International Journal of Stress Management

The Beliefs About Stress Scale (BASS): Development, Reliability, and Validity

Johannes A. C. Laferton, Nikola M. Stenzel, and Susanne Fischer

Online First Publication, October 10, 2016. http://dx.doi.org/10.1037/str0000047

International Journal of Stress Management

1072-5245/16/$12.00 http://dx.doi.org/10.1037/str0000047

The Beliefs About Stress Scale (BASS): Development, Reliability, and Validity

Johannes A. C. Laferton
Philipps University of Marburg and
Psychologische Hochschule Berlin

Nikola M. Stenzel
Psychologische Hochschule Berlin

Susanne Fischer
Philipps University of Marburg and King's College London

Evidence from population and experimental studies suggests that laypersons' beliefs about stress influence mental and physical health. Yet, studies so far have solely relied on psychometrically not evaluated instruments to measure stress beliefs. Standardized assessment is needed to facilitate research on this novel and promising construct in stress research. This study reports on the development and psychometric evaluation of a new questionnaire to assess stress beliefs: The Beliefs About Stress Scale (BASS). An item pool of 24 statements on stress beliefs was administered to $N = 455$ university students at the beginning of term via an online survey. Additionally, participants' subjective stress levels, optimism, pessimism, neuroticism and somatosensory amplification were assessed. A subsample of $N = 216$ participants was reassessed during end of term exams 6 to 8 weeks later. Using a split sample procedure, both

Johannes A. C. Laferton, Department of Clinical Psychology and Psychotherapy, Philipps University of Marburg, and Clinical Psychology and Psychotherapy, Psychologische Hochschule Berlin; Nikola M. Stenzel, Clinical Psychology and Psychotherapy, Psychologische Hochschule Berlin; Susanne Fischer, Department of Clinical Biopsychology, Philipps University of Marburg, and Institute of Psychiatry, Psychology, and Neuroscience, King's College London.

Some of the ideas and data reported in this article have been presented at the 33rd Annual Meeting of the Section of Clinical Psychology and Psychotherapy of the German Society of Psychology, 2015, Dresden, Germany and the 15th Biannual Meeting of the German Society for Behavioral Medicine and Behavior Modification (DGVM) 2016, Mainz, Germany. Although the analyses reported here have not been published before, there is some participant overlap with a previous publication addressing a different research question with different outcome variables (Fischer, Nater, & Laferton, 2016).

Johannes A. C. Laferton was supported by a fellowship within the Postdoc Program of the German Academic Exchange Service (DAAD). Susanne Fischer is funded by the Swiss National Science Foundation (SNSF). The Philipps University of Marburg supplied partial funding of participant compensation. We gratefully acknowledge Alexandra Feiner's help in conducting the surveys.

Correspondence concerning this article should be addressed to Johannes A. C. Laferton, Clinical Psychology and Psychotherapy, Psychologische Hochschule Berlin, Am Köllnischen Park 2, 10179 Berlin, Germany. E-mail: j.laferton@psychologische-hochschule.de

exploratory and confirmatory factor analysis suggested 3 dimensions of stress beliefs: *negative stress beliefs, positive stress beliefs, controllability.* The scales showed good to acceptable internal consistency (Cronbach $\alpha = .73–87$) and retest-reliability ($r_{tt6\text{-}8} = .61–.81$). Correlations with optimism, pessimism, neuroticism and somatosensory amplification ($r = .15–.47$) indicated high to medium discriminant validity. Moreover, baseline negative stress beliefs appeared to be associated with an increased level of stress at end of term exams 6 to 8 weeks later by statistical trend ($\beta = .11$; $p = .062$). Stress beliefs appear to be multidimensional and stable over time. The BASS offers a promising new way to assess stress beliefs via a brief, psychometrically evaluated questionnaire.

Keywords: stress, stress beliefs, questionnaire, laypersons' representation of stress, stress appraisal

Stress is an extremely prominent phenomenon in modern societies. It occurs when environmental demands are perceived as exceeding one's resources and is accompanied by emotions, coping behavior, and a biological stress response (Lazarus & Folkman, 1984). Although acute stress is deemed an adaptive process to maintain homeostasis, very high levels of stress and persistent stress may be a threat to one's health (Schneiderman, Ironson, & Siegel, 2005). An extensive line of research has connected stress to deleterious health outcomes in conditions such as coronary heart disease, stroke, diabetes and mental health issues (Chrousos, 2009; Hammen, 2005; Schneiderman et al., 2005; Segerstrom & O'Connor, 2012).

Besides the scientific attention, the concept of stress has reached high popularity among the general public within the last decades. Public perceptions of stress, at least partially driven by media coverage (Lewig & Dollard, 2001), appear to be negative, up to assigning stress an almost disease like status (Jones & Bright, 2001; Kinman & Jones, 2005). This should be of concern, because laypersons' beliefs have extensively shown to affect health related behavior and health outcomes (Hagger & Orbell, 2003; Leventhal, Weinman, Leventhal, & Phillips, 2008; Petrie & Weinman, 2012).

Indeed, recent studies suggest that laypersons' beliefs about stress are related to health outcomes. In a cross-sectional analysis of the representative 1998 National Health Interview Survey, Keller et al. (2012) found that the perception that stress affects health was associated with both worse mental and physical health. This association was independent of the reported level of stress. Further, participants reporting both a high level of stress and the perception that stress affects health a lot had a 43% increased mortality risk, whereas reporting high levels of stress combined with the belief that stress does not or only a little affect health was not associated with an increase in mortality risk. Similarly, Nabi et al. (2013) in a prospective analysis of the Whitehall II cohort study showed that patients reporting that stress has affected their health in the past had a twofold increased risk of cardiac

mortality or nonfatal myocardial infarction. Further support for the link between beliefs about stress and health can be found in experimental studies. In two similar experiments, Jamieson, Nock, and Mendes (2012, 2013) assigned participants undergoing a laboratory stress task to either reappraise their stress response as functional and adaptive, to an attention reorientation control group, or to no instruction at all. Participants assigned to the positive reappraisal instruction showed a more adaptive cardiac stress response compared to the two control groups.

