



The Revised Compound Psychological Capital Scale (CPC-12R): Validity and Cross-Cultural Invariance in an Organizational Context

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Abstract

This study aims to validate the revised Compound Psychological Capital scale (CPC-12R) which is a recently published inventory for measuring psychological capital across contexts. The data from three representative samples of employees from the U.S. ($n = 456$), the Czech Republic ($n = 966$), and Slovakia ($n = 965$) revealed a weak measurement invariance across the three cultures, a high internal consistency of all subscales and a good fit of the data to the theoretical model of psychological capital. The data obtained by means of the English version of the CPC-12R showed a very strong correlation with the established Psychological Capital Questionnaire (PCQ), medium to strong positive correlations with work engagement, job satisfaction and positive affect, and a weak negative correlation with negative affect. Therefore, this study demonstrates the reliability and factorial, concurrent and convergent validity of CPC-12R in the context of organizations. The study also provides indicative norms for measuring psychological capital in three populations and refers to the limitations of the CPC-12R, in particular, the very small residual variance in first-order factors and the lack of strong invariance across cultures, which prevents a meaningful comparison of factor means across countries.

Keywords Psychological capital · Psychometric analysis · Organizational context · Cross-cultural study

This study aims to provide missing evidence on the validity of the Compound Psychological Capital scale (CPC-12R) published by Lorenz et al. (2016) and recently revised by Dudasova et al. (2021b). *Psychological Capital (PsyCap)* is defined as an individual's positive psychological state of development, which consists of four components, namely, self-efficacy, optimism, hope, and resilience (Luthans et al., 2015). The construct itself is relatively new. In 2004, Luthans and Youssef (2004) identified psychological capital as another source of competitive advantage in addition to traditional capital (financial, structural, and technological), human capital, and social capital. Since 2008, PsyCap has become a frequent topic of research studies and there have been an increasing number of papers on the subject, especially in recent years. For example, of the 787 articles in the SSCI (Social

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Science Citation Index) database with "psychological capital" or "PsyCap" in the title, 502 (64%) were published between 2019 and 2022 ([webofscience.com](https://www.webofscience.com), accessed 10/01/2023). This increasingly popular research topic requires high-quality measurement tools applicable across different contexts and cultures for which there is sufficient evidence of validity and reliability.

The most widely used method for measuring PsyCap has been the Psychological Capital Questionnaire (PCQ), which was developed by Luthans et al. (2007). A new questionnaire was later developed by Lorenz et al. (2016), which is known as the Compound PsyCap Scale (CPC-12). Subsequently, Dudasova et al. (2021b) pointed out certain psychometric limitations of this questionnaire and proposed a revised version, which was denoted CPC-12R. Perhaps because the CPC-12(R) is available free of charge and provides additional benefits over PCQ as discussed below, researchers began to use it in studies measuring PsyCap. However, as CPC-12R is a relatively new questionnaire, there is only limited evidence of its reliability and validity. The original method (Lorenz et al., 2016) has only been validated on a German sample and the revised version (Dudasova et al., 2021b) has been validated on Czech and Slovak samples. Moreover, the validation studies were based on rather small convenience samples that were not very representative of employee populations. Also, the studies to date have provided only limited evidence of CPC-12R's construct validity and concurrent validity with PCQ as a reference method. Last but not least, there is a lack of evidence for invariance across cultures and genders. Moreover, although previous studies on CPC-12 and CPC-12R have been published in English, the English version of the questionnaire has not yet been validated.

This study aims to address these gaps and critically assess the quality of CPC-12R as an alternative method for measuring PsyCap. Using three large samples of American, Czech, and Slovak employees, this study shows the concurrent validity of CPC-12R with PCQ, the invariance of CPC-12R across cultures and genders, and it also provides additional evidence of the convergent validity of CPC-12R. As far as we know, this is the first study to focus on the psychometric characteristics of the published English version of CPC-12R.

PsyCap and its Nomological Network

Although PsyCap is a relatively new concept, its four components are well-established constructs in positive psychology. *Self-efficacy* describes a person's belief in his or her own ability to achieve set goals (Bandura, 1997). People with high self-efficacy believe in their own ability to mobilize their cognitive and motivational resources in order to achieve their goals and increase their performance (Stajkovic & Luthans, 1998). *Optimism* is understood as the tendency to attribute positive characteristics to life events (Seligman, 1998). This definition is based on attribution theory, and it explains that people with high levels of optimism attribute stable internal causes to positive events, and, conversely, look for the cause in external factors for negative events. *Resilience* refers to a person's ability to overcome negative life events, the tendency to cope quickly with negative experiences, and the ability not to be discouraged by failure (Luthans, 2002). People with high levels of resilience are able to cope more quickly with significant change and adapt better to stressful conditions (Luthans et al., 2005; Tugade & Fredrickson, 2004). The final component of PsyCap is *hope*, which is considered the ability to find a path to achieve goals and to motivate oneself in pursuit of those goals (Snyder, 2000). A person with a high level of hope can be

characterized as someone who strives to achieve difficult but realistic self-imposed goals through self-determination and the proper direction of his or her energy (Luthans et al., 2006).

According to the taxonomy of Law et al. (1998), *PsyCap* is typically categorized as a multidimensional reflective latent construct with four dimensions/components. The common characteristics of all four components of *PsyCap* are a sense of control, intentionality, and agentic goal pursuit (Luthans and Youssef-Morgan, 2017). Although the individual components of *PsyCap* can also be studied separately, *PsyCap* as a whole is considered to be more than the sum of its parts (Avey, 2014). *PsyCap* is a domain-specific construct. As Avey (2014) explains, someone with high work-related *PsyCap* may be low in other areas, for example, in family-related *PsyCap*. A systematic review by Burhanuddin et al. (2019) shows that *PsyCap* has been most frequently researched within the work domain in organizational settings, although in recent years there has been increasing research in sport (see, e.g., Sood & Puri, 2022), educational and health contexts (see, e.g., Dudasova et al., 2021a).

