



# Construct Validity and Population-Based Norms of the German Brief Resilience Scale (BRS)

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**Abstract:** The Brief Resilience Scale (BRS) measures the ability to recover from stress. To provide further evidence for construct validity of the German BRS and to determine population-based norms, a large sample ( $N = 1,128$ ) representative of the German adult population completed a survey including the BRS and instruments measuring perceived stress and the resilience factors optimism, self-efficacy, and locus of control. Confirmatory factor analyses showed best model fit for a five-factor model differentiating the ability to recover from stress from the three resilience factors. On the basis of latent and manifest correlations, convergent and discriminant validity of the BRS were fair to good. Female sex, older age, lower weekly working time, higher perceived stress, lower optimism, and self-efficacy as well as higher external locus of control predicted lower BRS scores, that is, lower ability to recover from stress.

**Keywords:** BRS, German version, representative sample, norm data, predictors

Every year, more than half a billion people worldwide suffer from mental disorder, such as depression (Vos et al., 2013). The reasons vary but frequently include the occurrence of stressors such as traumatic events, challenging life circumstances, or daily hassles (Kalisch, Müller, & Tüscher, 2015). Thus, stress-related mental disorders are considered as one of the core challenges for our health systems.

Resilience as the maintenance or quick recovery of mental health during or after periods of adversity may protect from developing stress-related mental disorders. The phenomenon has stimulated extensive research in the last decades (Chmitorz, Kunzler, et al., 2018; Kalisch et al., 2015). Resilience is defined as the outcome of a process of successfully dealing with or adapting to stressors that is only partially determined by resilience factors (Earvolino-Ramirez, 2007; Hu, Zhang, & Wang, 2015; Kalisch et al., 2015). In addition, it is progressively considered as a

dynamic and modifiable process (Bonanno, Romero, & Klein, 2015; Hu et al., 2015).

A variety of resilience scales have been developed, most of them based on a trait-oriented approach or assessing the availability of putative resilience factors, that is, resources assumed to contribute to maintaining or regaining mental health despite adversities (e.g., Windle, Bennett, & Noyes, 2011). To date, no gold standard exists to measure resilience, especially not as an outcome of a process and independent of resilience factors. According to Smith et al. (2008), measuring the ability to recover or “bounce back” from stress emphasizes an outcome-oriented definition of resilience. Rather than referring to a personality trait or composite of resources, the construct refers to the psychological adaptation in the face of adversity, that is, the core components of resilience (Earvolino-Ramirez, 2007). Thus, the ability to recover from stress can be viewed as a good

proxy assessment of resilience. Individuals, who are able to successfully recover from stress, are less likely to develop mental dysfunctions in view of stressors (Rodríguez-Rey, Alonso-Tapia, & Hernansaiz-Garrido, 2016).

The Brief Resilience Scale (BRS; Smith et al., 2008) is a short self-report measure that assesses the ability to recover from stress despite significant adversity. Up to now, the BRS has been translated into various languages (e.g., Dutch, Malaysian, Portuguese, Spanish). The original version and these translations have been validated in several samples (e.g., healthy adults, oncology patients; Amat, Subhan, Jaafar, Mahmud, & Johari, 2014; Chmitorz, Wenzel, et al., 2018; Consten, 2016; de Holanda Coelho, Hanel, Medeiros Cavalcanti, Teixeira Rezende, & Veloso Gouveia, 2016; Lai & Yue, 2014; Leontjevas, de Beek, Lataster, & Jacobs, 2014; Macovei, 2015; Rodríguez-Rey et al., 2016). In these studies, the BRS showed good psychometric properties with low to high internal consistency ( $\alpha = .56-.93$ ) and moderate to high retest reliability (test-retest ICC =  $.69-.94$ ). In the original validation, the unidimensional scale has been demonstrated to be associated to other resilience measures, personality traits, health outcomes, coping styles, or social relationships (Smith et al., 2008). Finally, in systematic comparisons with other resilience scales, the BRS received some of the highest ratings concerning internal consistency, convergent, and discriminant validity (e.g., Windle et al., 2011).

With regard to the German BRS, the psychometric properties of the scale have been examined in a population-based sample ( $N = 1,481$ ) as well as, in part, in the same representative sample ( $N = 1,128$ ) that was investigated in the present study (see Chmitorz, Wenzel, et al., 2018). Only in the population-based sample, Chmitorz, Wenzel, et al. (2018) determined the convergent validity by correlating the BRS scores with measures for mental health, coping styles, social support, and optimism. In addition, in both samples, the factorial validity of the BRS was investigated using confirmatory factor analyses (CFA). Excellent model fit was shown for a two-factor model with one factor for general resilience (items 1–6) and a method factor controlling for method effects due to item wording (items 2, 4, 6). In line with studies on the Malaysian and Portuguese BRS, acceptable model fit was also found for the one-factor model in both samples. Therefore, the authors recommended using the unidimensional BRS score but also pointed out the challenge of future research to find ways to reduce methodological effects within the BRS. For both samples, good reliability was identified ( $\alpha = .85$ ,  $\omega = .85$ ).

