.64
WEMWBS (*N* = 74, 85.14% female)							
Wellbeing	.92	47.72	8.86	48.46	8.84	43.45	8.07
SVS (*N* = 166, 92.17% females)							
Vitality	.83	20.66	5.96	20.83	5.89	18.69	6.63

Note. PERS-S – Perth Emotional Reactivity Scale – Short Form; ER subscale from FCB-TI(R) – Emotional Reactivity subscale from the Formal Characteristics of Behaviour–Temperament Inventory; ERQ – Emotion Regulation Questionnaire; WEMWBS – Warwick-Edinburgh Mental Wellbeing Scale; PSS-10 – Perceived Stress Scale; SVS – Subjective Vitality Scale. The number of the participants (N) who completed each questionnaire is shown in parentheses near the measures.

tive-activation (r = .03, p = .633), positive-intensity (r = −.06, p = .344) and positive-duration (r = .04, p = .460) were statistically insignificant. Age was correlated with general negative reactivity (r = −.13, p = .026), negative-activation (r = −.12, p = .042), negative-intensity (r = −.13, p = .021) and was not correlated with negative-duration (r = −.09, p = .107).

Summarizing the above, the results suggested that negative reactivity and the majority of its characteristics decrease with age, especially in the group of females. In contrast, the positive reactivity traits were practically unrelated to age.

CONFIRMATORY FACTOR ANALYSIS

The 1-factor and 2-factor models were a very poor fit to the data. The 6-factor model was a good fit (see Table 2). The values of estimated correlations between subscales of the 6-factor model are shown in Table 3. The estimated correlations between subscales of positive-activation, positive-intensity and positive-duration were positive and high (from .61, all p < .001). Slightly higher correlations were reported between negative-activation, negative-intensity and negative-duration, which ranged from .89 (all p < .001). All factor loadings of the 6-factor model are presented in Table 5.

A 6-factor model with two higher-order factors (general negative reactivity, general positive reactivity) was also tested. It should be stressed that the higher-order model included only three first-order factors per second-order factor. Following the recommendations of the PERS-S authors Preece et al. (2019), one more loading among the loadings for each second-order factor was constrained to 1. The 6-factor model with two higher-order factors was an acceptable fit to the data. The estimated correlation between general positive and general negative reactivity was negative and weak (r = −.24, p < .001). Although the fit indices allow the model to be accepted, the analysis showed that in one case the variance took a negative value (positive-activation: −.027). The positive-activation standardized factor loading value for general positive reactivity was equal to 1.014. This is a common situation in factor analysis and structural equation models called a Heywood case. It refers to negative estimates of variances or the correlation is estimated to be greater than one in absolute value (Kolenikov & Bollen, 2012). One of the necessary conditions for the application of second order factor models is the lower order factors being substantially correlated with each other (Chen et al., 2005). We assume that estimated correlations between first-order factors of positive-activation, positive-intensity and positive-

Table 2

Goodness-of-fit indices for the PERS-S models (robust maximum-likelihood estimation)

Model	χ^2/df	CFI	TLI	RMSEA (90% confidence interval)	SRMR	AIC
1-Factor	2217.65/135	.579	.523	.170 (.163; .176)	.189	34597.74
2-Factor	918.28/134	.847	.825	.103 (.096; .109)	.120	32925.05
6-Factor	308.72/120	.963	.953	.053 (.046; .061)	.057	32212.87
6-factor model with two higher-order factors*	551.58/130	.919	.905	.076 (.069; .082)	.118	32476.28

Note. *Heywood case; PERS-S – Perth Emotional Reactivity Scale – Short Form.

Table 3

Estimated correlations between the factors of the 6-factor model for the PERS-S

Factors	Positive-activation	Positive-intensity	Positive-duration	Negative-activation	Negative-intensity
Positive-intensity	.86***	–	–	–	–
Positive-duration	.79***	.61***	–	–	–
Negative-activation	−.19*	−.06	−.61***	–	–
Negative-intensity	−.07	.12*	−.44***	.89***	–
Negative-duration	−.22**	−.08	−.53***	.89***	.89***

Note. PERS-S – Perth Emotional Reactivity Scale – Short Form; *p < .05, **p < .01, ***p < .001.