Within the work domain, the *PsyCap* of employees is connected to many positive outcomes. The meta-analysis of Avey et al. (2011b) showed a positive relationship between employees' *PsyCap* and their well-being, positive job attitudes (job satisfaction, organizational commitment), and various indicators of job performance. Similarly, the meta-analysis of Loghman et al. (2023) found a positive relationship between the *PsyCap* of employees and their job performance and job satisfaction. Furthermore, this recent meta-analysis also found a positive relationship between *PsyCap* and work engagement and negative relationships between *PsyCap* and employees' burnout and turnover intentions. Although some authors have suggested that the relationship between *PsyCap* and outcomes such as well-being or performance is mediated by coping strategies, Rabenu et al. (2017) showed that these relationships are rather direct.

One of the variables that may explain the above-mentioned relationships between *PsyCap* and work outcomes is affectivity. Multiple studies have found a positive relationship between *PsyCap* and positive affectivity and a negative relationship with negative affectivity, indicating that the relationship with positive affectivity is a little stronger (Afzal et al., 2016; Malinowski & Lim, 2015; Meyers & van Woerkom, 2017; McMurray et al., 2010; Roche et al., 2014). Therefore, employees with high *PsyCap* tend to experience more positive emotions (see also Carmona-Halty et al., 2021) and fewer negative emotions, compared to employees with low *PsyCap*.

Measurement of *PsyCap*

Although some questionnaires have been developed to measure *PsyCap* in the context of sport (Sood & Puri, 2022) and education (King and Caleon, 2021; Lou et al., 2022; Martínez et al., 2021), *PsyCap* is mostly measured in the work context. The original Psychological Capital Questionnaire (PCQ-24) (Luthans & Youssef, 2004; Luthans et al., 2006) was based on established measures of self-efficacy, optimism, hope, and resilience. The items were slightly modified and then combined into a single questionnaire with 24 items. Most of the items explicitly address psychological capital within the occupational domain (Luthans et al., 2006). Shortened versions of the questionnaire containing 12 (PCQ-12, Avey et al., 2011a) or five items (PCQ-5, Szerdahelyi et al., 2022) have also been developed, and the questionnaire has been translated into more

than 40 languages (MindGarden.com, see, e.g., Abbasi et al., 2020; Choisy et al., 2021; Martínez et al., 2021; Tashima Cid et al., 2020).

PCQ-24 and PCQ-12 are the most used and cited methods for measuring PsyCap (webofscience.com, accessed 10/01/2023), and a number of recent studies have used it without reporting significant problems with measuring psychological capital (see, e.g., Kumar et al., 2022; Peng & Chen, 2023; Ravikumar, 2022). Nevertheless, the questionnaire has also been the target of some criticism. For example, Lorenz et al. (2016) questioned the appropriateness of using the questionnaire outside the occupational domain. Dudasova et al. (2021b) note that some items might be hard to use in small organizations (e.g., *"I feel confident contributing to discussions about the company's strategy."*) and they also mention that there is a fee required for the non-commercial use of PCQ, which limits the use of the questionnaire in practice (especially in the developing and low-income countries). Dawkins et al. (2013) pointed out some limitations in test-retest reliability and in convergent and discriminant validity of PCQ. Tomás et al. (2022) found that the scale had difficulties measuring resilience in a sample of adolescents. Moreover, the factor structure of many language adaptations of PCQ has not matched the theoretical four-factor structure of PsyCap (Cheung et al., 2011; Rego et al., 2010; Sahoo and Sia, 2015) and the questionnaire also lacked measurement invariance across various language versions. Wernsing (2014) tested for the invariance of the established PCQ-12 across 12 cultures. In her study, she found no support for even weak invariance due to three items that were understood differently across cultures. Because of specific expressions based on American English (e.g., *"If I should find myself in a jam at work, I could think of many ways to get out of it"*), these items seem to be hard to translate into other languages. Therefore, she proposed a shortened version - PCQ-9 - and found support for its weak measurement invariance across 12 samples from different cultures. However, this cross-cultural version of PCQ covers only three of four PsyCap dimensions (optimism is missing) and therefore does not measure psychological capital in its full breadth as defined in theory.

The partial limitations of the PCQ have led to the development of alternative methods for measuring PsyCap. The projective Implicit Psychological Capital Questionnaire (I-PCQ) developed by Harms and Luthans (2012) was recommended as a supplement to commonly used self-assessment questionnaires rather than as their replacement (Harms et al., 2018). The OREA (an acronym for optimism, resilience, hope, and self-efficacy in Spanish) questionnaire created by Meseguer-de Pedro et al. (2017) has, as we know, only a Spanish version.

The most relevant alternative for PCQ is, therefore, the *Compound Psychological Capital Scale (CPC-12)*; Lorenz et al., 2016). Lorenz et al. (2016) designed it so that it could be used in various domains such as work, education, sport, and health. The authors of CPC-12 followed a similar approach as the authors of PCQ and OREA. They chose six scales connected to the various dimensions of PsyCap and selected the most appropriate items to measure the PsyCap components hope, optimism, self-efficacy, and resilience. Specifically, they selected items from the State Hope Scale (SHS; Snyder et al., 1996), the Affective Valence of the Orientation Toward the Future questionnaire (AFF, Brandtstädter & Wentura, 1994), the Life Orientation Test (LOT-R, Glaesmer et al., 2008), the Resilience Scale (RS-13, Röhrig et al. 2006), the General Self Efficacy Scale (GSE, Jerusalem, 1991), and the Occupational Self-Efficacy Scale (OSE, Schyns & von Collani, 2002). Their new questionnaire had 12 items, three in each dimension. Lorenz et al. (2016) published English and German versions of the scale and conducted two validation studies using the German version.

Dudasova et al. (2021b) translated CPC-12 into Czech. They used the original German and the new Czech data to show that the resilience subscale was not internally consistent and that the resilience items did not load on the resilience factor as the theory would expect. Subsequently, they proposed a *revised version*, *CPC-12R*, which replaced the items for measuring resilience. Using another Czech sample, they also provided evidence about the internal consistency of all the subscales and about the factorial validity of the revised scale. Kacmar et al. (2022) translated CPC-12R into Slovak. Using a bilingual Slovak sample, they replicated the previous results supporting the factorial validity of the CPC-12R. They also showed the concurrent validity of the Slovak version of CPC-12R with the English version of PCQ-12. Moreover, they provided evidence on the convergent validity of the CPC-12R by finding positive relationships between the score of CPC-12R and job satisfaction, intention to stay in an organization, engagement, life satisfaction, well-being, extraversion, agreeableness, conscientiousness, openness to experience, and negative relationships with perceived stress and negative emotionality.