Although this study provided evidence for the reliability and validity of the German BRS, there were still several open questions. First, the convergent and discriminant validity of the German adaptation have only been analyzed in the population-based, but not in the representative

sample. Thereby, correlations between the BRS and conceptually similar or distinct constructs were only investigated with measures already used to validate the original scale (Smith et al., 2008). The relationships between the BRS and resilience factors in addition to optimism have not been analyzed. Second, for both samples, CFAs were only conducted for BRS items in order to determine the factorial structure of the scale. Thus, it is unclear whether the ability to recover from stress assessed by the BRS is actually different from resilience factors, such as optimism, self-efficacy, or locus of control and to what extent the constructs can be differentiated. Third, differences in the ability to recover from stress with regard to demographic or psychological variables and potential predictors of this ability in the German population are unclear. Fourth, population-based norms for the German population or other countries have not yet been published to date.

With regard to the construct validity of the BRS concerning the resilience factors optimism, self-efficacy, and locus of control, different models seem possible based on theoretical assumptions in resilience research and the empirical evidence. To date, resilience is often conceptualized and measured as the sum or composite of protective factors (e.g., Windle et al., 2011) which suggests a unidimensional model. Second, the literature provides arguments for a two-factor model with one factor accounting for the ability to recover from stress, optimism, self-efficacy, and internal locus of control and a second factor for external control beliefs. There is evidence of external locus of control as a risk factor for mental dysfunctions in face of adversity (e.g., Zhang, Liu, Jiang, Wu, & Tian, 2014), whereas a protective function of self-efficacy, optimism, and internal locus of control has been found (Helmreich et al., 2017). In addition, external locus of control refers to an individual's external environment, whereas the ability to recover from stress and the other factors could be viewed as internal.

In previous studies on the BRS, positive associations with optimism and self-efficacy were shown (Macovei 2015; Smith et al., 2008). Besides, they present two well-supported resilience factors (Helmreich et al., 2017). For locus of control, however, previous findings concerning a protective function were more inconsistent (e.g., Buddelmeyer & Powdthaveeb, 2017). Thus, the ability to recover from stress, self-efficacy, and optimism on the one hand and internal and external locus of control on the other could load on different factors. Finally, as mentioned above, resilience is increasingly understood as an outcome that is not the simple sum score of resilience factors (Kalisch et al., 2015). Assuming that the BRS and measures of resilience factors assess different, though associated constructs, a five-factor model is the theoretically most plausible model.

Overall, the present study has the following objectives:

- First, to analyze the construct, convergent, and discriminant validity of the BRS in a representative sample. This will be achieved by investigating latent and manifest associations between the BRS and subjective perception of stress as well as specific resilience factors.
- Second, to determine demographic and psychological predictors of the ability to recover from stress.
- Third, to provide population-based norms for the German population in order to facilitate a more frequent use of the scale in different contexts.

## Method

### Design and Participants

The study used data from a representative observational survey conducted in a collaborative research project on pharmacological neuroenhancement (PNE) that was coordinated by the Johannes Gutenberg University Mainz and its University Medical Center (BMBF Knowledge Transfer “Pharmacological Cognitive Enhancement,” project number O1GP1303A/B). The sample included participants of a representative sample of the German adult population (mean age [range]: 51.23 years [18–92]; 51.7% female). Data were collected cross-sectionally by the “Institut für Demoskopie Allensbach” between August and September 2016. Face-to-face interviews were conducted nationwide with  $N = 1,128$  individuals aged 18 years and over with a standardized survey developed by the authors. The interviewers were trained and could answer further questions in case of uncertainties. Based on the German official statistics (2015 microcensus), individuals were selected if they met criteria of a quota sample with regard to age, gender, education, professional position, region, and size of town. To ensure informed consent, participants were informed about the objectives of the study, procedures of data storage, the voluntary nature of study participation, and their right to withdraw at any time. Verbal consent was obtained to guarantee anonymity. Individuals were allowed to refuse participation. The study procedures were approved by the local Ethics Committee at the Rhineland-Palatine state chamber of physicians (No. 837.209.14, 9448F). Individuals were not compensated for study participation.

For the current study, data related to the ability to recover from stress, perceived stress and the resilience factors optimism, self-efficacy, and locus of control were considered. Study results concerning the associations

between these constructs and PNE use are published elsewhere (Bagusat et al., 2018).