The latter findings suggest that the biological concomitants of the stress experience may be a key factor in explaining how negative stress beliefs translate into ill health. Being aware of one's own biopsychological stress response (e.g., by noticing one's racing heart) and appraising these processes as harmful may further increase the overall stress experience (Jamieson, Mendes, & Nock, 2013). In addition, people holding strong negative stress beliefs may be particularly prone to directing their attention toward bodily sensations in high-stress periods.

In conclusion, research from large population studies and laboratory studies including physiological outcomes strongly suggest that subjective beliefs about stress are an important factor to consider in psychological research on health and disease. Unfortunately, little is known about the construct so far. Both population studies used psychometrically not evaluated one-item instruments to assess the perception that stress negatively affects health. Yet given the research on laypersons' theories in health psychology (Leventhal et al., 2008; Petrie & Weinman, 2012) as well as qualitative research on laypersons' perceptions of stress (Kinman & Jones, 2005; Muncer, Taylor, Green, & McManus, 2001; Rydstedt, Devereux, & Furnham, 2004), it seems very likely that stress beliefs, too, are multidimensional. Other open questions concern the temporal stability of stress beliefs and their relationship to potentially related constructs, such as, neuroticism, optimism and somatosensory amplification. Taken together, a better understanding of the construct of stress beliefs is needed for future research to further the understanding of its effects and mediating processes. Therefore, this study aimed at developing and evaluating a questionnaire to assess laypersons' beliefs about stress.

Method

Participants and Procedure

Students of the local university were invited at the beginning of the summer term to take part in a Web based survey via e-mail. Participation was

voluntary and all subjects provided electronic informed consent. This total sample was randomly split into two equally sized subsamples. The first half was used to explore the factorial structure of stress beliefs (exploratory factor analysis [EFA] subsample). The second half was used to confirm the factorial structure using confirmatory factor analysis (confirmatory factor analysis subsample; CFA subsample). Discriminant validity was evaluated using the total sample. To evaluate retest reliability and predictive validity, a subsample of students was reassessed 6 to 8 weeks later when they were undergoing end of term exams (period of academic stress). Reassessment was tailored to each student's self-reported time of exams. All procedures were in accordance with the ethical standards laid down in the Declaration of Helsinki, and were approved by the local ethics committee. Participants had the chance to win gift certificates as compensation for their efforts.

Assessment

Beliefs About Stress Scale (BASS). The preliminary item pool for the development of the BASS was generated following several strategies. Structured interviews designed to learn about participants' subjective beliefs about stress were conducted with a convenience sample of $N = 18$ subjects of diverse occupational and educational background (age $M = 40.56$; range = 23–84). Responses were used to formulate items about stress beliefs. Further, instruments or phrasings used in previous research on stress beliefs (Jamieson et al., 2012, 2013; Keller et al., 2012; Nabi et al., 2013) and instruments addressing other beliefs (Multidimensional Health Locus of Control Scales [Wallston, Strudler Wallston, & DeVellis, 1978], Revised Illness Perception Questionnaire [Moss-Morris et al., 2002]) were scanned for suitable items to be included. These two strategies resulted in a preliminary item pool of 24 items that were all phrased as subjective statements about the state of "being stressed." An English translation of the item pool can be seen in the Appendix. The English translation was performed using a forward-backward-translation procedure. The answering format was a 4-point Likert scale:1 = *completely disagree*; 2 = *mostly disagree*; 3 = *somewhat agree*; 4 = *definitely agree*. Item order was created using a random number generator.

To evaluate discriminant validity several constructs were assessed. Neuroticism was measured via the 10 item Big Five Inventory (BFI; Rammstedt & John, 2007). Optimism and Pessimism were assessed using the Life Orientation Test Revised (LOT-R; Glaesmer et al., 2012; Scheier & Carver, 1985). Somatosensory amplification, which refers to a cognitive style that is characterized by experiencing somatic sensations as more intense, and evaluating them as more negative, was measured using the Somatosensory Amplifications Scale (SSAS; Barsky, Wyshak, & Klerman, 1990).

To evaluate predictive validity, stress was measured both at baseline and at follow-up, when students underwent academic exams. The 12 item Screening Scale for the Assessment of Chronic Stress was used for this purpose (SSCS; Schulz, Schlotz, & Becker, 2004). The rationale behind this was the above-mentioned experimental study by Jamieson et al. (2012). This study showed that instilling positive stress beliefs into participants resulted in less intense stress experiences in the laboratory, which led us to believe that the opposite would be true as well (i.e., the more negative stress beliefs one holds at baseline the higher his or her stress levels at follow-up). The SSCS is a subjective measure of stress, in our case referring to the stress experience in the past 2 weeks. It covers different aspects of stress, such as worrying, work and social overload, excessive demands at work, and lack of social recognition. An example item is, "In the past two weeks, I experienced times when I had too many duties to fulfil."

Furthermore, participants provided information about demographic variables (age, sex, subject of study).

Thus, the following variables were assessed at baseline: beliefs about stress (BASS), neuroticism (BFI), optimism (LOT-R), somatosensory amplification (SSAS), stress levels (SSCS), background stressors, chronic somatic diseases, mental disorders, and demographic variables. Of these, the SSCS and BASS were readministered at follow-up.