Lorenz et al. (2022) published a validation study on CPC-12R that supported the factorial and convergent validity of the English and German versions of the questionnaire, and they also provided evidence on the scalar invariance of CPC-12R across the U.S. and German samples. However, the study had two major limitations that meant it could not be considered strong enough evidence for the validity of CPC-12R. The first was that the authors did not use the final wording of the items to measure resilience. They used the preliminary wording, which was provided within the description of the development of new items in the text of the study by Dudasova et al. (2021b), and not the final wording of the items, with which the CPC-12R was validated and which were listed in the appendix of the original paper. The second limitation was that the authors used samples ($N_{U.S.} = 385$; $N_{German} = 202$) that were not representative of the U.S. and German populations. The U.S. sample was rather young ($M_{age} = 31.8$, $SD = 10.36$), overeducated (75% of respondents with university degree), and almost a third of the respondents were only working part-time. Moreover, the small size of the German sample prevented authors from testing complex structural models with sufficient power (see the Limitations section in Lorenz et al., 2022).

Therefore, there is a need for a robust evidence on the validity of the English version of CPC-12R. This study aims to fill this gap. It assesses the validity of the English version of CPC-12R and tests the invariance using large U.S., Czech, and Slovak samples that are representative of employee populations in terms of major socio-demographic variables.

Cross-Cultural Differences in PsyCap Measurement

The testing of measurement invariance is an important part of the validation of new questionnaires and assessment tools (e.g., Dimitrov, 2010). It shows whether the relationships between indicators (e.g., items) and underlying constructs are the same across groups (e.g., cultures, genders), which helps to interpret group differences in the observed scores (Yoon & Millsap, 2007). There are three levels of invariance to examine. Weak (i.e., metric) invariance requires equal factor loadings across groups and enables a comparison of the relationships between factors and external variables across these groups. Strong (i.e., metric and scalar) invariance requires equal factor loadings and equal indicator intercepts across groups and enables meaningful comparison of factor means across these groups. Strict (i.e., metric, scalar, and uniqueness) invariance requires equal factor loadings, equal indicator intercepts, and also equal error variances and covariances of items across the

groups. In the case of strict invariance, the group differences on any questionnaire item can be attributed to group differences on the respective factor only (Dimitrov, 2010). A questionnaire administered in various language versions should have at least weak measurement invariance in order to compare effects found in different local studies and to look for relationships and examine the nomological network of the construct on international samples. Based on previous studies on the invariance of PsyCap questionnaires (Lorenz et al. 2022; Rice et al., 2021; Wernsing, 2014), we expect to find support for at least weak (i.e., metric) measurement invariance of CPC-12R across the cultures.

Method

Sample and Procedure

The total sample consisted of 2387 respondents from three different countries ($N_{U.S.} = 456$; $N_{Czech} = 966$; $N_{Slovak} = 965$). We paid local agencies to collect the data (Lucid in the U.S., Median in the Czech Republic, and 2muse in Slovakia). The respondents were members of online panels managed by these agencies. The agencies contacted the respondents and ensured that the samples were representative of the working population in terms of socio-economic characteristics. As the three data collections were originally part of different research projects, there were slight variations in the quotas and in the socioeconomic data that was collected on the respondents.

The English survey was completed by 494 participants from the U.S. who passed all attention checks. For the purposes of the study, we excluded 32 respondents who were not employed and three respondents with a low workload, one respondent who used the same response pattern across all questions, and two respondents who completed the questionnaire in less than 120 seconds, which was not sufficient time to read all the questions. The final sample consisted of 456 employees who had permanent jobs in the United States and worked at least 20 hours per week. The characteristics of the sample corresponded to the characteristics of the population in terms of gender (male 55%), age ($M = 42.3$, $SD = 13.7$), level of education (39% university degree), and the economic sector in which they work (see the open-source dataset for a full sample description).

The Czech survey was completed by 1,020 respondents who passed all attention checks. For the purposes of the study, we excluded 15 respondents with a low workload (less than 20 hours per week), 14 respondents who were on long-term sick or parental leave, and 25 respondents who did not answer three or more questions from the CPC-12R questionnaire. The final sample consisted of 966 employees who had permanent jobs in the Czech Republic and worked at least 20 hours per week. The characteristics of the sample corresponded to the characteristics of the population in terms of gender (male 54.2%), age ($M = 41.8$, $SD = 11.6$), level of education (21.7% university degree), and the economic sector in which they work (see the open-source dataset for a full sample description).

Slovak data were collected as a part of a bigger research project that focused on both the working and non-working populations. The survey was sent to 2,398 respondents, but only 1,297 of them who had a job were asked to complete the CPC-12R questionnaire. For the purpose of the present study, we included only full-and part-time employees and excluded other respondents such as summer workers, retired persons, or people on maternity leave (i.e., 256 respondents). Moreover, we excluded 75 respondents who did not pass the attention check, and/or were considered multi-variate outliers, and also one participant who did

not indicate gender. The final sample consisted of 965 employees who had permanent jobs in Slovakia. The characteristics of the sample corresponded to the characteristics of the population in terms of gender (male 51%), and age ($M = 41.9$, $SD = 11.1$) (see the open-source dataset for a full sample description).

Measures

Respondents in all three countries completed an online survey in Qualtrics. PsyCap was measured by a local version of CPC-12R (Dudasova et al., 2021b, Kacmar et al., 2022; 12 items, response scale ranged from 1 to 6, see online Appendix 7-9. for full wording of the items).

To assess the concurrent validity of CPC-12R, we administered the *Psychological Capital Questionnaire* (PCQ; Luthans et al., 2007; 24 items, response scale ranged from 1 to 5) as a part of the U.S. survey. The U.S. survey also measured positive and negative affect (I-PANAS-SF; Thompson, 2007; 5 items measuring positive affect, 5 items measuring negative affect, response scale ranged from 1 to 5), work engagement (UWES-3; Schaufeli et al., 2019; 3 items, response scale ranged from 1 to 7), and satisfaction with work (SWWS; Bérubé et al., 2007; 5 items, response scale ranged from 1 to 5) to assess the convergent validity of CPC-12R.