## Measures

### Brief Resilience Scale (BRS; Smith et al., 2008)

The ability to recover from stress was assessed using the German translation of the BRS (Chmitorz, Wenzel, et al., 2018). Six items (e.g., “I tend to bounce back quickly after hard times.”) are rated on a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). Items 2, 4, and 6 are negatively phrased. For the analysis, these items were recoded to calculate the mean (range: 1–5). Higher scores indicate a higher ability to recover from stress. The psychometric properties of the German BRS were already demonstrated (Chmitorz, Wenzel, et al., 2018).

### Perceived Stress-4 (PSS-4; Warrtig, Forshaw, South, & White, 2013)

The PSS-4 measures the subjective perception of stress, that is, the extent to which situations in the participants’ life were perceived as stressful in the last 12 months (e.g., “In the last 12 months, how often have you felt that you were unable to control the important things in your life?”). The self-report inventory consists of four items measuring perceived stress on a 5-point Likert scale (1 = *never*; 5 = *very often*). To ensure comparability with other studies (Warrtig et al., 2013), this format was adapted (0 = *never*; 4 = *very often*). Items 2 and 3 were recoded to calculate a sum score (range: 0–16). Higher scores indicate higher levels of perceived stress. The PSS-4 shows acceptable reliability [ $\alpha = .77$ ,  $\omega$  not reported (NR)] and significant correlations with perceived health and social support (Warrtig et al., 2013). In the current study, the German version (Engling, 2010) was administered.

### Optimism/Pessimism Scale (SOP2; Kemper, Beierlein, Kovaleva, & Rammstedt, 2012)

The two-dimensional self-rating scale consists of two items measuring dispositional optimism and pessimism. On a 7-point Likert scale (e.g., 1 = *not at all optimistic*; 7 = *very optimistic*), participants indicate how optimistic or pessimistic they are in general (e.g., “How optimistic are you in general?”). For the SOP2, acceptable to good internal consistency was demonstrated ( $\omega = .74-.83$ ;  $\alpha = .78-.99$ ) and significant correlations were shown with life satisfaction, self-efficacy, or another optimism measure (Kemper, Wassermann, Hoppe, Beierlein, & Rammstedt, 2017; Kemper et al., 2012). Kemper et al. (2012) found a general factor model with two group factors for optimism and pessimism. The item pessimism was recoded to calculate the mean (range: 1–7). Higher optimism is indicated by higher SOP2 scores, higher pessimism by lower scores.

### Short Scale for Measuring General Self-efficacy Beliefs (ASKU; Beierlein, Kovaleva, Kemper, & Rammstedt, 2012)

The self-report inventory consists of three positively worded items measuring self-efficacy, that is, the self-rated confidence in the ability to overcome challenges or to achieve desired goals (e.g., “I am able to solve most problems on my own”). Items are rated on a 5-point Likert scale (1 = *does not apply at all*; 5 = *applies completely*). Good internal consistency of the ASKU was demonstrated ( $\omega = .81-.86$ ;  $\alpha$  NR) (Beierlein et al., 2012). In addition, the unidimensional scale is associated with life satisfaction, optimism, locus of control, and another scale of self-efficacy (Beierlein et al., 2012). Mean scores were calculated (range: 1–5). Higher values indicate higher self-efficacy.

### Short Scale for the Assessment of Locus of Control (IE-4; Kovaleva, Beierlein, Kemper, & Rammstedt, 2012)

The four-item self-rating instrument measures internal (items 1, 2) and external control beliefs (items 3, 4). Internal locus of control describes an individual’s belief that life events can be controlled by active behavior (e.g., “If I work hard, I will succeed.”). External locus of control refers to personal beliefs that life is controlled by external forces (e.g., “Fate often gets in the way of my plans.”). Items are rated on a 5-point Likert scale (1 = *does not apply at all*; 5 = *applies completely*). For the IE-4, a two-factor model was demonstrated. The scale shows low to acceptable reliability for the two subscales ( $IE_{int}$ :  $\omega = .70-.71$ ;  $IE_{ext}$ :  $\omega = .53-.63$ ;  $\alpha$  NR) and is correlated with life satisfaction, optimism, and self-efficacy (Kovaleva et al., 2012). We calculated mean scores for internal and external locus of control (range: 1–5), whereby higher values are indicated by higher scores in the respective subscales.

### Demographic Data

The following demographic data were assessed using single items: age, gender, education, employment status, current or last professional position, shift work, weekly working hours, federal state, size of town.

### Data Analyses

Missing values analysis (MVA) including Little’s MCAR test was conducted to analyze the form and number of missing values. As data were missing completely at random (MCAR) and the percentages of missing data were below 2.3% (PSS-4), expectation-maximization-imputation (EM) was used to deal with missing data.

