

ORIGINAL ARTICLE

# *Scores of short and free scale for Big Five explain perceived stress at different stages of life: validity, reliability and measurement invariance of the Polish adaptation of Mini-IPIP*

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## BACKGROUND

Big-Five personality traits are related to a variety of quality of life outcomes; therefore, they should arguably be controlled for whenever health and well-being are investigated. Valid and reliable short measures of these constructs may enable large scale epidemiological studies. Stress is a well-recognized risk factor for a host of health-related outcomes and its relationship with Big-Five personality is well-evidenced. The aim of this research was to investigate psychometric properties of the Polish version of the Mini-IPIP scale measuring Big Five personality factors. This included measurement invariance between genders and between two samples representing different stages of life – an employee sample and an adolescent sample – and investigating the relationships of Big Five personality traits with perceived stress.

## PARTICIPANTS AND PROCEDURE

Sample 1 comprised 723 employees from a wide range of professions and sample 2 comprised 765 high school students. The Perceived Stress Scale (PSS-4) was used in each sample.

## RESULTS

The Mini-IPIP had an acceptable fit and reliability in both samples and showed measurement invariance between samples and between genders within the samples. Big Five personality traits explained the variance in perceived stress similarly in both samples, and analogously to previous studies.

## CONCLUSIONS

The present study shows that the Polish version is a valid and reliable psychometric tool and provides evidence that the relationship between personality and stress is relatively stable at different life stages, and can be effectively investigated with short measures.

## KEY WORDS

Big Five; measurement invariance; psychometrics; quality of life; stress

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## BACKGROUND

Studies on personality, especially concerning the Big Five model, have been crucial in understanding risk factors for a variety of quality of life outcomes (Anaby, Jarus, Backman, & Zumbo, 2010; Diener, Oishi, & Lucas, 2003; Feng, Ji, & Yin, 2013; Gutiérrez, Jiménez, Hernández, & Puente, 2005; Haslam, Whelan, & Bastian, 2009). Since most of the Big Five traits are significant predictors of health and well-being (Iacovino, Bogdan, & Oltmanns, 2015; Steel, Schmidt, & Shultz, 2008), they need to be controlled for whenever unique predictors of health and well-being are investigated. Therefore having valid, reliable and convenient measures is valuable for researchers interested in this area. The aim of this study was to investigate psychometric properties of the Polish version of the Mini-IPIP scale, which is a brief and free measure of Big Five personality traits (Donnellan, Oswald, Baird, & Lucas, 2006). Perceived stress is well known to play a significant role in well-being. Its relationship with health is well-evidenced (Cohen, Janicki-Deverts, & Miller, 2007). Previous research suggests that in terms of personality, the most important variables related to experienced stress are extraversion, conscientiousness and most significantly neuroticism (Bunevicius, Katkute, & Bunevicius, 2008; Ebstrup, Eplov, Pisinger, & Jørgensen, 2011; Oliveira, 2017; Urquijo, Extremera, & Villa, 2015). The results of the studies on the relationship between Big Five personality, stress and coping with stress, and well-being are well-established (Connor-Smith & Flachsbart, 2007; Iacovino et al., 2015; Steel et al., 2008); therefore, perceived stress is a very useful criterion variable to test the validity of a short personality inventory suggested for large scale psychological and epidemiological surveys.

Short scales are becoming increasingly popular due to their usefulness in saving the time of both participants and researchers, reducing response burden, and having satisfactory psychometric properties (Rammstedt & Beierlein, 2014). While ultra-short scales are obviously not adequate as tools for precise individual diagnosis, they are suitable for large scale studies as a means to control for confounding variables or investigating the relationships between variables in complex models (Kemper, Trapp, Kathmann, Samuel, & Ziegler, 2018). In the case of the Big Five personality traits, the shortest 10 and 5 item scales, although frequently used, have been relatively problematic. Typically, they demonstrate lower reliability measured with internal consistency coefficients such as Cronbach's  $\alpha$  or Spearman-Brown's coefficient, which makes them somewhat psychometrically more problematic than their longer counterparts, because they require less biased estimates of test-retest reliabil-