Data Analysis

Frequency distribution, means and standard deviations were assessed for each variable. Item difficulties were assessed and items with lacking discriminatory value (above $p = .80$ and below $p = .20$) were excluded from further analysis. Item intercorrelations were assessed to identify and exclude items without any intercorrelation larger than $r = .30$ and to exclude items with intercorrelations higher than $r = .80$ (the latter was conducted to avoid multicollinearity). To investigate the dimensionality of the BASS exploratory factor analysis (principal axis factoring; PAF; Field, 2013; Tabachnik & Fidell, 2007) was conducted using SPSS (version 23, SPSS Inc., Chicago, IL, U.S.A.) on the randomly generated EFA subsample. Kaisers' criteria (Eigenvalue >1), visual inspection of the scree plot and a parallel analysis (Horn, 1965; Ledesma & Valero-Mora, 2007) were used to determine the number of factors to extract. A parallel analysis is a simulation method that compares the observed eigenvalues with those obtained from uncorrelated normal variables. A factor is retained if the associated eigenvalue is bigger than the 95th of the distribution of eigenvalues derived from the random data. An oblique rotation method (OBLIMIN) was chosen because interrelations

between different stress beliefs were to be expected. In the rotated factor solution items were assigned to one factor, if their main loadings were $> .40$ and no side loadings were $> .30$. The resulting factor solution was tested with the remaining CFA subsample using structural equation modeling (SEM) with AMOS (Version 23, SPSS Inc., Chicago, IL). To minimize parameter estimation bias associated with nonnormal data, a Maximum Likelihood estimation procedure with nonparametric bootstrapping was used.

BASS subscale scores reflect the sum of their corresponding items (item 19 was inverted). Predictive validity of the BASS was assessed using stepwise linear multiple regression analysis on a subsample of participants who underwent end of term exams (academic stressor) at follow-up. The dependent variable was the subjective stress level at follow-up. Step I assessed the associations of the BASS subscales at baseline with subjective stress at follow up, controlling for baseline levels of subjective stress (SSCS). Step II further controlled for optimism (using the LOT-R sum score), neuroticism and somatosensory amplification.

Results

Sample. The link to the online survey was accessed 671 times. Four hundred fifty-three participants (67.1%) completed the entire survey. Eight participants had to be excluded because they were not students. Therefore, the main sample consisted of $N = 445$ students. The two subsamples used to conduct exploratory and confirmatory factor analyses did not differ with regard to sample characteristics (cf. Table 1). A total of 416 participants (93.5%) agreed to be contacted for a follow-up survey and 269 (64.7%) completed the follow-up survey of which 52 had to be excluded because they did not undergo end of term exams. One participant could not be linked to any baseline data and was therefore excluded as well, leaving $N = 216$ (48.5% of the baseline sample; 32.2% of survey accesses) participants in the follow-up sample. Sample characteristics can be seen in Table 1.

Dimensionality. To investigate the dimensionality of the BASS, an item analysis and exploratory PAF with oblique rotation was conducted within the EFA subsample. Item difficulties can be found in Appendix. Four items (#1, 7, 10, 23) were deleted due to low difficulty; 55.6% of the items were between $p = 40$ and $p = 60$. Three items (#4, 9, 20) had no intercorrelation above $r = .30$ and were excluded from further analysis. There was no intercorrelation higher than $r = .80$, indicating absence of multicollinearity.

The exploratory factor analysis was conducted with all remaining BASS items. The Kaiser–Meyer–Olkin (KMO) measure of .83 confirmed great

Table 1
Sample Characteristics

Characteristic	Baseline sample			Follow-up sample (N = 216)	
	Main sample (N = 445)	EFA subsample (n = 215)	CFA subsample (n = 230)	Baseline assessment	Follow-up assessment
Age, *M* (*SD*)	23.54 (3.02)	23.59 (3.03)	23.49 (3.02)	23.12 (2.83)	
Sex, female *f* (%)	313 (70.3)	158 (73.5)	155 (76.4)	156 (72.2)	
Subject of study *f* (%)					
Arts and social Sciences	161 (36.2)	88 (40.9)	73 (31.7)	79 (36.6)	
Natural sciences	103 (23.1)	51 (23.7)	52 (22.6)	42 (19.4)	
Psychology	27 (6.1)	11 (5.1)	16 (7.0)	13 (6.0)	
Medicine	54 (12.1)	24 (11.2)	30 (13.0)	26 (12.0)	
Educational sciences	67 (15.1)	30 (14.0)	37 (16.1)	37 (17.1)	
Other	33 (7.4)	11 (5.1)	22 (9.6)	19 (8.8)	
Chronic disease *f* (%)	69 (15.5)	30 (14.0)	39 (17.0)	38 (17.6)	
Mental disorder *f* (%)	49 (11.0)	24 (11.2)	25 (10.9)	18 (8.3)	
Negative stress beliefs (BASS-N)	23.35 (4.43)	22.91 (4.21)	23.76 (4.39)	23.27 (4.48)	23.47 (4.18)
Positive stress beliefs (BASS-P)	10.28 (2.95)	10.41 (2.94)	10.17 (2.96)	10.28 (2.96)	10.36 (2.68)
Control beliefs (BASS-C)	8.49 (1.88)	8.41 (1.84)	8.56 (1.92)	8.43 (1.81)	8.51 (1.74)
Subjective Stress (SSCS)	22.98 (9.93)	22.66 (9.65)	23.28 (10.19)	22.76 (9.26)	24.36 (9.15)
Optimism (LOT-R)	7.27 (2.62)	7.14 (2.64)	7.39 (2.59)	7.18 (2.52)	
Pessimism (LOT-R)	4.52 (2.49)	4.57 (2.41)	4.48 (2.59)	4.52 (2.43)	
Neuroticism (BFI)	6.31 (2.15)	6.33 (2.22)	6.30 (2.09)	6.73 (1.99)	
Somatosensory Amplification (SSAS)	26.41 (5.96)	25.94 (5.53)	26.85 (6.22)	27.27 (6.04)	