In order to adjust the dataset to the structural data of the German official statistics, it was weighted according to the

distribution of the general population with regard to age, gender, education, professional position, region, and size of town in the 2015 microcensus. Thus, the weighted sample is representative for the German population concerning these characteristics.

To investigate the construct validity of the BRS with regard to optimism, self-efficacy, and internal and external locus of control, we performed CFAs with maximum likelihood method. Given the empirical evidence, for example, concerning the factor structures of the respective instruments in prior research (Beierlein et al., 2012; Chmitorz, Wenzel, et al., 2018; Kemper et al., 2012; Kovaleva et al., 2012) and based on theoretical assumptions, four models were fitted in the current study. Starting with a unidimensional model with one factor accounting for all items, two variations of a two-factor model, and a final five-factor model with five separate factors accounting for the items of BRS, ASKU, SOP2,  $IE_{int}$ , and  $IE_{ext}$ , were tested (see Electronic Supplementary Material, ESM 1).

To assess the fit of these models, we used the chi-square test, the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), and the Akaike Information Criterion (Akaike, 1987; Hu & Bentler, 1999). We considered a value of  $\geq .95$  for CFI, a value of  $\leq .06$  for RMSEA, and a score of  $\leq .08$  for the SRMR as (very) good fit (Hu & Bentler, 1999). A lower AIC value indicates better model fit (Symonds & Moussalli, 2011).

The convergent and discriminant validity of the BRS with regard to the resilience factors were also determined using CFAs. Latent correlations between the ability to recover from stress, perceived stress, optimism, self-efficacy, internal, and external locus of control in a six-factor model were analyzed. In addition, manifest correlations between the constructs were examined by calculating zero-order correlations.

We analyzed predictors of the ability to recover from stress using multiple linear regressions. Those served as a supplement to correlation analyses to identify, via regression weights, the relationship between demographic and psychological variables and the BRS score that is independent of other variables. Prior to multivariate analyses, bivariate associations between demographic characteristics, perceived stress, and the resilience factors on the one hand and the ability to recover from stress on the other were investigated (two-sample *t*-tests, one-factor analyses of variance, simple linear regressions). Based on these analyses and previous studies (e.g., Lai & Yue, 2014), only variables with a statistically significant effect concerning the BRS were included as predictors in the multiple regression. Education and weekly working time were dummy-coded. First, all predictors were entered simultaneously; second, a multiple regression with backward elimination was used which was chosen as it minimizes suppressor effects (Field, 2013).

In order to analyze the sole influence of resilience factors for the ability to recover from stress, multiple regressions were repeated without perceived stress as predictor. To test a-posteriori if the negative association found between age and the BRS score in multiple regression was only caused by subjects older than 80 years, a subgroup analysis was conducted comparing the regression results for the two age groups ( $</\geq 80$  years).

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For the population-based norms, stanine values were used as they are more robust against violations of the normal distribution (Bühner, 2011). Based on the BRS mean values, percent ranks and stanine values (derived from percent ranks; Tent & Stelzl, 1993) were calculated for the total sample. In addition, norm values were stratified by age and gender.

Statistical significance of effects was determined by  $p$  values of  $p \leq .05$  or by 90% or 95% confidence intervals (CI). Due to the high number of bivariate and multivariate tests, analyses were adjusted for multiple testing using Bonferroni correction (total: 22 tests). For bivariate and multivariate analyses, we used a significance level of  $\alpha = .002$ . All analyses were conducted in IBM SPSS 23v except for the CFAs that were run using Mplus (Muthén & Muthén, 1998–2012).

## Results

### Sample Characteristics

The final sample included  $N = 1,128$  participants. Table 1 shows the demographic characteristics of the sample. Around half of the participants were women (51.7%). Age was distributed equally between 18 and 79 (approx. 14–18% per group), and a minority of participants were older than 80 (3.5%). Only 35.1% had a higher level of education. ESM 2 includes the corresponding reference values according to 2015 microcensus.

### Construct Validity

As indicated in Table 2, the best model fit was found for the five-factor model (ESM 3), whereas the one-factor model with one general factor accounting for all items showed the lowest fit to the data. For the different combinations of two-factor models tested, the five-factor model always showed a better model fit.

### Convergent and Discriminant Validity and Predictors of the BRS

Latent and manifest correlations were calculated to determine the relations between the BRS and conceptually similar (e.g., optimism) and distinct measures (e.g., perceived stress). The latent, CFA-based correlations identified in a six-factor model, and the manifest, Pearson correlations, are presented in Table 3. In both cases, the correlations confirmed the theoretical presumptions. On the latent level, large positive associations were shown for the resilience factors optimism, self-efficacy, and internal locus of control. Perceived stress and external control beliefs, however, were negatively correlated with the BRS. With respect to manifest correlations, moderate to large associations in the same direction were found.