ity (Credé, Harms, Niehorster, & Gaye-Valentine, 2012; Gosling, Rentfrow, & Swann, 2003; Muck, Hell, & Gosling, 2007). Moreover, the Ten Item Personality Inventory (TIPI) frequently showed low criterion validity, particularly for the agreeableness and openness to experience/intellect factor (Burns et al., 2017; Iwasa & Yoshida, 2018; Oshio, Abe, Cutrone, & Gosling, 2014; Rojas & Widiger, 2013). The 20-item Mini-IPIP scale does seem to provide the optimal solution for situations when short Big Five measurement is needed. It shows satisfactory psychometric properties and poses a limited burden upon completion (Baldasaro, Shanahan, & Bauer, 2013; Cooper, Smillie, & Corr, 2010; Donnellan et al., 2006; Laverdière, Morin, & St-Hilaire, 2013; Oliveira, 2017). It is important to note while discussing the validity of Big Five scales that comparative fit index (CFI) and Tucker-Lewis index (TLI) model fit indices are often lower for these types of models and therefore it was argued that they should be considered less restrictively (Hopwood & Donnellan, 2010; Marsh et al., 2010). Whether that is a purely statistical issue or rather a conceptual problem requires more investigation (see Strus, Ciecuch, & Rowiński, 2014).

The International Personality Item Pool (IPIP) is a large-scale collaborative repository of public domain personality items for measuring constructs in personality research (Goldberg et al., 2006). All tools at the site are free to use, making it very convenient for researchers. Moreover, for the Big Five measurement, when compared to their for-pay alternatives, the free scales have similar or even better psychometric properties (Hamby, Taylor, Snowden, & Pettersen, 2015).

Previous studies on measurement invariance of the Mini-IPIP showed mixed results. Data presented by Baldasaro et al. (2013) indicate partial metric invariance for all subscales when comparing men and women. When comparing racial groups, partial scalar invariance was obtained for conscientiousness and agreeableness subscales and partial metric invariance for extraversion, neuroticism and intellect subscales. However, the results of a study conducted by Laverdière et al. (2013) support complete measurement invariance when comparing employee and student samples, men and women and different age groups. Here, it should be noted that age as a variable is confounded by other factors such as socioeconomic status. Also, age in itself is a complex variable related to different effects including age, cohort and period, which should be kept in mind when interpreting the data (Yang & Land, 2016).

The aim of this study was to investigate psychometric properties of the Polish version of the Mini-IPIP scale, including measurement invariance between genders and between two samples repre-

senting different stages of life – an employee sample and an adolescent sample – and to investigate the relationships of Big Five personality to perceived stress in each sample. Based on the previous research, it was hypothesized that the scale would have satisfactory validity and reliability in both samples and that extraversion, conscientiousness and especially neuroticism are significantly related to the perceived stress.

## PARTICIPANTS AND PROCEDURE

### PARTICIPANTS

Sample 1 consisted of 723 employees from a wide range of professions, including lawyers, managers, IT specialists, academics, researchers, medical doctors, psychologists, teachers, engineers, accountants, commercial trades, librarians and functionaries, of whom 513 (71.9%) were female, and 200 (27.7%) were male (10 respondents did not specify their gender). Participants' mean age was 36.37 years ( $SD = 11.33$ ).

Sample 2 consisted of 765 adolescents from three different high schools in Gdansk, of whom 494 (64.6%) were female, and 264 (34.5%) were male (7 respondents did not specify their gender). Participants' mean age was 17.03 years ( $SD = 0.88$ ).