Table 4

Goodness-of-fit indices for invariance analysis of the 6-factor model across gender, age and educational level categories (robust maximum-likelihood estimation)

Model	Gender (female vs. male)					Age (18-30 years old vs. over 30 years old)					Educational level (higher education degree vs. no higher education degree)				
	χ^2 (*df*)	CFI	ΔCFI	RMSEA	ΔRMSEA	χ^2 (*df*)	CFI	ΔCFI	RMSEA	ΔRMSEA	χ^2 (*df*)	CFI	ΔCFI	RMSEA	ΔRMSEA
Configural	523.31 (240)	.963	–	.053	–	492.44 (240)	.969	–	.048	–	498.30 (240)	.966	–	.051	–
Metric	542.75 (252)	.961	–.002	.053	.000	510.13 (252)	.968	–.001	.048	.000	519.32 (252)	.964	–.002	.051	.000
Scalar	570.89 (264)	.958	–.003	.054	.001	540.06 (264)	.965	–.003	.049	.001	549.00 (264)	.961	–.003	.052	.001

duration scales were not high enough (*r* from .61 to .86, all $p < .001$) to form a second-order factor of general positive reactivity (see Table 3).

Summarizing the above, the results of CFA showed the superiority of the 6-factor model over other solutions. In turn, this demonstrates the utility of separating valence and the activation, intensity and duration components of ER.

MEASUREMENT INVARIANCE

Measurement invariance of the 6-factor model in females (n = 379) and males (n = 296), two age groups (18-30 years old [n = 477] vs. over 30 years old [n = 198]) as well as in two educational level categories (higher education degree [n = 265] vs. no higher education degree [n = 410]) was supported (see Table 4).

CONVERGENT AND DIVERGENT VALIDITY

The relationships between the PERS-S subscale and other study variables were analysed (see Table 6).

In general, most positive ER characteristics were positively correlated with cognitive reappraisal, well-being and vitality and negatively with stress and expressive suppression. In contrast, most negative ER characteristics were positively associated with the other established measure of negative ER, stress and expressive suppression, and negatively with cognitive reappraisal, vitality and well-being.

The relationships between the PERS-S composite scores and the variables in the study were also analysed. However, in this case conclusions should be drawn with caution due to the unsatisfactory results of CFA in this regard.

GROUP NORMS

Due to the gender differences in ER traits, the group norms were calculated using the sten scale separately for females and males for all the PERS-S subscales and composite scores (see Tables 7 and 8), based on the empirical data.

DISCUSSION

The purpose of the study was to validate the PERS-S scale and to demonstrate its psychometric properties. The analysis showed that the Polish version of the PERS-S is an accurate and reliable tool. The 6-factor model, which makes it possible to examine the six dimensions of ER, including activation, intensity, and duration of positive or negative emotions separately,

Table 5

Completely standardized item factor loadings from confirmatory factor analyses of the 6-factor model (robust maximum likelihood estimation)

Subscales	Item number	Statements (original / Polish version)	Completely standardized factor loadings
Negative-activation	2	I tend to get upset very easily Mam tendencję do tego, że bardzo łatwo staję się zmartwiony	.741
	8	I tend to get disappointed very easily Mam tendencję do tego, że bardzo łatwo się rozczarowuję	.586
	14	I tend to get pessimistic about negative things very quickly Mam tendencję do tego, że bardzo szybko staję się pesymistyczny w obliczu negatywnych wydarzeń	.762
Negative-intensity	6	If I'm upset, I feel it more intensely than everyone else Jeśli jestem smutny, odczuwam to intensywniej niż inni	.749
	12	Normally, when I'm unhappy I feel it very strongly Zwykle, kiedy jestem nieszczęśliwy, odczuwam to bardzo silnie	.819
	18	My negative feelings feel very intense Moje negatywne uczucia są bardzo intensywne	.857
Negative-duration	4	When I'm upset, it takes me quite a while to snap out of it Kiedy jestem smutny, zajmuje mi sporo czasu, zanim się od tego uwolnię	.777
	10	It's hard for me to recover from frustration Trudno mi otrząsnąć się z frustracji	.666
	16	Once in a negative mood, it's hard to snap out of it Gdy wpadnę w negatywny nastrój, trudno mi się z niego uwolnić	.866
Positive-activation	1	I tend to get happy very easily Mam tendencję do tego, że bardzo łatwo staje się radosny	.653
	7	I feel good about positive things in an instant Momentalnie dobrze się czuję, gdy dzieje się coś pozytywnego	.629
	13	I react to good news very quickly Bardzo szybko reaguję na dobre wiadomości	.633
Positive-intensity	5	When I am joyful, I tend to feel it very deeply Kiedy jestem radosny, mam tendencję do tego, by przeżywać to bardzo intensywnie	.730
	11	I experience positive mood very strongly Bardzo silnie odczuwam pozytywny nastrój	.846
	17	When I'm enthusiastic about something, I feel it very powerfully Kiedy z jakiegoś powodu czuję entuzjazm, odczuwam go bardzo silnie	.783
Positive-duration	3	When I'm happy, the feeling stays with me for quite a while Kiedy jestem szczęśliwy, to uczucie pozostaje ze mną na długo	.764
	9	When I'm feeling positive, I can stay like that for a good part of the day Kiedy czuję się pozytywnie, mogę utrzymać taki stan przez dłuższą część dnia	.794
	15	I can remain enthusiastic for quite a while Mogę pozostać entuzjastyczny przez długi czas	.799