Analyses

The higher-order reflective latent variable model was selected as the main analytical choice based on previous research on the development of PsyCap scales (see, e.g., Luthans et al., 2007 for PCQ-24 and Dudasova et al., 2021b; Lorenz et al., 2016, 2022 for CPC-12). This type of model is applicable in situations where the instrument assesses constructs that are related and there is a hypothesis that these constructs are accounted for by underlying higher-order constructs (i.e., first-order factors are highly correlated and there is an expectation that first-order latent variables directly influence the indicator variables, while the influence of the second-order factors on the manifest variables is indirect; Beaujean, 2014).

To provide evidence about the structural aspect of validity, we conducted a multi-group confirmatory factor analysis (MG-SEM) with an MLR estimator (maximum likelihood estimation with robust Huber-White standard errors and a scaled test statistic that is asymptotically equal to the Yuan-Bentler test statistic). As significant χ^2 could be caused by the oversensitivity of this index in larger samples (Barrett, 2007), the decision to accept the model was based on a joint evaluation of alternative fit indices. Specifically, the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Squared Residual Fit Index (SRMR) were used and evaluated as follows: Root Mean Square Error of Approximation (RMSEA) ≤ 0.05 was considered a very good fit, while ≤ 0.08 was considered an acceptable fit; Standardized Root Mean Squared Residual Fit Index (SRMR) ≤ 0.08 was considered a good fit with the upper bound of the confidence interval not higher than 0.10; and Comparative Fit Index (CFI) ≥ 0.95 was considered a very good fit, while CFI ≥ 0.90 was considered an acceptable fit (Gana & Broc, 2018). The model was considered acceptable if the SRMR and at least one of the two other fit indices were in line with the above-mentioned criteria (Hu & Bentler, 1999).

Furthermore, to examine the degree to which PsyCap measured via CPC-12R has the same meaning across the three countries and two genders, we tested factorial invariance. For this purpose, a sequential constraint imposition approach was used. We followed the

suggested sequence of model comparison for second-order factors (Chen et al., 2005; Rudnev et al., 2018). Although the χ^2 difference test for the nested model is reported, the conclusions about invariance were based on the differences in alternative fit indices as suggested by Chen (2007) ($\Delta\text{CFI} < .01$, $\Delta\text{RMSEA} < .015$, $\Delta\text{SRMR} < .03$ for establishing metric invariance; $\Delta\text{CFI} < .01$, $\Delta\text{RMSEA} < .015$, $\Delta\text{SRMR} < .01$ for establishing scalar invariance).

The analysis was conducted in R version 4.2.1 (R Core Team, 2022) using the Laavan package ver. 0.6-12 (Rosseel, 2012) and semTools version 0.5-6 (Jorgensen et al., 2022). Data and analytic script are available at: (non-anonymous link will be added after the review procedure).

Results

Descriptive Statistics and Preliminary Analyses

Table 1 presents the descriptive statistics for all scales (summary scores) as well as the estimates of internal consistency (McDonald's omegas, ω_i) for the Czech, Slovak, and U.S. samples. As can be seen from the table, the subscales have sufficient internal consistency across all three samples, considering both first-order and second-order levels of analysis. The descriptive statistics for the CPC-12R items are available in online Appendix 1.

Before estimating the structural models, we checked the assumptions (i.e., the assumption of additivity, linearity, normality, homogeneity, and homoscedasticity).

Structural Aspect of Validity

The theoretical model with four first-order factors and one second-order factor (M2) was compared with a one-factor model (M0) and a model with four correlated factors (M1) using a series of multi-group confirmatory factor analyses. The M0 (model with one-general factor) did not fit the data well, $\chi^2(162) = 1595.48$, $p < .001$, CFI = .88, RMSEA = .134, 90% CI [.128, .140], SRMR = .057, indicating that PsyCap measured by CPC-12R is not a one-dimensional construct. In contrast, the M1 (the model with four correlated factors) showed an acceptable to very good fit according to the various fit indices, $\chi^2(144) = 425.39$, $p < .001$, CFI = .98, RMSEA = .061, 90% CI [.055, .068], SRMR = .028). As the strength of the relationships between first-order latent factors was relatively high ($r = .54 - .97$, see online Appendix 2), a hierarchical structure seemed appropriate. When analyzing the model with a hierarchical structure (M2, the variance of a second-order factor was constrained to 1), Heywood case occurred. Specifically, a negative variance of hope in the U.S. sample was observed. However, as the negative residual variance was small and did not significantly differ from 0, we fixed it to zero, as recommended e.g. by Farooq (2022). The variance of Hope was fixed to zero in every following analysis where the U.S. sample was examined.

The hierarchical M2 showed an acceptable fit of the data to the model, $\chi^2(151) = 514.25$, $p < .001$, CFI = .97, RMSEA = .068, 90% CI [.062, .075], SRMR = 0.034. The main issue that prevented the model from fitting the data very well was item 3 from the self-efficacy subscale, which, according to the modification indices, also tended to load on

Table 1 Descriptive statistics for CPC_12R

	CZ (N=966)	SK (N=965)	USA (N=456)	Overall (N=2387)
CPC_12R_PsyCap				
Mean (SD)	52.8 (8.74)	52.0 (10.6)	56.3 (9.52)	53.2 (9.85)
Median [Min, Max]	53.0 [20.0, 72.0]	52.0 [12.0, 72.0]	57.0 [12.0, 72.0]	53.0 [12.0, 72.0]
Missing	71 (7.3%)	7 (0.7%)	0 (0%)	78 (3.3%)
ω_t	.94	.96	.94	
CPC_12R_Hope				
Mean (SD)	12.6 (2.44)	12.5 (2.88)	13.7 (2.87)	12.8 (2.75)
Median [Min, Max]	13.0 [3.00, 18.0]	12.0 [3.00, 18.0]	14.0 [3.00, 18.0]	13.0 [3.00, 18.0]
Missing	21 (2.2%)	0 (0%)	0 (0%)	21 (0.9%)
ω_t	.78	.86	.83	
CPC_12R_Selfefficacy				
Mean (SD)	13.4 (2.29)	13.1 (2.81)	14.2 (2.53)	13.4 (2.59)
Median [Min, Max]	13.0 [5.00, 18.0]	13.0 [3.00, 18.0]	14.0 [3.00, 18.0]	13.0 [3.00, 18.0]
Missing	7 (0.7%)	4 (0.4%)	0 (0%)	11 (0.5%)
ω_t	.81	.90	.82	
CPC_12R_Resilience				
Mean (SD)	13.0 (2.57)	13.1 (3.00)	13.9 (2.79)	13.2 (2.81)
Median [Min, Max]	13.0 [3.00, 18.0]	13.0 [3.00, 18.0]	14.0 [3.00, 18.0]	13.0 [3.00, 18.0]
Missing	24 (2.5%)	3 (0.3%)	0 (0%)	27 (1.1%)
ω_t	.77	.86	.79	
CPC_12R_Optimism				
Mean (SD)	13.6 (2.67)	13.3 (3.29)	14.5 (2.97)	13.7 (3.02)
Median [Min, Max]	14.0 [3.00, 18.0]	13.0 [3.00, 18.0]	15.0 [3.00, 18.0]	14.0 [3.00, 18.0]
Missing	29 (3.0%)	1 (0.1%)	0 (0%)	30 (1.3%)
ω_t	.84	.90	.88	