### MEASURES

*Mini-IPIP.* The Mini-IPIP consists of a 20-item inventory with four items measuring each of the Big-Five personality factors: extraversion, agreeableness, conscientiousness, neuroticism and openness to experience (Donnellan et al., 2006). Participants indicate how well each statement describes them using a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). For the purpose of the current study the scale was translated in 2014 from English to Polish in a multi-step translation process conforming to the commonly used standards of psychometric instruments translation. The process included the following procedures: i) translation from English into Polish separately by one bilingual person and one psychologist fluent in English, ii) developing an agreement on the initial Polish version within a panel consisting of both translators and a psychometrician, iii) back translation by two different translators: a bilingual person and a psychologist fluent in English, iv) comparing the back translation with the original version and with the initial Polish translation within a panel consisting of all four translators and a psychometrician, and choosing item wording for the final Polish version, v) pre-testing among a group

of individuals ( $n = 15$ ) for any problems with understanding the items and their intended meaning, and introducing any necessary corrections to items' wording. This is a different Polish version than that by Topolewska et al. (2014), which was developed using a different approach. The current version used the original 20 items from Donnellan et al. (2006). Using the same items has advantages in terms of cross-cultural comparisons and is congruent with the confirmatory approach in science. The current version of the scale was developed around the same time as the version by Topolewska et al. (2014), and before that version was published, with the specific aim of providing a short measure of Big Five personality for large scale surveys. The same items as in the original short version were chosen, especially to enable direct cross-cultural comparisons. Since then it has been used in several large scale cross-cultural projects on behavioral addictions, including surveys in which IPIP scales consisting of the same items were used in Poland and Norway (e.g. Atroszko, Pallesen, Griffiths, & Andreassen, 2017). At the time of developing the current scale, the Topolewska et al. (2014) wording of the 50-item version was not available.

*Perceived Stress Scale.* Perceived stress was measured with the Perceived Stress Scale (PSS-4; Cohen, Kamarck, & Mermelstein, 1983). It has four items referring to the perceived stress during the last month. The grading scale was: 0 (*never*), 1 (*almost never*), 2 (*sometimes*), 3 (*fairly often*), 4 (*very often*). The scale showed good validity and reliability in previous research (Atroszko, 2015; Atroszko et al., 2018). Cronbach's  $\alpha$  reliability coefficient was .75 in sample 1 and .77 in sample 2.

### PROCEDURE

Sample 1 used convenience sampling. Employees were invited to participate anonymously in the study through their employers or directly. It was a 'paper and pencil' cross-sectional study. No monetary or other material rewards were given for participation. Written informed consent was obtained from each participant. Data were gathered between January 2014 and July 2016 as part of a research project on behavioral addiction. Some of the results on the relationship between Big Five personality and addiction have been published before (Atroszko et al., 2017).

Sample 2 used convenience sampling. Those willing to participate filled in 'paper and pencil' anonymous questionnaires during regular school classes. The questionnaires were divided into 3 sets, each one completed a week apart from each other. Data were gathered between January and April 2018 as part of a research project on behavioral addictions.

## STATISTICAL ANALYSES

Confirmatory factor analyses were performed using Mplus 6.11. Due to the strictly ordinal character of the response scale, the CFA models were tested using the weighted least square mean and variance adjusted (WLSMV) estimator. The following measures were used to evaluate the fit of the model:  $\chi^2$  divided by degrees of freedom ( $\chi^2/df$ ), comparative fit index (CFI), Tucker-Lewis index (TLI) and root mean squared error of approximation (RMSEA). Measurement invariance between females and males in both samples, as well as between the samples, was assessed using multiple-group procedures in which sets of parameters were freed sequentially in a series of four hierarchically nested models. Configural invariance tests whether the number of factors and the pattern of factor-indicator relationships are the same across groups. Metric invariance tests whether the factor loadings are equal across groups. Scalar invariance tests the equality of item thresholds. Strict invariance tests the equality of residual variances across groups. Because the models for each level of invariance are nested within the previous models, they are compared using the change in fit indices (Putnick & Bornstein, 2016). A change in CFI ( $\Delta CFI$ ) less than .01 and a change in RMSEA ( $\Delta RMSEA$ ) less than .015 suggest no meaningful decrease in model fit and support measurement invariance (Chen, 2007).