Table 6

Pearson correlations between scores on the PERS-S and the ER subscale from the FCB-TI(R), ERQ, PSS-10, WEMWBS and SVS

Scales	General positive reactivity	Positive-activation	Positive-intensity	Positive-duration	General negative reactivity	Negative-activation	Negative-intensity	Negative-duration
Negative ER (the ER subscale from the FCB-TI(R)) (*N* = 199)	.08	.19**	.18*	–.15*	.53***	.50***	.48***	.44***
Cognitive reappraisal (ERQ) (*N* = 79)	.39***	.27*	.29**	.45***	–.42***	–.40***	–.36**	–.38**
Expressive suppression (ERQ) (*N* = 79)	–.28*	–.19	–.23*	–.31**	.27*	.30**	.18	.26*
Stress (PSS-10) (*N* = 79)	–.33**	–.23*	–.12	–.50***	.53***	.47***	.43***	.54***
Well-being (WEMWBS) (*N* = 74)	.51***	.37**	.19	.72***	–.45***	–.47***	–.32**	–.44***
Vitality (SVS) (*N* = 166)	.49***	.35***	.38***	.55***	–.37***	–.34***	–.33***	–.31***

Note. PERS-S – Perth Emotional Reactivity Scale – Short Form; ER subscale from FCB-TI(R) – Emotional Reactivity subscale from the Formal Characteristics of Behaviour–Temperament Inventory; ERQ – Emotion Regulation Questionnaire; WEMWBS – Warwick-Edinburgh Mental Wellbeing Scale; PSS-10 – Perceived Stress Scale; SVS – Subjective Vitality Scale. *$p < .05$, **$p < .01$, ***$p < .001$. The number of participants (N) who completed each questionnaire is shown in parentheses near the measures.

had the best fit to the data. Activation, intensity and duration are highly correlated with each other in every valence domain, but there is statistical value in separating them. The obtained results of CFA are consistent with the conclusions regarding the predominance of the 6-factor model presented in other validation studies on the PERS-S or the PERS (Larionov et al., 2021; Mousavi Asl et al., 2020; Preece et al., 2019).

Measurement invariance of the Polish 6-factor model across gender, age and educational level categories was supported. This demonstrates the possibility of comparing different PERS-S scores across gender, age and educational backgrounds. To sum up the factor structure assessment, the 6-factor model is an optimal and theoretically grounded solution, emphasizing the utility of separating valence and the activation, intensity and duration components of ER. However, there is still good support for the use of the two composite scores (general negative reactivity, general positive reactivity) in scientific research, given the high correlation between the three factors within each valence domain and the fact that the two composites have high reliability (α = .91 and .87 respectively). The reliability of the five subscales was also high (α ≥ .70), except the positive-activation subscale (α = .68). Considering the fact that this subscale contains only three statements, such a result can be considered fully satisfactory.

The results of the scale validity were in line with expectations. It can be concluded that positive ER dimensions are strongly related to high levels of well-being and vitality. The important role of emotion expression for mental health is reflected in the fact that the less the emotions are suppressed, the longer positive emotions last. Positive reactivity subscales were positively correlated with cognitive reappraisal, emphasizing that capability of adaptive emotion regulation led to experiencing more positive emotions. It should be stressed that positive reactivity subscales were slightly correlated with the ER subscale from the FCB-TI(R), which was designed for measuring the level of negative reactivity. In turn, negative reactivity subscales were positively correlated with the ER subscale from the FCB-TI(R), which confirms the divergent validity of the PERS-S. Higher negative ER is related to stress and emotion regulation difficulties as well as decreases in well-being and vitality. These results are consistent with other studies on the PERS-S, in which the same or similar constructs and research tools for validation of the scale were used (Larionov et al., 2021; Preece et al., 2019).

In our study high levels of negative ER and low levels of positive ER were correlated with a high level of stress as well as a low level of vitality and well-being. According to Preece et al. (2019) and

Table 7

The current (September 2021) norm groups of the Polish version of the PERS-S in the group of females (N = 379)

General positive reactivity		Positive-activation		Positive-intensity		Positive-duration		General negative reactivity		Negative-activation		Negative-intensity		Negative-duration	
Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten
9-16	1	3-6	1	3-4	1	3	1	9-14	1	3	1	3-4	1	3-4	1
17-20	2	7	2	5	2	4-5	2	15-18	2	4-5	2	5	2	5	2
21-23	3	8	3	6-7	3	6	3	19-22	3	6-7	3	6-7	3	6-7	3
24-27	4	9	4	8	4	7-8	4	23-26	4	8	4	8	4	8	4
28-30	5	10	5	9-10	5	9	5	27-30	5	9-10	5	9-10	5	9-10	5
31-33	6	11	6	11	6	10	6	31-35	6	11	6	11-12	6	11	6
34-37	7	12-13	7	12-13	7	11-12	7	36-39	7	12-13	7	13	7	12-13	7
38-40	8	14	8	14	8	13	8	40-43	8	14	8	14-15	8	14	8
41-44	9	15	9	15	9	14-15	9	44-45	9	15	9	–	9	15	9
45	10	–	10	–	10	–	10	–	10	–	10	–	10	–	10

Note. PERS-S – Perth Emotional Reactivity Scale – Short Form.