ω_t = McDonald's omega total (measure of reliability)

the resilience factor. The factor loadings (unstandardized estimates) are shown in online Appendix 3, while the standardized paths ($\lambda \geq .67$ across all samples) are depicted in Figs. 1, 2 and 3.

Measurement Invariance Across Countries and Genders

In the next step, we examined the invariance of CPC-12R across the Czech, Slovak, and U.S. samples. We successively estimated several multi-group models of PsyCap. The first model (A, *configural*) assumed the same factor structure (i.e., 4 first-order factors, 1 second-order factor) but different factor loadings and different intercepts for the Czech, Slovak, and U.S. samples. The second model (B1) additionally assumed equal factor loadings for the first-order factors. The third model (B2, *metric*) assumed equal factor loadings for both first- and second-order factors. The fourth model (C1, *scalar*) assumed equal factor loadings and equal intercepts. We tested the invariance by comparing these

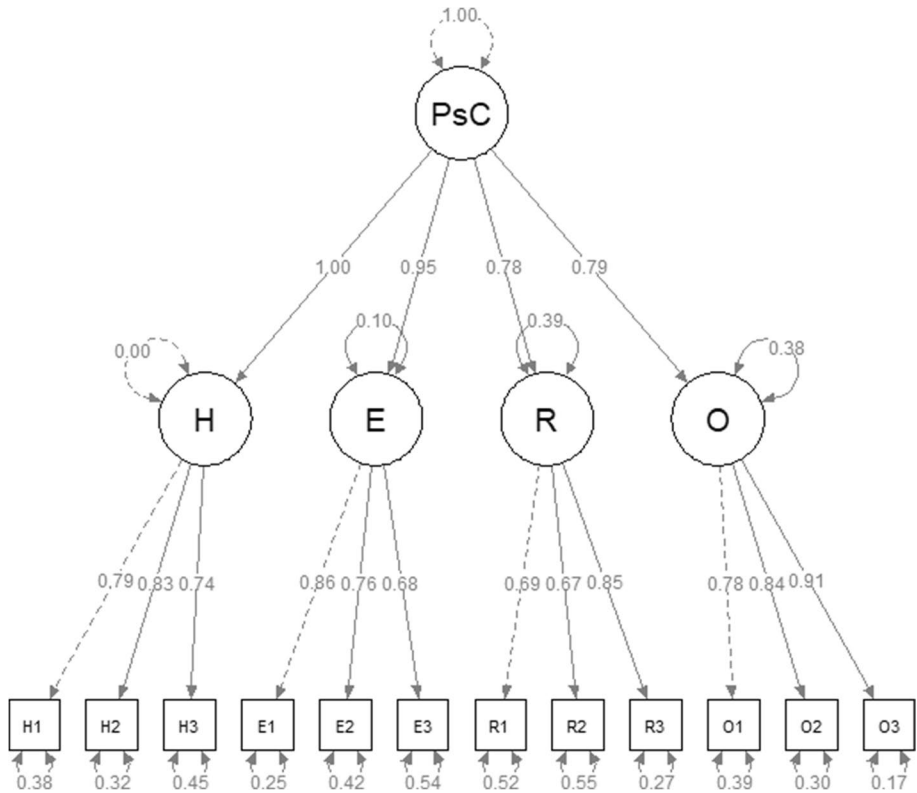


Fig. 1 Model of PsyCap with standardized factor loadings (U.S. sample)

models using the criteria recommended by Chen (2007). A comparison of the models is shown in Table 2.

The first model (A) had a very good fit to the data according to CFI and SRMR and an acceptable fit according to RMSEA. Therefore, configural invariance was established. This means that PsyCap measured with the different language versions of the CPC-12R scale has the same factor structure and that each indicator (i.e., item) loads on the same first-order factor (i.e., dimension of PsyCap) across the samples. In the case of the second (B1) and third (B2) models, the alternative fit indices (CFI, RMSEA, SRMR) did not differ significantly when compared to the first model (A). Therefore, metric invariance (i.e., weak invariance) was established. This means that the factor loadings do not significantly differ across the samples, and, therefore, the relationships between factors and external variables can be meaningfully compared when using the Czech, Slovak, and English versions of CPC-12R. The third model (C1) showed a good fit to the data according to SRMR, an acceptable fit according to CFI, but an insufficient fit according to the RMSEA index. Moreover, all these indices differed significantly from the indices of the B2 model according to the cut-offs set by Chen (2007). Therefore, scalar invariance (i.e., strong invariance) was not established. We attempted to establish at least partial scalar invariance freeing one parameter per factor (see C1P and C2P models). Although partial first-order invariance was