Hierarchical regression analyses were conducted where stress was the dependent variable. Independent variables introduced in step 1 were gender and age, and independent variables introduced in step 2 were extraversion, agreeableness, conscientiousness, neuroticism and openness to experience. In order to compare differences in betas between samples, 95% confidence intervals were calculated. Preliminary analysis was conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, or homoscedasticity. All tests were two-tailed, and the significance level was set to  $\alpha = .05$ . SPSS 25 was used to calculate means, standard deviations, percentages, correlation coefficients and regression analyses.

## RESULTS

The five-factor model of personality showed satisfactory model fit in each of the four groups (see Table 1). Slightly lower values of CFI and TLI are congruent with previous research. The standardized factor loadings are shown in Table 2.

Cronbach's  $\alpha$  reliability coefficients were: .77 for extraversion, .75 for agreeableness, .76 for conscientiousness, .71 for neuroticism and .72 for intellect in sample 1, and .82 for extraversion, .75 for agreeableness, .73 for conscientiousness, .73 for neuroticism and .75 for intellect in sample 2.

The indicators of model fit showed acceptable strict measurement invariance between genders (see Table 3). Changes in the CFI coefficients for the scalar invariance were somewhat excessively large, but the changes in RMSEA were acceptable. It is crucial to note that the used cutoff points are for the maximum likelihood (ML) estimator (Chen, 2007), as there are no cutoff points for the WLSMV estimator, making the results difficult to interpret.

Table 4 presents mean scores, standard deviations, percentages, and correlation coefficients of the study variables.

Regression analysis in sample 1 (see Table 5) showed that the independent variables explained a total of 32.1% of the variance of stress,  $F(7, 691) = 46.61$ ,  $p < .001$ . Significant independent variables in Step 2 were age ( $\beta = -.07$ ), conscientiousness ( $\beta = -.17$ ) and neuroticism ( $\beta = .48$ ). In sample 2, the independent variables explained a total of 39.0% of the variance of stress,  $F(7, 717) = 65.50$ ,  $p < .001$ . Significant independent variables in Step 2 were conscientiousness ( $\beta = -.10$ ) and neuroticism ( $\beta = .58$ ). There were no significant differences in betas of the Big Five personality traits between the samples.

## DISCUSSION

This study examined psychometric properties of the Polish adaptation of the Mini-IPIP scale for Big Five personality traits, including measurement invariance between genders as well as employee sample

Table 1  
*Model fit indices for five factor model in subgroups of interest*

Group	$\chi^2$	df	$\chi^2/df$	CFI	TLI	RMSEA	90% CI
Female employees	560.08	160	3.50	.91	.89	.070	[.064-.077]
Male employees	323.99	160	2.02	.91	.89	.072	[.060-.083]
Female adolescents	432.48	160	2.70	.94	.93	.059	[.052-.065]
Male adolescents	352.87	160	2.21	.91	.90	.067	[.058-.077]

Table 2  
Standardized item factor loadings in the five factor model in each sample

Item	Extraversion		Agreeableness		Conscientiousness		Neuroticism		Intellect	
	Employee sample	Adolescent sample	Employee sample	Adolescent sample	Employee sample	Adolescent sample	Employee sample	Adolescent sample	Employee sample	Adolescent sample
1. Am the life of the party. / Jestem duszą towarzystwa.	.85	.89								
6. Don't talk a lot. / Jestem mało mówny. (R)	.71	.73								
11. Talk to a lot of different people at parties. / Na imprezach rozmawiam z wieloma różnymi osobami.	.73	.74								
16. Keep in the background. / Nie lubię być w centrum uwagi. (R)	.62	.68								
2. Sympathize with others' feelings. / Potrafię współczuć innym ludziom.			.74	.75						
7. Am not interested in other people's problems. / Nie interesuję mnie problemy innych. (R)			.72	.72						
12. Feel others' emotions. / Potrafię odczuwać emocje innych.			.75	.67						
17. Am not really interested in others. / Nie za bardzo interesuję mnie inni ludzie. (R)			.74	.75						
3. Get chores done right away. / Swoje obowiązki wypelniam od razu.					.52	.50				
8. Often forget to put things back in their proper place. / Często zapominam odłożyć rzeczy na ich miejsce. (R)					.77	.71				
13. Like order. / Lubię porządek.					.70	.64				
18. Make a mess of things. / Robię bałagan. (R)					.90	.88				