Note. BASS = Beliefs About Stress Scale; BFI = Big Five Inventory; BASS-N = Subscale negative stress beliefs (range = 8–32); BASS-P = Subscale positive stress beliefs (range = 4–16); BASS-C = Subscale control beliefs (range = 3–12); EFA = exploratory factor analysis; CFA = confirmatory factor analysis. Stress (SSCS; range = 0–48); Life Orientation Test Revised (LOT-R) Optimism subscale (range = 0–12); LOT-R Pessimism subscale (range = 0–12); Neuroticism (BFI; range = 2–10). Somatosensory amplification (SSAS; range = 10–50).

sampling adequacy. Bartlett's test of sphericity indicated that correlations between items were sufficiently large for PAF ($\chi 2$ (105) = 1156.74, $p <$ .000). The Eigenvalue >1 criterion suggested to extract 3 or 4 factors (Eigenvalue of the 4th factor was 1.01). The scree plot suggested a three-factor solution (see Figure 1). Moreover, the parallel analysis also suggested an extraction of three factors. A three-factor solution and a four-factor solution was extracted. In the rotated four-factor solution three items could not be assigned to any factor (# 3, 8, 18; main loadings < .40) and two items had side loadings > .30 (# 14, 21). Only one item was sufficiently loading on the fourth factor (#15). In the rotated three-factor solution all items could be uniquely assigned to a specific factor with all main loadings > .40 and no side loadings > .30. The only exception was item no. 14, which had a side loading of .33. Given the indications of the scree plot and the parallel analysis and because the factor loadings of the three-factor solution showed a superior interpretability this respective model was chosen. Item no. Fourteen was omitted from further analysis due to its' side loadings. The final factor solution after oblique rotation accounted for 46.01% of the variance. Factor loadings and communalities (h^2) can be seen in Table 2. Correlations between factors were small to medium confirming the choice of an oblique rotation method ($r_{FI,\ FII} = -.43$; $r_{FI,\ FIII} = -.28$; $r_{FII,\ FIII} = .22$). The

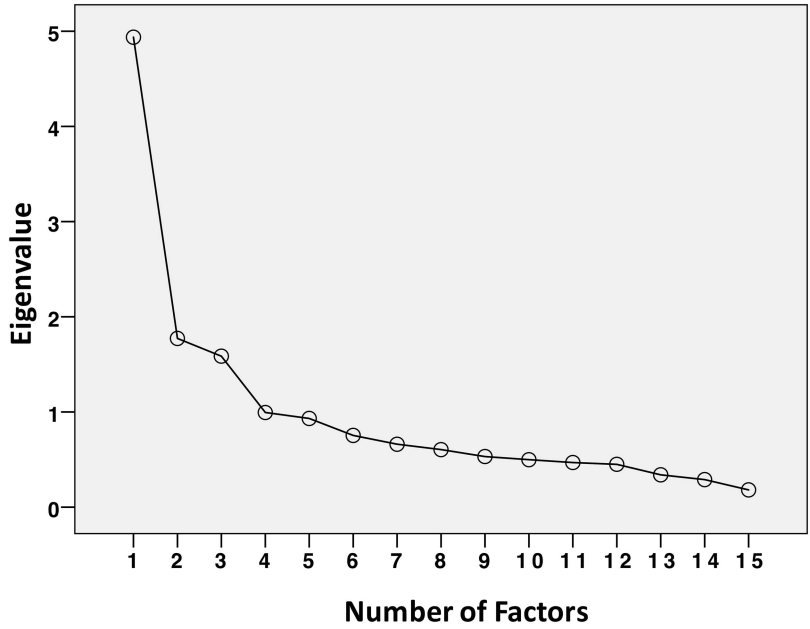

Figure 1. Scree plot of principal axis factoring in the exploratory factor analysis (EFA) subsample (N = 215).

Table 2
Exploratory PAF With Oblique Rotation (OBLIMIN), Including Communalities (h^2; After Extraction) and Factor Loadings (EFA Subsample; N = 215)

Item no.[a]	Item: Being stressed . . .	h^2	Factor loadings α[b]		
			FI	FII	FIII
19 (N)[c]	. . . is not problematic for me to deal with.	.52	**−.61**	.16	.09
11 (N)	. . . drains a good deal of my energy.	.29	**.58**	−.02	.14
13 (N)	. . . makes me less resilient.	.42	**.54**	.00	−.19
18 (N)	. . . is, for me, a predominantly negative thing.	.52	**.49**	−.10	−.27
15 (N)	. . . is something I need to avoid.	.32	**.46**	.06	−.21
2 (N)	. . . impacts negatively on my ability to perform.	.40	**.41**	.04	.02
3 (N)	. . . causes damage to my health in the long run.	.16	**.49**	−.10	.01
8 (N)	. . . causes damage to my health in the short-term.	.20	**.46**	−.03	.06
24 (C)	. . . is something I am able to mitigate using particular strategies.	.84	.22	**.95**	−.02
22 (C)	. . . is something I am able to influence positively using my thoughts.	.46	−.17	**.60**	.01
12 (C)	. . . is something I am able to control to a certain degree.	.29	−.11	**.49**	.03
6 (P)	. . . makes me more productive.	.74	−.04	−.05	**.89**
5 (P)	. . . enables me to work in a more focused manner.	.71	.10	−.06	**.80**
16 (P)	. . . enables me to reach my full potential.	.61	.02	.02	**.78**
21 (P)	. . . activates my resources.	.47	−.04	.19	**.60**

Note. EFA = exploratory factor analysis.
[a] Letters in brackets denote the associated subscale: N = Negative Stress Beliefs (subscale score equals sum of all items; item 19 inverted); C = Control Beliefs (subscale score equals sum of all items; item 19 inverted), *P* = Positive Stress Beliefs (subscale score equals sum of all items; item 19 inverted) FI = Negative stress beliefs (BASS-N); FII = Positive stress beliefs (BASS-P); FIII = Beliefs about the controllability of stress (BASS-C). [b] Bold values depict factor assignment. [c] Item needs to be inverted for scale calculation.

content of the three factors as defined by their main factor loadings were summarized as follows: FI = Negative stress beliefs (BASS-N); FII = Positive stress beliefs (BASS-P); FIII = Beliefs about the controllability of stress (BASS-C). Sum scores of each scale can be seen in Table 1.