Table 8

The current (September 2021) norm groups of the Polish version of the PERS-S in the group of males (N = 296)

General positive reactivity		Positive-activation		Positive-intensity		Positive-duration		General negative reactivity		Negative-activation		Negative-intensity		Negative-duration	
Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten	Raw score	Sten
9-15	1	3-5	1	3	1	3	1	9-11	1	3	1	–	1	3	1
16-19	2	6	2	4-5	2	4	2	12-15	2	4	2	3-4	2	4	2
20-22	3	7	3	6	3	5-6	3	16-19	3	5-6	3	5-6	3	5-6	3
23-26	4	8-9	4	7-8	4	7	4	20-23	4	7	4	7	4	7	4
27-29	5	10	5	9	5	8-9	5	24-28	5	8-9	5	8-9	5	8-9	5
30-33	6	11	6	10-11	6	10	6	29-32	6	10	6	10-11	6	10	6
34-36	7	12-13	7	12	7	11-12	7	33-36	7	11-12	7	12	7	11-12	7
37-40	8	14	8	13	8	13	8	37-40	8	13	8	13-14	8	13-14	8
41-43	9	15	9	14-15	9	14-15	9	41-45	9	14-15	9	15	9	15	9
44-45	10	–	10	–	10	–	10	–	10	–	10	–	10	–	10

Note. PERS-S – Perth Emotional Reactivity Scale – Short Form.

Mousavi Asl et al. (2020) these characteristics are also associated with emotion regulation difficulties in a non-clinical sample.

It should be stressed that negative and positive ER traits are not orthogonal, despite the presence of only minor correlations between them. Generally, these dimensions are negatively correlated (Larionov et al., 2021; Preece et al., 2019). Thus, in most cases, a person will experience either more negative emotions and fewer positive ones or more positive emotions and fewer negative ones.

As for gender and age differences, the results of this study suggest that females have more negative ER traits than males. The obtained results are consistent with the previous reports (Becerra et al., 2019; Larionov et al., 2021). The group norms of the PERS-S subscales as well as composite scores for females and males in the general population of Poles were calculated. They can be used when comparing the ER levels across individuals from the general population and different clinical groups.

PRACTICAL APPLICATIONS AND FUTURE DIRECTIONS

We recommend using six subscales of the PERS-S to assess the level of certain ER traits. For research purposes general negative reactivity and general positive reactivity scales can also be calculated. The general negative reactivity and its characteristics are higher in females; therefore we recommend using the norms calculated separately for females and males.

We support future directions of studies on ER proposed by Becerra et al. (2019) and Preece et al. (2019) in the field of psychopathology and emotion regulation, especially in establishing the typical reactivity profiles of various diagnostic categories, which seems promising. We predict that the PERS-S can be used as a screening tool for assessing the basic predictors of emotion difficulties. Additionally, we predict that assessing ER traits can be helpful in conducting primary prevention of mental disorders at the earliest stages of their development and when identifying risk groups.

Our study supports the results on the cross-cultural validity of the scale conducted in other languages (Preece et al., 2019; Larionov et al., 2021). This reflects the strengths of the validated scale and good support for conducting future studies on clinical and adolescent samples.

STRENGTHS AND LIMITATIONS OF THE STUDY

The validation study took place in a broad general sample with a wide range of ages and almost equal numbers of males and females. For the first time, gender, age and educational level category invariance of the PERS-S was explored.

Some limitations of this study should also be noted. The test-retest reliability was not assessed. The validity of the PERS-S was assessed in a sample of adults in the general community. We did not test the PERS-S in clinical or adolescent samples.

CONCLUSIONS

The validated Polish version of the PERS-S is a short and useful tool for quantifying different dimensions of the ER construct. The recommended 6-factor model of the scale is characterised by a theoretically congruent factor structure and is invariant across gender, age and educational level categories. The PERS-S scales show good convergent and divergent validity and high reliability. The two composite scores can also be used for scientific purposes only. The Polish version of the PERS-S is a comprehensive tool for measuring the activation, intensity and duration of positive and negative emotions.

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Supplementary materials are available on journal's website.

Disclosure

The authors declare no conflict of interest.

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