(Table 2 continues)

Table 2  
(Table 2 continued)

Item	Extraversion			Agreeableness			Conscientiousness			Neuroticism			Intellect		
	Employee sample	Adolescent sample	Employee sample	Employee sample	Adolescent sample	Employee sample	Employee sample	Adolescent sample	Employee sample	Employee sample	Adolescent sample	Employee sample	Employee sample	Adolescent sample	
4. Have frequent mood swings. / Często mięwam huśtawki nastrojów.						.75					.70				
9. Am relaxed most of the time. / Zazwyczaj jestem zrelaksowany. (R)						.69					.71				
14. Get upset easily. / Łatwo się denerwuję.						.70					.52				
19. Seldom feel blue. / Rzadko bywam smutny. (R)						.54					.77				
5. Have a vivid imagination. / Mam bujną wyobraźnię.												.66		.85	
10. Am not interested in abstract ideas. / Nie interesuję mnie abstrakcyjne pojęcia i pomysły. (R)												.70		.66	
15. Have difficulty understanding abstract ideas. / Mam problem ze zrozumieniem abstrakcyjnych pojęć. (R)												.64		.56	
20. Do not have a good imagination. / Nie mam dobrej wyobraźni. (R)												.79		.87	

Note. (R) – reverse scored item.

Table 3  
*Model fit indices for measurement invariance*

Groups compared	Model	$\chi^2$	<i>df</i>	CFI	$\Delta$ CFI	RMSEA	90% CI	$\Delta$ RMSEA
Female employees vs. male employees	Configural invariance	861.16	320	.907	–	.070	[.064, .075]	–
	Metric invariance	895.36	335	.904	–.003	.069	[.064, .075]	–.001
	Scalar invariance	956.12	390	.903	–.001	.065	[.059, .070]	–.004
	Residual invariance	976.78	410	.902	–.001	.063	[.058, .068]	–.002
Female adolescents vs. male adolescents	Configural invariance	777.46	320	.934	–	.061	[.056, .067]	–
	Metric invariance	806.15	335	.932	–.002	.061	[.055, .066]	.000
	Scalar invariance	900.14	390	.927	–.005	.059	[.054, .064]	–.002
	Residual invariance	933.51	410	.925	–.002	.058	[.053, .063]	–.001
Employees vs. adolescents	Configural invariance	1363.65	320	.925	–	.066	[.063, .070]	–
	Metric invariance	1472.96	335	.918	–.007	.068	[.064, .071]	.002
	Scalar invariance	1864.23	390	.893	–.025	.071	[.068, .075]	.003
	Residual invariance	1992.87	410	.886	–.007	.072	[.069, .075]	.001

Table 4  
*Mean scores, standard deviations (SD) and correlation coefficients between Big Five personality traits and stress*

Variable	Mean (SD)		1.	2.	3.	4.	5.	6.
	Employee sample	Adolescent sample						
1. Extraversion	13.17 (3.78)	13.12 (4.10)	–	.23**	–.00	–.12**	.12**	–.12**
2. Agreeableness	16.40 (2.90)	15.97 (3.16)	.22**	–	.05	.04	.10**	–.04
3. Conscientiousness	14.80 (3.76)	12.06 (3.76)	–.03	.17**	–	–.10**	–.09*	–.16**
4. Neuroticism	12.24 (3.44)	13.72 (3.68)	–.15**	.00	–.15**	–	–.01	.60**
5. Intellect	14.74 (3.48)	15.94 (3.11)	.20**	.16**	–.18**	–.12**	–	–.04
6. Stress	9.57 (2.96)	11.17 (3.20)	–.09*	–.00	–.24**	.61**	–.07	–

Note. Below diagonal are results for employee sample (sample 1) and above diagonal are results for adolescent sample (sample 2). \* $p < .05$ , \*\* $p < .01$ .

and adolescent sample and the relationship of Mini-IPIP scores to the perceived stress. The scale showed a satisfactory model fit in all samples and strict measurement invariance between genders and generally strict measurement invariance between the samples. Although CFI and TLI were slightly below the usual cut-off points, the findings are congruent with previous research on Big Five questionnaires. All the subscales showed satisfactory reliability.