In addition to correlation analyses, multiple regressions were conducted to examine the partial influence of demographic and psychological variables on the ability to recover from stress. ESM 4 contains the results of bivariate analyses for demographic and psychological variables. Descriptive statistics of the BRS for the subgroups of demographic variables are presented in ESM 5. In bivariate analyses, differences in the BRS were found for age, gender, education, employment status, weekly working time, perceived stress, optimism, self-efficacy, as well as internal and external locus of control. Thus, these variables were included as potential predictors.

In a multiple regression using the enter method (ESM 6), age ( $\beta = -0.12, p < .001$ ) and gender ( $\beta = -0.10, p < .001$ ) were significantly associated with BRS scores. The ability to recover from stress was higher in younger subjects and in men. Compared to participants working  $\geq 50$  hr per week, the ability to recover from stress was lower for individuals working more than 20 and below 30 hr ( $\beta = -0.1247, p < .001$ ) and those with a weekly working time of 41 to less than 50 hr ( $\beta = -0.33, p = .002$ ). No associations with education and employment status were found. Higher perceived stress was negatively associated with the ability to recover from stress ( $\beta = -0.26, p < .001$ ). Optimism ( $\beta = 0.18, p < .001$ ) and self-efficacy ( $\beta = 0.19, p < .001$ ) showed positive associations with the BRS. Internal control beliefs were no significant predictor ( $\beta = 0.07, p = .02$ ). However, the ability to recover from stress was negatively associated with external locus of control ( $\beta = -0.14, p < .001$ ). Overall, 47% of variance in BRS scores were explained ( $R^2 = .47$ ) indicating a strong effect (Cohen, 1992).

The multiple regression with backward elimination provided almost identical results concerning the direction and significance of effects (Table 4), except for the non-significant difference between a weekly working time of 41 to less than 50 hr and  $\geq 50$  hr per week. The final model

**Table 1.** Demographic characteristics of the sample

Variable	<i>n</i> <sup>1</sup>	Percentage
Gender		
Female	583	51.7
Age ( <i>M</i> / <i>SD</i> )	1,128	51.23 (18.11)
18–29 years	178	15.8
30–39 years	155	13.8
40–49 years	191	16.9
50–59 years	207	18.4
60–69 years	165	14.6
70–79 years	192	17.0
80+ years	39	3.5
Education	1,128	
No formal degree	18	1.6
≤ 9 years (Hauptschule) or ≤ 10 years (Realschule) without degree	363	32.2
≤ 10 years (Realschule)	350	31.0
≤ 12 years (Subject-linked) university entrance qualification	200	17.7
University of applied sciences or university degree	196	17.4
Employment	1,128	
Yes	666	59.0
No	462	41.0
Professional position	1,128	
Managerial responsibility	144	12.8
Non-managerial employee	488	43.3
Civil servant	75	6.6
Skilled worker	161	14.3
Self-employed	50	4.4
No previous employment	53	4.7
Other	156	13.8
Shift work <sup>2</sup>	666	
Yes	119	17.9
No	547	82.1
Weekly working time (hours) <sup>2</sup>	666	
< 20	36	5.4
≥ 20 to < 30	62	9.3
≥ 30 to 40	336	50.5
41 to < 50	170	25.5
≥ 50	63	9.5
West and East Germany	1,128	
West Germany	892	79.1
East Germany	236	20.9
Size of town (residents)	1,128	
< 2.000	91	8.1
≥ 2.000 to < 20.000	388	34.4
≥ 20.000 to < 100.000	311	27.6
≥ 100.000	338	30.0

Notes. Percentages rounded; *M* = Mean; *SD* = Standard Deviation (listed in parentheses); weighted according to 2015 microcensus; <sup>1</sup>due to weighting of results, total *n* sometimes falls below or exceeds *N* = 1,128 or *n* = 666; <sup>2</sup>previous filter; percentage of employed individuals in total sample (*n* = 666).

accounted for 46% of the variance in the BRS score (strong effect). Overall, the results of these multiple regressions confirmed the bivariate associations found.

When omitting perceived stress as predictor, the results of multiple regression analyses both with enter and backward methods largely corresponded to previous findings concerning the direction and significance of effects for demographic and psychological variables (ESM 7).

With respect to the subgroup analysis for age, the two multiple regressions provided similar results for individuals aged 18–79 years as for the total sample (ESM 8), including a negative association between age and the ability to recover ( $\beta = -0.11$ ;  $p < .001$ ). For participants aged  $\geq 80$  years, there was no significant relation between any of the predictors and BRS scores (see ESM 8).