In a next step, the factor structure obtained from exploratory factor analysis was cross-validated with a confirmatory factor analysis using the remaining CFA subsample. Therefore, a model with three correlated factors (see Figure 2) was tested. The following criteria were used to evaluate model fit: standardized root mean residual (SRMR) ≤ 0.08, root mean square error of approximation (RMSEA) ≤ 0.06, comparative fit index (CFI) ≥ 0.95, insignificant χ^2 test (see Hu & Bentler, 1999). The SEM yielded a very good model fit (SRMR = .05; RMSEA = .04; 90% confidence interval [CI] [.02, .06], CFI = .97). The chi-square—$\chi^2(87) = 124.31$—was not statistically

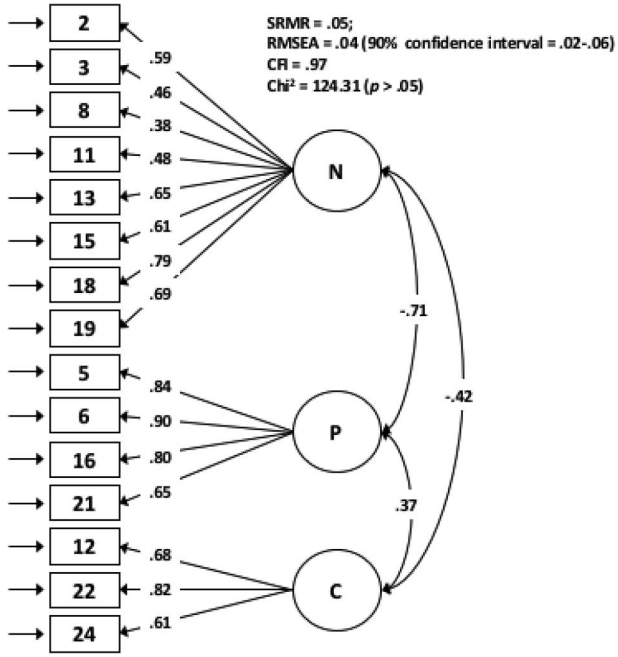

Figure 2. Structural equation model confirming the resulting three factor solution (N: negative stress beliefs; P: positive stress beliefs; C: control beliefs) in the independent confirmatory factor analysis (CFA) subsample (n = 230); standardized regression weights are depicted between items (with item number) and subscales as well as correlations among the subscales; chi-square statistics is reported as well as fit indices root-mean-square error of approximation (RMSEA; with 90% confidence interval), square-root-mean residual (SRMR), and comparative fit index (CFI).

significant ($p > .05$). Furthermore, an alternative model with one latent factor showed an unsatisfactory model fit (SRMR = .09; RMSEA = .12; 90% CI [.11, .13], CFI = .76). The chi-square—$\chi^2(90) = 393.50$—was statistically significant ($p < .01$).

Reliability

Internal consistency was good for BASS-N (Cronbach's α = .80) and BASS-P (Cronbach's α = .87) and acceptable for BASS-C (Cronbach's α = .73). Retest reliability was tested in a subsample ($N = 209$) that completed the questionnaire again after a period of 6 to 8 weeks. Retest reliability was very good for BASS-N (r_{tt} = .81), good for BASS-P (r_{tt} = .74) and modest for BASS-C (r_{tt} = .61).

Discriminant validity. To test the discriminant validity of beliefs about stress with established constructs, such as optimism, pessimism, neuroticism and somatosensory amplification, bivariate correlations between the BASS subscales and measures of the respective constructs were computed (see Table 3). All correlations including the BASS-N and the BASS-P were below .40, indicating high discriminant validity regarding these two subscales. The BASS-C, by contrast, showed medium discriminant validity regarding neuroticism, optimism, and pessimism (all r_{tc} between .40 and .47).

Predictive validity. To assess predictive validity it was investigated whether the BASS would predict subjective stress levels (SSCS) in students under academic stress (end of term exams) using multiple linear regression analysis. Controlling for baseline levels of subjective stress, there was a statistical trend ($p = .062$) of negative beliefs about stress predicting a higher level of subjective stress during exams at follow-up (Step 1; see Table 4). The only statistically significant predictor of the follow-up subjective stress level was baseline stress level. Positive beliefs about stress and control beliefs were not significantly associated with the follow-up subjective stress level.

Additionally, controlling for optimism, neuroticism and somatosensory amplification (Step 2; see Table 4) did not change the association of negative stress beliefs to the subjective stress level at follow up, and neither did it add to the amount of explained variance. Again, in Step 2, the association of negative stress beliefs with the subjective stress level during exams failed to reach statistical significance. However, the variables remained associated by trend ($p = .084$). Positive beliefs about stress and control beliefs were not significantly associated with the follow-up subjective stress level, and neither were optimism, neuroticism and somatosensory amplification. Baseline subjective stress level re-

Table 3
Construct Validity (Pearson's r_{Tc}) of BASS and Stress, Optimism, Pessimism, Neuroticism, Somatosensory Amplification in the Main Sample (N = 445)

Construct	Negative stress beliefs (BASS-N)	Positive stress beliefs (BASS-P)	Control beliefs (BASS-C)
Optimism (LOT-R)	$-.26^{***}$	$.18^{***}$	$.47^{***}$
Pessimism (LOT-R)	$.21^{***}$	$-.15^{**}$	$-.40^{***}$
Neuroticism (BFI)	$.39^{***}$	$-.21^{***}$	$-.42^{***}$
Somatosensory Amplification (SSAS)	$.31^{***}$	$-.15^{**}$	$-.20^{***}$

Note. BASS = Beliefs About Stress Scale; BFI = Big Five Inventory; BASS-N = Subscale negative stress beliefs; BASS-P = Subscale positive stress beliefs. BASS-C = Subscale controllability; Life Orientation Test Revised (LOT-R) Pessimism subscale; Neuroticism (BFI); somatosensory amplification (Somatosensory Amplifications Scale).
$^{**}p < .01$. $^{***}p < .001$.