The relationships between Big Five personality traits and the perceived stress were as expected and similar in both samples. Conscientiousness and especially neuroticism proved to be significant predictors of perceived stress, which is congruent with previous studies (Luo, Derringer, Briley, & Roberts,

2017). Age was only a significant predictor for the employee sample; however, the effect was unlikely to appear in the adolescent sample, because of its homogeneity in age.

#### STRENGTHS AND LIMITATIONS

In terms of limitations, both samples were convenience samples, predominantly female; therefore, the results of the present study cannot be generalized to other populations without some reservation. Regarding the strengths, to the authors' knowledge, this is the first study to compare an employee sample with an adolescent sample in terms of measure-

Table 5

Results of hierarchical multiple regression analyses in which age, gender and Big Five personality traits were regressed upon the scores for stress

Predictor	Stress					
	Employee sample			Adolescent sample		
	$\beta$	95% CI for unstandardized B	$\Delta R^2$	$\beta$	95% CI for unstandardized B	$\Delta R^2$
Step 1			.04**			.06**
Gender <sup>a</sup>	-.10**	[-1.14, -.17]		-.25**	[-2.22, -1.22]	
Age	-.15**	[-.06, -.02]		.04	[-.16, .37]	
Step 2			.29**			.33**
Gender <sup>a</sup>	-.03	[-.63, .24]		-.05	[-.80, .05]	
Age	-.07*	[-.04, -.00]		.04	[-.08, .35]	
Extraversion	-.05	[-.09, .01]		-.04	[-.08, .02]	
Agreeableness	.05	[-.02, .12]		-.04	[-.10, .02]	
Conscientiousness	-.17**	[-.19, -.08]		-.10**	[-.14, -.04]	
Neuroticism	.48**	[.36, .48]		.58**	[.46, .57]	
Intellect	-.01	[-.06, .05]		-.03	[-.09, .03]	
Total R <sup>2</sup>			.32**			.39**

Note. <sup>a</sup>0 – female, 1 – male; \* $p < .05$ , \*\* $p < .01$ .

ment invariance of the Mini-IPIP scale for Big Five personality factors, as well as the relationship of this measure to the perceived stress. The study comprised relatively large and diverse samples, providing high statistical power. The results were consistent across different age groups. Furthermore, valid and reliable measures were used. The same items as in the original version of the scale were used, which should allow for direct cross-cultural comparisons.

## CONCLUSIONS AND FUTURE STUDIES

The Polish version of the Mini-IPIP proved to be valid, reliable, and invariant across different groups. The scale has the advantage of being short and free while having good psychometric properties, making it a valuable option for researchers. The Big Five is one of the most investigated psychological personality models and is applied in numerous contexts. One of these applications is the wide practice of measurement of the personality in quality of life research. Future studies should provide more data on the predictive value of Mini-IPIP scores in longitudinal designs. This could contribute to a broader and valid control of Big Five personality in epidemiological studies. Also, future studies should investigate whether the current version of the scale shows measurement in-

variance with other linguistic versions of the scale using the same items. Measurement invariance of the scale with the same 20 items from the Polish translation of the 50-item scale by (Topolewska et al., 2014) could provide evidence for wording independent invariance of the scores of the Polish version of the scale, and potentially support higher comparability of results across samples. This has wider implications for the personality research area and could provide data on wording sensitivity of different versions of the scale in the same language, which currently tends to be a common situation in the case of non-commercial tools widely available for usage and adaptations; see for example proliferation of the same language, different wording versions of Ten Item Personality Inventory.

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