## Population-Based Norms of the BRS

ESM 9 contains population norms containing percent ranks and stanine values for the total sample as well as normative values stratified by age and gender.

## Discussion

Our results provide further evidence for the construct validity of the German BRS and complement the analyses of Chmitorz, Wenzel, et al. (2018). In a representative sample of the German population, the study confirmed a five-factor model with separate factors for the ability to recover from stress and the resilience factors self-efficacy, optimism, and locus of control. Thus, the study underpins that the ability to recover from stress and those factors are correlated but distinct constructs. In other words, the ability to recover from stress assessed by the BRS represents a different construct instead of a simple sum score of resilience factors. As a consequence, studies aiming at measuring indicators of resilience should clearly distinguish between resilience factors and the ability to recover from stress, conceptually as well as when measuring the constructs. Together with the norm values reported in this study, these results indicate that the German BRS may be used as a valid instrument to assess the ability to recover from stress in a variety of contexts, ranging from clinical practice or individual counseling to other applied contexts such as workplace health promotion.

To date, a few representative surveys on resilience in Germany have been conducted (Beutel et al., 2017; Schmalbach et al., 2016). However, in this study, for the first time, the ability to recover from stress was assessed using the BRS in a representative German sample. Compared to the original validation study in the US (Smith et al., 2008), BRS scores were found to be lower in the current sample.

**Table 2.** Results from CFAs

Model	<i>n</i>	$\chi^2$	<i>df</i>	<i>p</i>	RMSEA	CFI	SRMR	AIC
(1) One Factor	1,128	1,780.359	90	< .001	.13	.77	.08	444,387.780
(2) Two Factors, v1	1,128	1,728.382	89	< .001	.13	.78	.07	444,337.803
(3) Two Factors, v2	1,128	1,671.489	89	< .001	.13	.78	.07	44,280.910
(4) Five factors	1,128	319.621	80	< .001	.05	.97	.03	42,947.042

Notes. *v* = Variant;  $\chi^2$  = Chi-Squared; *df* = Degrees of Freedom; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; model 1 = One-Factor Model Accounting for all Items (BRS, ASKU, SOP2, IE<sub>int</sub>, IE<sub>ext</sub>); model 4 = Five-Factor Model With One Factor for Items of BRS, ASKU, SOP2, IE<sub>int</sub>, IE<sub>ext</sub>, respectively; for models 2–3, see ESM 1.

**Table 3.** Latent and manifest correlations between the BRS and other psychological variables with Cronbach's  $\alpha$  values on the diagonal

	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.
1. Ability to recover from stress (BRS)	3.35	0.95	<b>.85</b>	-.69***	.63***	.62***	.60***	-.65***
2. Perceived stress (PSS-4)	7.01	2.84	-.53**	<b>.74</b>	-.69***	-.58***	-.60***	.73***
3. Optimism (SOP2)	4.98	1.20	.51**	-.51**	<b>.77</b>	.57***	.63***	-.67***
4. Self-efficacy (ASKU)	3.97	0.72	.51**	-.44**	.46**	<b>.86</b>	.80***	-.61***
5. Internal locus of control (IE <sub>int</sub> )	4.18	0.71	.45**	-.40**	.45**	.62**	<b>.68</b>	-.73***
6. External locus of control (IE <sub>ext</sub> )	2.46	0.83	-.45**	.47**	-.44**	-.42**	-.46**	<b>.56</b>

Notes. BRS = Brief Resilience Scale; PSS-4 = Perceived Stress Scale-4; SOP2 = Optimism/Pessimism Scale; ASKU = Short Scale for Measuring General Self-efficacy Beliefs; IE<sub>int</sub>, IE<sub>ext</sub> = Subscales Internal/External of Short Scale for the Assessment of Locus of Control (IE-4);  $\alpha$  = Cronbach's Alpha, diagonal from top left to lower right. Manifest (Pearson) correlations: below the bold diagonal, *N* = 1,128; latent correlations based on a six-factor model in CFA above bold diagonal. \**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

**Table 4.** Predictors of the ability to recover from stress in multiple linear regression (backward regression, final model)