Table 4
Linear Multiple Regression Analysis Predicting Stress at Follow-Up in n = 216 Students Undergoing End-of-Term Exams

Predictor	*B (SE)*	*t*	*p*	*CI (B)*	β
Step 1	$\Delta R^2 = .51$, $p = .000^{***}$				
Baseline subjective stress (SSCS)	.62 (.05)	11.08	$.000^{***}$	[.52, .73]	.64
Negative stress beliefs (BASS-N)	.23 (.12)	1.71	.062	[.01, .47]	.11
Control beliefs (BASS-C)	−.11 (.28)	.33	.753	[−.69, .45]	−.02
Positive stress beliefs (BASS-P)	−.13 (.18)	.69	.479	[−.50, .24]	−.04
Constant	6.91 (4.83)				
Step 2	$\Delta R^2 = .00$, $p = .912$				
Baseline subjective stress (SSCS)	.61 (.07)	9.30	$.000^{***}$	[.48, .73]	.61
Negative stress beliefs (BASS-N)	.21 (.12)	1.52	.084	[−.04, .44]	.10
Control beliefs (BASS-C)	−.04 (.29)	.12	.905	[−.63, .54]	−.04
Positive stress beliefs (BASS-P)	−.12 (.18)	.64	.510	[−.47, .25]	−.01
Optimism (LOT-R)	−.06 (.13)	.47	.648	[−.32, .19]	−.03
Neuroticism (BFI)	.07 (.27)	.27	.775	[−.44, .65]	.02
Somatosensory amplification (SSAS)	.04 (.08)	.47	.652	[−.13, .22]	.03
Constant	6.61 (5.75)				

Note. BASS = Beliefs About Stress Scale; BFI = Big Five Inventory; SSCS = Screening Scale for the Assessment of Chronic Stress; BASS-N = Subscale negative stress beliefs (range = 8–32); BASS-P = Subscale positive stress beliefs (range = 4–16); BASS-C = Subscale controllability (range = 3–12); Stress (SSCS; range = 0–48); Life Orientation Test Revised (LOT-R) sum scale including both pessimism and optimism subscales (range = 0–24); LOT-R Pessimism subscale (range = 0–12); Neuroticism (BFI; range = 2–10); Somatosensory amplification (SSAS; range = 10–50).
$^{***}p < .001$.

mained as the only significant predictor of follow-up subjective stress level.

Discussion

This study describes the development and psychometric evaluation of a new questionnaire to assess laypersons' beliefs about stress. Investigation of dimensionality revealed that beliefs about stress are multidimensional, including beliefs about the harmfulness of stress (negative stress beliefs), beliefs about the positive aspects of stress, and beliefs about the personal controllability of stress.

Overall, all subscales showed good internal and re-test reliability. The high retest reliability shows that positive and negative beliefs about stress seem to be stable over time, even when external stressors are present (academic exams). This indicates that those stress beliefs are more than just a reflection of a current state. The lower values of the BASS-C scale might be influenced by its shortness (three items). However, it might also indicate that beliefs about the controllability of stress are more flexible and fluctuate over time. This is interesting in light of

the fact that the personal control dimension of the Illness Perception Questionnaire (a frequently used tool to assess laypersons' beliefs about illness) and its short version appears to have lower retest reliability as well (Broadbent, Petrie, Main, & Weinman, 2006; Moss-Morris et al., 2002).

With regards to validity, results show that beliefs about stress seem to be distinct from already established traits in stress research, such as optimism, pessimism, and neuroticism (Carver, Scheier, & Segerstrom, 2010; Gunthert, Cohen, & Armeli, 1999). Furthermore, beliefs about stress appear to be distinct from somatosensory amplification, a concept that refers to the tendency to experience somatic and visceral sensations as noxious, intense and distressing (Barsky et al., 1990). Somatosensory amplification has primarily been associated with the occurrence of somatic symptoms and somatoform disorders (Barsky & Wyshak, 1990; Doering et al., 2015; Rief & Broadbent, 2007), but also with stress and stress-related processes (Nakao, Tamiya, & Yano, 2005; Perez, Barsky, Vago, Baslet, & Silbersweig, 2015). Besides other mechanisms it includes the tendency to negatively appraise bodily sensations as harmful or pathological, which is similar to the mechanisms that presumably underlie the stress beliefs-ill health link (Jamieson et al., 2013) and may explain the small overlap with somatosensory amplification in this study.

The results of this study might also indicate initial evidence of the predictive validity of the BASS. Besides baseline subjective stress levels higher scores on the BASS-N scale seemed to be predictive of the increase of subjective stress levels in students undergoing end of term exams 6 to 8 weeks later. This association remained stable even after controlling for optimism, neuroticism and somatosensory amplification. However, it is noteworthy that this relationship was only present by trend. Future studies with higher statistical power (larger sample sizes, better control of influencing variables) are therefore warranted to replicate this finding. Stronger evidence of the predictive validity the BASS can be found in a recent study in which negative stress beliefs prospectively predicted an increase in somatic symptoms among students under academic stress (Fischer, Nater, & Laferton, 2016). To investigate the predictive validity of positive stress beliefs and beliefs about controllability, future studies are advised to use different target criteria. For instance, positive stress beliefs might be associated with performance under stress and beliefs about controllability with coping behavior.