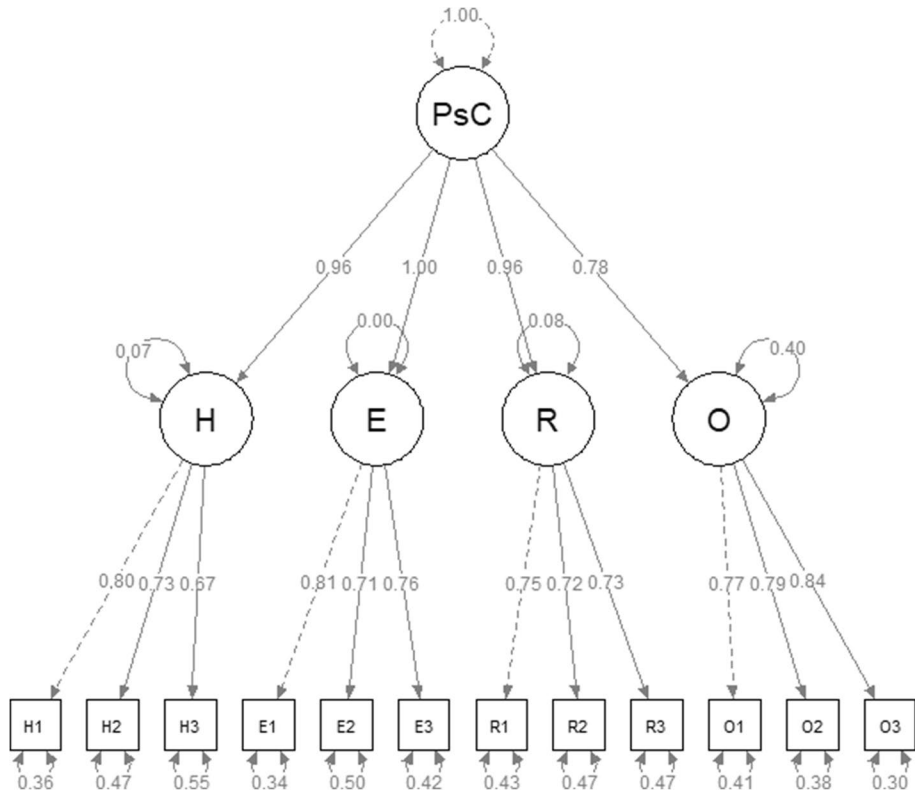


Fig. 2 Model of PsyCap with standardized factor loadings (Czech sample)

established, partial second-order scalar invariance was not established as RMSEA was above .08 and the difference in fit indices between C1P and CP2 exceeded the cut-offs set by Chen (2007). We stopped invariance testing at this level and concluded that the means of the latent variables may not be meaningfully compared when using the different language versions of CPC-12R. In online Appendix 4, we provide indicative norms for the PsyCap summary scores for the U.S., Czech, and Slovak employee populations separately. These indicative norms may help to assess the general level of PsyCap in specific populations in future research on psychological capital.

As strong measurement invariance was not established across the Czech, Slovak, and U.S. samples, we tested the invariance across genders in each sample separately. As with the cross-country invariance testing, we estimated several multi-group models that were consecutively more constrained. Since only a small number of respondents indicated a gender other than male or female, we only tested for invariance across males and females. A detailed comparison of the models for all countries is provided in online Appendix 5. As the model with equal factor loadings, equal intercepts and equal error variances and covariances of items across males and females did not differ from the less constrained models, strict invariance was established for all three countries.

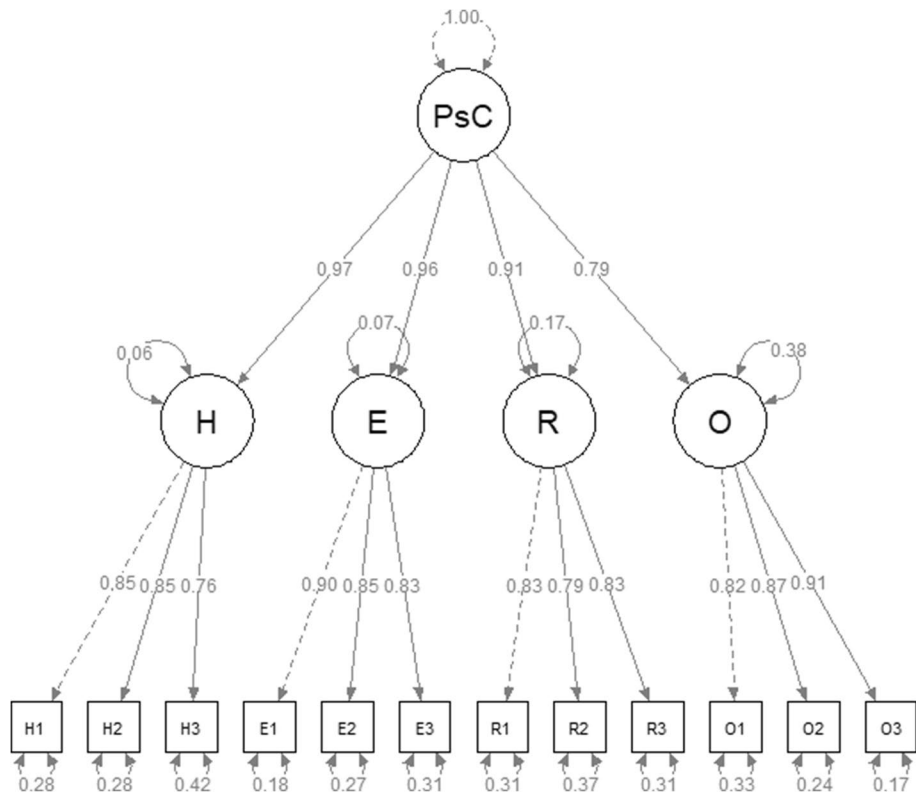


Fig. 3 Model of PsyCap with standardized factor loadings (Slovak sample)

Therefore, CPC-12R can be used without limitations for research on samples including both male and female respondents.

Evidence for Concurrent and Convergent Validity

The concurrent and convergent validity of the English version of CPC-12R were tested using just the U.S. sample. We focused only on the English version because we could compare it with the established English version of the PCQ and because, unlike the Czech and Slovak versions, it has so far lacked evidence of convergent validity. To provide evidence for concurrent validity, we examined the relationship between PsyCap measured by CPC-12R and PsyCap measured by PCQ ($M = 113$, $SD = 16.1$, $Min. = 47$, $Max = 150$, $N = 456$). Specifically, we fit a model with two correlated higher-order factors (CPC-12R and PCQ) that account for four first-order latent variables (hope, optimism, self-efficacy, and resilience), and, consequently, influence indicator variables (items of CPC-12R and PCQ, respectively) via these first-order latent variables, ($\chi^2(283) = 1170.73$, $p < .001$, $CFI = .93$, $RMSEA = .054$, $90\% CI [.049, .058]$, $SRMR = .053$ (the error terms of reverse-scored items were allowed to covary for PCQ and negative non-significant variance has been fixed to 0 as in the previous analysis). According to the analyses, the CPC-12R higher-order