Variable	<i>b</i>	95% CI	$\beta$	<i>t</i>	<i>p</i>
Constant	2.68	2.17, 3.20		10.24	< .001
Age	-0.006	-0.009, -0.004	-0.12	-4.46	< .001
Gender (Reference: men)	-0.20	-0.29, -0.12	-0.11	-4.72	< .001
Education [Reference: ≤ 9 years (Hauptschule)/≤ 10 years (Realschule) without degree] ≤ 12 years [(Subject-linked) university entrance qualification]	0.10	-0.01, 0.21	0.04	1.76	.08
Employment status	0.20	0.04, 0.36	0.10	2.44	.02
Weekly working hours (Reference: ≥ 50 hr)					
≥ 20 to < 30 hr	-0.40	-0.63, -0.17	-0.10	-3.45	.001
≥ 30 to 40 hr	-0.21	-0.37, -0.05	-0.10	-2.59	.01
41 to < 50 hr	-0.26	-0.44, -0.09	-0.10	-2.95	.003
Perceived stress (PSS-4)	-0.09	-0.10, -0.07	-0.26	-9.16	< .001
Optimism (SOP2)	0.14	0.10, 0.18	0.18	6.31	< .001
Self-efficacy (ASKU)	0.26	0.18, 0.33	0.19	6.44	< .001
Internal locus of control (IE <sub>int</sub> )	0.09	0.01, 0.17	0.07	2.25	.03
External locus of control (IE <sub>ext</sub> )	-0.16	-0.22, -0.10	-0.14	-5.12	< .001

Notes. *b* = Unstandardized Regression Coefficient; CI = Confidence Interval;  $\beta$  = Standardized Regression Coefficient; *t* = *t* value; *p* = *p* value; PSS-4 = Perceived Stress Scale-4; SOP2 = Optimism/Pessimism Scale; ASKU = Short Scale for Measuring General Self-efficacy Beliefs; IE<sub>int</sub>, IE<sub>ext</sub> = Subscales Internal/External of Short Scale for the Assessment of Locus of Control (IE-4).

Based on the definition of resilience as maintaining or regaining mental health despite adversities (Earvolino-Ramirez, 2007), this difference may be explained by varying levels of stressor exposure between the two studies. On the one hand, our sample could have been exposed to more adversities leading to a higher vulnerability and lower BRS scores. On the other hand, in line with stress inoculation theory, individuals in the original study might have

experienced more stressors. Thus, they could have learned certain coping strategies resulting in a higher ability to recover.

Although there is some evidence for individuals with low BRS scores having more symptoms of mental disorders (e.g., Rodríguez-Rey et al., 2016), the predictive validity of the German BRS is unclear so far. Longitudinal studies assessing individual stressor exposure and mental health

outcomes have to be performed to validate whether the use of BRS is indeed a predictor for mental health outcomes. If such a longitudinal study provides evidence for worse mental health outcomes in individuals with low BRS scores, this population may benefit particularly from health promotion interventions. Interventions to foster resilience (e.g., Vanhove, Herian, Perez, Harms, & Lester, 2015) may be one possible approach here.

The current study provides further evidence for the convergent and discriminant validity of the German BRS and supplements the findings of Chmitorz, Wenzel, et al. (2018). In a representative sample, we found negative latent and manifest correlations between the BRS and perceived stress as well as external locus of control. Positive correlations were shown between the BRS and optimism, self-efficacy, and internal control beliefs. The finding for optimism in this study is in line with Smith et al. (2008) and the validation results for the German adaptation (Chmitorz, Wenzel, et al., 2018). The negative association found between perceived stress and the ability to recover from stress is consistent to previous studies in the US, Romania, and Spain (Macovei, 2015; Rodríguez-Rey et al., 2016; Smith et al., 2008). Individuals who report a higher ability to recover from stress also perceive less stress. Based on the moderate to large correlations of the BRS with perceived stress and the resilience factors in the representative survey, the convergent and discriminant validity of the German BRS can be viewed as fair to good.

In addition to bivariate associations between the BRS and the resilience factors, we identified predictors of the ability to recover from stress when controlling for other variables. With regard to demographic characteristics, the multivariate analyses in the current study partially replicated previous findings. Men reported a higher ability to recover from stress than women which is in line with results for the English and Spanish adaptations (e.g., Rodríguez-Rey et al., 2016; Smith et al., 2008). This difference is consistent with a higher prevalence of many stress-related mental disorders in women (e.g., Cleary, 1987) and might be explained by biological vulnerability, different social roles or stress reactivity, or socially desirable responses by men (e.g., Verma, Balhara, & Gupta, 2011). For the first time, weekly working time was identified as predictor of the BRS with individuals working  $\geq 50$  hr per week reporting a higher ability to recover than participants working less. Consistent with stress inoculation theory, individuals working  $\geq 50$  hr per week, since they are probably exposed to many stressors, could also have learned coping strategies that help them to recover faster. The negative association between age and the ability to recover from stress differs from studies that found higher BRS scores with increasing age (e.g., Rodríguez-Rey et al., 2016). This finding might be explained by heterogeneity in stressor exposure or a