Limitations

The results of this study have to be interpreted considering certain limitations. In this study, the BASS has been evaluated using a sample of university students. Although stress plays an important role among university students (Robotham & Julian, 2006) and as such it is important to learn more

about stress beliefs in these individuals, extending our findings to other healthy and clinical populations is warranted. This would ideally include the collection of norm data among different populations. Furthermore, it is not possible to rule out that the drop out of participants at the follow-up assessment might have been selective. There was no difference between participants who dropped out and those who completed follow-up assessment on baseline beliefs about stress or baseline stress level. However, participants might have dropped out due to higher levels of stress at follow-up possibly, biasing the results. Additionally, the sample used to qualitatively assess stress beliefs in order to generate the BASS item pool did not only consist of university students. It is possible that stress beliefs might vary between age groups and groups of different educational backgrounds. Further qualitative research should assess stress beliefs in larger samples of university students and additional populations. Future research should also assess discriminant as well as convergent validity with other important constructs in stress research (i.e., primary and secondary appraisal as proposed in the transactional stress model by Lazarus and Folkman, coping, stress reactivity, emotion regulation).

In conclusion, the results of this study show that the BASS offers a promising new way to assess laypersons multidimensional beliefs about stress via a brief, psychometrically evaluated questionnaire. The use of this standardized instrument has the potential to facilitate the research on beliefs about stress as a promising new construct in stress research.

References

Barsky, A. J., & Wyshak, G. (1990). Hypochondriasis and somatosensory amplification. *The British Journal of Psychiatry, 157,* 404–409. http://dx.doi.org/10.1192/bjp.157.3.404

Barsky, A. J., Wyshak, G., & Klerman, G. L. (1990). The somatosensory amplification scale and its relationship to hypochondriasis. *Journal of Psychiatric Research, 24,* 323–334. http://dx.doi.org/10.1016/0022-3956(90)90004-A

Broadbent, E., Petrie, K. J., Main, J., & Weinman, J. (2006). The brief illness perception questionnaire. *Journal of Psychosomatic Research, 60,* 631–637. http://dx.doi.org/10.1016/j.jpsychores.2005.10.020

Carver, C. S., Scheier, M. F., & Segerstrom, S. C. (2010). Optimism. *Clinical Psychology Review, 30,* 879–889. http://dx.doi.org/10.1016/j.cpr.2010.01.006

Chrousos, G. P. (2009). Stress and disorders of the stress system. *Nature Reviews Endocrinology, 5,* 374–381. http://dx.doi.org/10.1038/nrendo.2009.106

Doering, B. K., Nestoriuc, Y., Barsky, A. J., Glaesmer, H., Brähler, E., & Rief, W. (2015). Is somatosensory amplification a risk factor for an increased report of side effects? Reference data from the German general population. *Journal of Psychosomatic Research, 79,* 492–497. http://dx.doi.org/10.1016/j.jpsychores.2015.10.010

Field, A. (2013). *Discovering statistics using SPSS* (4th ed.). London, England: Sage.

Fischer, S., Nater, U. M., & Laferton, J. A. C. (2016). Negative stress beliefs predict somatic symptoms in students under academic stress. *International Journal of Behavioral Medicine*. http://dx.doi.org/10.1007/s12529-016-9562-y

Glaesmer, H., Rief, W., Martin, A., Zenger, M., Hinz, A., & Brähler, E. (2012). Psychometric properties and population-based norms of the Life Orientation Test Revised (LOT-R), *Health Psychology, 2,* 432–445. http://dx.doi.org/10.1111/j.2044-8287.2011.02046.x

Gunthert, K. C., Cohen, L. H., & Armeli, S. (1999). The role of neuroticism in daily stress and coping. *Journal of Personality and Social Psychology, 77,* 1087–1100. http://dx.doi.org/10.1037/0022-3514.77.5.1087

Hagger, M., & Orbell, S. (2003). A meta-analytic review of the common-sense model of illness representations. *Psychology & Health, 18,* 141–184. http://dx.doi.org/10.1080/0887044031000813321

Hammen, C. (2005). Stress and depression. *Annual Review of Clinical Psychology, 1,* 293–319. http://dx.doi.org/10.1146/annurev.clinpsy.1.102803.143938

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika, 30,* 179–185. http://dx.doi.org/10.1007/BF02289447

Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. http://dx.doi.org/10.1080/10705519909540118

Jamieson, J., Mendes, W., & Nock, M. K. (2013). Improving acute stress responses: The power of reappraisal. *Current Directions in Psychological Science, 22,* 51–56. http://dx.doi.org/10.1177/0963721412461500

Jamieson, J. P., Nock, M. K., & Mendes, W. B. (2012). Mind over matter: Reappraising arousal improves cardiovascular and cognitive responses to stress. *Journal of Experimental Psychology: General, 141,* 417–422. http://dx.doi.org/10.1037/a0025719

Jamieson, J., Nock, M. K., & Mendes, W. B. (2013). Changing the conceptualization of stress in social anxiety disorder: Affective and physiological consequences. *Clinical Psychological Science, 1,* 363–374. http://dx.doi.org/10.1177/2167702613482119

Jones, F., & Bright, J. (2001). *Stress: Myth, theory and research*. Essex, England: Pearson Education Limited.

Keller, A., Litzelman, K., Wisk, L. E., Maddox, T., Cheng, E. R., Creswell, P. D., & Witt, W. P. (2012). Does the perception that stress affects health matter? The association with health and mortality. *Health Psychology, 31,* 677–684. http://dx.doi.org/10.1037/a0026743

Kinman, G., & Jones, F. (2005). Lay representations of workplace stress: What do people really mean when they say they are stressed? *Work & Stress, 19,* 101–120. http://dx.doi.org/10.1080/02678370500144831

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal and coping*. New York, NY: Springer.

Ledesma, R. D., & Valero-Mora, P. (2007). Determining the number of factors to retain in EFA: An easy-to-use computer program for carrying out Parallel Analysis. *Practical Assessment, Research & Evaluation, 12,* 1–11.