Table 2 Invariance testing across countries

Model	Type	χ^2	df	CFI	RMSEA	SRMR	Comp.	$\Delta\chi^2$	Δdf	ΔCFI	$\Delta RMSEA$	$\Delta SRMR$
A	Configural	514.25***	151	.97	.068	.034						
B1	First-order metric	583.22***	169	.97	.068	.046	vs. A	70.07***	18	-0.004	0.001	.012
B2	First- and second-order metric	606.616***	173	.97	.069	.050	vs. B1	25.58***	4	-0.001	0.001	.006
C1	First-order scalar	1060.86***	188	.93	.092	.063	vs. B2	660.56***	15	-0.033	.025	.011
C1P	Partial first-order scalar	744.49***	180	.96	.077	.053	vs. B2	226.7***	7	-0.009	.008	.001
C2P	Partial first and second order scalar	921.43***	188	.94	.085	.072	vs. C1	221.63***	8	-0.013	.008	.018

Table 3 Descriptive statistics for variables used for assessment of convergent validity

	Mean (SD)	ω_t	Engagement	Satisfaction	Positive_Affect	Negative_Affect
Engagement	14.4 (3.69)	.82/.86		.74***	.67***	-.24***
Satisfaction	17.9 (4.18)	.89/.87	.87***		.57***	-.20***
Positive affect	18.1 (4.25)	.89/.86	.76***	.66***		-.28***
Negative affect	9.23 (4.32)	.90/.87	-.27***	-.25***	-.32***	

Latent correlations are shown in the lower part of the diagonal, while correlations with computed scores are shown in the upper part of the diagonal; ω_t = McDonald's omega total (measure of reliability).

latent factor was very strongly related to the PCQ higher-order latent factor, .79, $p < .001$, which indicates that both scales seem to measure the same construct.

Table 3 shows the descriptive statistics of variables that were compared with PsyCap measured by CPC-12R. The latent correlation between CPC-12R and work engagement, job satisfaction, and positive and negative affect were examined side by side with PCQ to provide evidence for the convergent validity of CPC-12R. In particular, the latent variables of work engagement, job satisfaction, and positive and negative affect were correlated with the higher-order factor of PsyCap in the model with CPC-12R, $\chi^2(392) = 772.87$, $p < .001$, CFI = .94, RMSEA = .051, 90% CI [.046, .056], SRMR = .053, and in the model with PCQ, $\chi^2(802) = 1533.93$, $p < .001$, CFI = .93, RMSEA = .049, 90% CI [.046, .053], SRMR = .058. As shown in Table 4, both CPC-12R and PCQ were significantly related to work engagement, job satisfaction, and positive affect, and negatively related to negative affect. The strength of the correlations between the latent variables was higher for PCQ than for CPC-12R and the models with PCQ had a worse fit (see online Appendix 6). While CPC-12R showed convergent and discriminant validity consistent with theory, with PCQ it was more difficult to distinguish PsyCap from other related constructs. Nevertheless, the interpretation of the results is very similar when using both questionnaires.

Discussion

This study is the first to provide evidence of the reliability and validity of the English version of the CPC-12R questionnaire, which has recently emerged as a possible alternative to PCQ for measuring psychological capital. The study also revealed that the three language versions of CPC-12R (English, Czech, and Slovak) have similar psychometric characteristics and provided initial support for the weak invariance of the questionnaire across the three cultures. The study was based on samples of employees from U.S., Czech, and Slovak organizations who matched the target populations in terms of basic sociodemographic characteristics. Across the three samples, all subscales of CPC-12R were shown to have

Table 4 Convergent validity: Correlations of CPC-12R and PCQ with latent factors of work engagement, job satisfaction, positive and negative affect

Operationalization of PsyCap	Work engagement	Job satisfaction	Positive affect	Negative affect
CPC-12R	.59***	.58***	.64***	-.31***
PCQ	.79***	.78***	.77***	-.64***

sufficient internal consistency, and the data collected with CPC-12R had a good fit to the theoretical model with four first-order factors (hope, self-efficacy, resilience, optimism) and one second-order factor (PsyCap). The fit of the data to the model was similar to previous studies conducted on smaller and more homogeneous samples (Dudasova et al., 2021b; Kacmar et al., 2022) and similar to the more established PCQ-12 (Wernsing, 2014). Item 3 from the self-efficacy dimension ("I can remain calm when facing difficulties because I can rely on my coping abilities.") had the most negative effect on the fit of the model, as it tended to double load on the resilience factor. The phrase "remain calm when facing difficulties" is indeed close to the content of resilience. It may be worth considering reformulating this item in the next revision of the scale or allowing double loading in the models. In the analysis of the U.S. sample, the initial estimate of the hope factor's variance was negative. It was very close to zero and did not differ significantly from zero. Similarly, the variance of hope was close to zero in the other samples in this study and it was also very low in the previous study (Dudasova et al., 2021b). The individual components of PsyCap are highly correlated and hope, in particular, has very strong factor loadings and little variance across studies using both CPC-12R and PCQ-12 (e.g., Martinez et al., 2021; Sood and Puri, 2022). Hence, finding a very small non-significant negative variance may be due to the fact that the true variance in the population is close to zero, and its estimate in samples of a few hundred respondents may fluctuate around zero in either direction. In fact, hope seems to capture the essence of PsyCap. Luthans and Youssef-Morgan (2017) report that all dimensions of PsyCap share a sense of control, intentionality, and agentic goal pursuit. However, factor analyses of both CPC-12R and PCQ suggest that hope might be more than just one component of PsyCap. This idea warrants additional investigation.