different use of coping strategies between younger and older subjects. The non-significant association in the subgroup aged  $\geq 80$  years might result from the small number of participants ( $n = 39$ ) or a lack of variance of BRS scores in this group. With respect to psychological variables, a higher ability to recover from stress was only predicted by lower perceived stress, higher optimism, and self-efficacy, as well as lower external locus of control. Internal control beliefs did not reliably predict the ability to recover from stress. This result can be attributed to the high predictive power of perceived stress and the other resilience factors as was shown in the multivariate model with backward regression and the analyses without perceived stress. In line with the positive appraisal theory of resilience (PASTOR; Kalisch et al., 2015), resilience factors, such as optimism, might present positive appraisal styles that foster an individual's ability to recover from stress and thus favor resilience despite adversities. Future studies should examine this mediation model by assessing resilience as an outcome.

Provided that a low BRS score is predictive of resilience, the results of the present study could have important implications for further research. For example, instruments for resilience factors along with other psychological measures or physiological parameters could be used to assess differences between groups with low versus high BRS scores. In the context of occupational health management, the BRS could be applied to identify potential risk groups in order to provide health-promoting interventions. Resilience trainings could also address more specifically individuals that exhibit certain risk factors (e.g., women, people low on optimism) in order to prevent stress-related mental disorders.

Advantages of the present study are the representative nature of the sample, the large sample size, and the broad age range of participants. One limitation is the focus on the adult population. Future research should also aim at providing norms for the BRS in children and youth as these populations also suffer from stress. Another limitation concerns the cross-sectional design which allows no causal conclusions. To avoid different forms of bias, several methods were applied (e.g., measures with tolerable to satisfactory psychometric quality). However, by using a quota sample instead of a random sample, a selection bias cannot be excluded. Moreover, the longer survey period in the PSS-4 compared to the English version (Warttig et al., 2013) or the PSS-10 (Klein et al., 2016) (1 month) could have resulted in an information bias. Through the use of self-report questionnaires, a social desirability bias cannot be ruled out. Another potential limitation refers to the missing assessment of mental health in the current study. A good mental health status could have resulted in more positive appraisals by the respondents ("positivity bias"), for example, in the form of a better judgment of resilience factors. These limitations should be eliminated in further research.



As stated above, the ability to recover from stress assessed by the BRS is only an approximate measure for resilience. In addition to longitudinal studies, mental health and the individual stressor exposure (e.g., life events, daily hassles) should be considered by assessing objective data in order to make valid conclusions. Kalisch et al. (2015) proposed the Resilience Score (*R Score*) which could be applied in future representative surveys. Based on a longitudinal design, the *R Score* is calculated as quotient of the difference in mental health problems between two time points normalized by the individual stressor load in the same period.

## Conclusion

The study provides further evidence for the validity of the German adaptation of the BRS in a representative sample. The five-factor model identified supports the idea that the ability to recover from stress and resilience factors are correlated but distinct constructs. In addition, convergent and discriminant validity of the BRS are in a fair to good range. Population-based norms reported here will allow using the BRS in clinical practice and in various applied contexts, such as the workplace. In future studies, longitudinal research measuring the individual stressor load and mental health would allow assessing the predictive power of the BRS for changes in psychological resilience over time. The current study indicates certain risk factors associated with lower BRS scores (e.g., lower optimism). Therefore, resilience interventions could be tailored on and address parts of the population having these characteristics. By fostering the ability to recover from stress in those individuals, stress-related mental disorders may be prevented.

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## Electronic Supplementary Materials

The electronic supplementary material is available with the online version of the article at <https://doi.org/10.1027/2512-8442/a000016>

*ESM 1. Models tested in CFAs (.docx)*

The table presents the 4 models tested in CFAs.

*ESM 2. Norm-based reference values (.docx)*

The table contains demographic characteristics and reference values from 2015 microcensus.

*ESM 3. Item statistics of the five-factor model (.docx)*

The table includes item statistics of the best-fitting model.

*ESM 4. Bivariate analyses (.docx)*

The tables show bivariate effects of demographic and psychological variables on the BRS.

*ESM 5. BRS scores in subgroups of demographic variables (.docx)*

The table presents descriptive statistics of the BRS in subgroups of demographic variables.

*ESM 6. Multiple regression (enter) (.docx)*

The table shows multivariate effects of demographic and psychological variables on the BRS.

*ESM 7. Multiple regressions without PSS-4 (.docx)*

The tables present results of the multiple regressions without perceived stress.

*ESM 8. Multiple regressions depending on age (.docx)*

The tables present results of the multiple regressions for subjects aged < 80 and ≥ 80 years.

*ESM 9. Population-based norms of the BRS (.docx)*

The tables show percent ranks and stanine values for the BRS in general and stratified by age and gender.

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