Leventhal, H., Weinman, J., Leventhal, E. A., & Phillips, L. A. (2008). Health psychology: The search for pathways between behavior and health. *Annual Review of Psychology, 59,* 477–505. http://dx.doi.org/10.1146/annurev.psych.59.103006.093643

Lewig, K. A., & Dollard, M. F. (2001). Social construction of work stress: Australian newsprint media portrayal of stress at work, 1997–98. *Work & Stress, 15,* 179–190. http://dx.doi.org/10.1080/02678370110066986

Moss-Morris, R., Weinman, J., Petrie, K. J., Horne, R., Cameron, L., & Buick, D. (2002). The Revised Illness Perception Questionnaire (IPQ-R). *Psychology & Health, 17,* 1–16. http://dx.doi.org/10.1080/08870440290001494

Muncer, S., Taylor, S., Green, G. W., & McManus, I. C. (2001). Nurses' representations of the perceived causes of work-related stress: A network drawing approach. *Work & Stress, 15,* 40–52. http://dx.doi.org/10.1080/02678370120688

Nabi, H., Kivimäki, M., Batty, G. D., Shipley, M. J., Britton, A., Brunner, E. J., . . . Singh-Manoux, A. (2013). Increased risk of coronary heart disease among individuals reporting adverse impact of stress on their health: The Whitehall II prospective cohort study. *European Heart Journal, 34,* 2697–2705. http://dx.doi.org/10.1093/eurheartj/eht216

Nakao, M., Tamiya, N., & Yano, E. (2005). Gender and somatosensory amplification in relation to perceived work stress and social support in Japanese workers. *Women & Health, 42,* 41–54. http://dx.doi.org/10.1300/J013v42n01_03

Perez, D. L., Barsky, A. J., Vago, D. R., Baslet, G., & Silbersweig, D. A. (2015). A neural circuit framework for somatosensory amplification in somatoform disorders. *The Journal of Neuropsychiatry and Clinical Neurosciences, 27,* e40–e50. http://dx.doi.org/10.1176/appi.neuropsych.13070170

Petrie, K. J., & Weinman, J. (2012). Patients' perceptions of their illness: The dynamo of volition in health care. *Current Directions in Psychological Science, 21,* 60–65. http://dx.doi.org/10.1177/0963721411429456

Rammstedt, P., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41,* 203–212. http://dx.doi.org/10.1016/j.jrp.2006.02.001

Rief, W., & Broadbent, E. (2007). Explaining medically unexplained symptoms-models and mechanisms. *Clinical Psychology Review, 27,* 821–841. http://dx.doi.org/10.1016/j.cpr.2007.07.005

Robotham, D., & Julian, C. (2006). Stress and the higher education student: A critical review of the literature. *Journal of Further and Higher Education, 30,* 107–117. http://dx.doi.org/10.1080/03098770600617513

Rydstedt, L. W., Devereux, J., & Furnham, A. F. (2004). Are lay theories of work stress related to distress? A longitudinal study in the British workforce. *Work & Stress, 18,* 245–254. http://dx.doi.org/10.1080/02678370412331323906

Scheier, M. F., & Carver, C. S. (1985). Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychology, 4,* 219–247. http://dx.doi.org/10.1037/0278-6133.4.3.219

Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: Psychological, behavioral, and biological determinants. *Annual Review of Clinical Psychology, 1,* 607–628. http://dx.doi.org/10.1146/annurev.clinpsy.1.102803.144141

Schulz, P., Schlotz, W., & Becker, P. (2004). *TICS Trierer Inventar zum Chronischen Stress* [TICS Trier inventory for the assessment of chronic stress]. Göttingen, the Netherlands: Hogrefe.

Segerstrom, S. C., & O'Connor, D. B. (2012). Stress, health and illness: Four challenges for the future. *Psychology & Health, 27,* 128–140. http://dx.doi.org/10.1080/08870446.2012.659516

Tabachnik, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn & Bacon.

Wallston, K. A., Strudler Wallston, B., & DeVellis, R. (1978). Development of the Multidimensional Health Locus of Control (MHLC) Scales. *Health Education Monographs, 6,* 160–170. http://dx.doi.org/10.1177/109019817800600107

(*Appendix follows*)

Appendix

Item Pool for the Development of the Beliefs About Stress Scale, Including Item Difficulties (P) in the EFA Subsample (n = 215)

Item no.	Item: Being stressed . . .	P_{EFA}
1	. . . is, for me, a sign of weakness	.18
2	. . . impacts negatively on my ability to perform	.42
3	. . . causes damage to my health in the long run.	.61
4	. . . is something I am able to influence through my actions	.66
5	. . . enables me to work in a more focused manner	.35
6	. . . makes me more productive	.42
7	. . . makes my life more exciting in a positive sense	.19
8	. . . causes damage to my health in the short-term.	.39
9	. . . can affect my state of health to a widely varying degree - from not at all to very strongly—depending on how I deal with it	.42
10	. . . is something from which I only find relief once the stressful phase of my life has passed	.15
11	. . . drains a good deal of my energy	.66
12	. . . is something I am able to control to a certain degree	.52
13	. . . makes me less resilient	.37
14	. . . is something I am helpless to control	.41
15	. . . is something I need to avoid	.60
16	. . . enables me to reach my full potential	.36
17	. . . is something I am able to handle only with help from others	.56
18	. . . is, for me, a predominantly negative thing	.45
19	. . . is not problematic for me to deal with	.23
20	. . . is, for me, a part of life	.47
21	. . . activates my resources.	.42
22	. . . is something I am able to influence positively using my thoughts	.39
23	. . . is, for me, a predominantly positive thing	.17
24	. . . is something I am able to mitigate using particular strategies	.46

Received February 20, 2016
Revision received August 14, 2016
Accepted August 26, 2016 ■