This study also provides support for weak measurement invariance of CPC-12R across samples from three different countries using three different language versions of the questionnaire. This means that PsyCap measured by CPC-12R has the same structure in the U.S., Czech, and Slovak populations and that it is possible to use various language versions of CPC-12R in cross-cultural studies and to compare the effects connected to PsyCap. However, the study did not establish a strong measurement invariance, which prevents a meaningful comparison of factor means across countries. This result is not surprising, as even the more established PCQ-12 scale did not show strong invariance across cultures. In the case of our study, we found differences in item intercepts, particularly between the U.S. sample on the one hand and the Czech and Slovak samples on the other. It seems that U.S. respondents tend to score more positively, especially on the most generally worded items (e.g., "I am looking forward to the life ahead of me"; "Right now, I see myself as being pretty successful"; "I consider myself a person who can withstand a lot."). The tendency of U.S. respondents to score higher than respondents from less individualistic cultures on constructs related to positive perceptions of the self and the respondent's own life has been captured by other studies (see, e.g., Falk & Heine, 2015; Fischer & Chalmers, 2008; Klassen, 2004). As both the Czech Republic and Slovakia are significantly less individualistic (e.g., Kolman et al., 2003) than the U.S., this cultural difference might explain the difference in factor means we found in our study. Thus, the slight differences in PsyCap and its dimensions between samples from different cultures as measured by CPC-12R may not be due to differences in actual PsyCap levels, but to the tendency of respondents from some (perhaps more individualistic) cultures to score higher with the same PsyCap level, particularly on the more general items. Thus, differences in PsyCap resulting from cross-cultural studies should be interpreted with caution and with this item bias in mind. Nevertheless, another study that includes more samples from different cultures is needed to provide

stronger support for the existence of cultural differences in PsyCap self-assessment and to exclude sampling bias, which may also have influenced the results of our study.

This study provided the first evidence of strict invariance of CPC-12R across genders. However, only invariance across males and females was examined. Due to the very small number of respondents indicating a different gender, it was not possible to account for other gender groups.

To establish the construct validity of CPC-12R, we examined the relationships between CPC-12R and an established measure of PsyCap (PCQ) and between PsyCap measured by the English version of CPC-12R and other constructs that should be related to PsyCap according to the theory and existing research. The results showed a very strong relationship between both measures of PsyCap, supporting the concurrent validity of CPC-12R. Weaker but still significant relationships were found between PsyCap measured by CPC-12R and engagement, job satisfaction, and positive and negative affect. All these relationships were in line with the theory and past studies on PsyCap. Surprisingly, in the case of PCQ, the relationships between PsyCap and the other variables were too strong and approached the strength of the relationship between PCQ and CPC-12R. This suggests that CPC-12R might have higher discriminant validity than PCQ.

In summary, CPC-12R has been shown to be a (a) valid method for measuring PsyCap, (b) a method that is comparable to the established PCQ, and (c) a method that is applicable to international studies focusing on PsyCap-related effects. At the same time, however, our study highlighted the potential limitations of CPC-12R, in particular, the very small residual variance in first-order factors and the lack of strong invariance across cultures. These limitations should be taken into account when planning research using this questionnaire.

Strengths, Limitations, and Future Research Directions

This study is the first to provide evidence of the reliability and validity of the English version of CPC-12R with the new items measuring resilience. It is also the largest study to date focusing on CPC-12R and the first to examine the qualities of CPC-12R using large samples that match the employee population in terms of key sociodemographic characteristics. International PsyCap research has so far been dominated by PCQ. This study shows that there is an alternative freely available method in situations where the PCQ is not affordable due to licensing conditions, where the use of the specific formulation of PCQ items is not appropriate (e.g., in small organizations), or where the authors wish to measure and compare all four components of psychological capital across cultures. As Wernsing (2014) has shown, the full version of PCQ does not have even weak invariance across cultures, due to the use of specific English phrases in the original version of the questionnaire, which therefore makes it necessary to use a version that measures only three PsyCap components for multilingual samples.

There are also several limitations of this study, which are primarily related to the sample and the method of data collection. In order to obtain comparable and representative samples, we hired local agencies to collect the data and implemented quota sampling. However, such sampling is by nature non-probabilistic and the different compositions of the panels and the different procedures of the agencies may have led to differences that do not reflect the true differences between the populations. Respondents were paid by the agencies to complete the questionnaire. This extrinsic motivation may have influenced the quality of the responses (i.e., may have led to inattentive or inaccurate responses to the questions

asked). Although we attempted to avoid this by using attention checks, we cannot rule out the possibility that some of the responses were biased.

As we collected all the data within a single survey and from a single source (i.e., the self-reports of employees), the relationships between variables may be subject to common-method bias and therefore overestimated. However, we do not consider this to be a serious issue in the present study. We compared the relationships we found with earlier studies that were based on data collected in a similar manner. Also, the aim of this study was not to estimate the exact relationship between PsyCap and other variables but to compare the effects using CPC-12R with those reported in previous studies using other methods to measure PsyCap.

Finally, there may be a debate as to whether PsyCap should be conceptualized as a reflective or a formative second-order model. Although some aspects of the provided definitions could indicate a formative nature and there is a certain criticism of second-order reflective models, we worked with a conceptualization that understands PsyCap as a second-order reflective-reflective construct for several reasons. First and foremost, such an understanding is the dominant approach in PsyCap literature, and the articles we refer to (with regard to both, CPC-12 and the PCQ questionnaire) work with reflective-reflective conceptualization. Second, despite some recent criticism of reflective second-order models (e.g., Mikulic, 2022), much of this criticism has been refuted (see de Oliveira Santos, 2022). Third, formative models have their own limitations and deficiencies (see, e.g., Edwards, 2011). Nevertheless, we acknowledge that it is important to reflect on the need for correct model specifications in general (see Rhemtulla et al., 2020 for further discussion) and with regard to PsyCap in particular.

CPC-12R has been shown to be a promising method for measuring PsyCap. However, there is still a lack of evidence as to its reliability and validity. The test-retest reliability of the questionnaire has not been examined yet. Our study focused only on work-related PsyCap and on employee populations. However, the method was developed to measure PsyCap in different contexts (Lorenz et al., 2016). Therefore, it is necessary to validate its qualities with other populations in which PsyCap is studied - especially in sports and education. There is also a lack of a more comprehensive international study that includes PsyCap measurement outside Europe and North America. Given that differences in PsyCap measurement between the US and Central European countries have been found, one would expect (perhaps greater) differences in Asian, African, or Latin American samples. Hence, the potential for the further development of CPC-12R lies primarily in new cultural adaptations of this method and in testing its quality across different cultural and other contexts.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s11469-023-01135-6>.

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Data Availability The data that support the findings of this study are available at <https://osf.io/329dh/>

Declarations

All procedures followed were in accordance with the ethical standards of the ethical committees of Masaryk University and Comenius University Bratislava and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants for being included in the study.

Conflict of Interest Jakub Prochazka, Pavol Kacmar, Tereza Lebedova, Ludmila Dudasova and Martin Vaculik declare that they have no conflict of interest.

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