Psychological Reports
2023, Vol. 126(5) 2564–2593

DOI: 10.1177/00332941221074262
journals.sagepub.com/home/prx
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Development of a Scale to Examine Responses to Bodily Sensations

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Abstract

Objective: Individual differences in the perception of bodily sensations is known to be associated with affective symptomatology. However, the way people *psychologically* respond to everyday bodily sensations has not been examined in a systematic and balanced way. Thus, we developed the Bodily Sensations Response Scale (BSRS) to evaluate participants' self-reported cognitive, emotional, and behavioral responses to their bodily sensations. We investigated the scale's factor structure and its psychometric properties in two studies.

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Method: In *Study 1*, 297 participants completed the 50-item BSRS and exploratory factor analysis (EFA) was performed on the responses. In *Study 2* (N = 284), confirmatory factor analysis (CFA) was used to confirm the factor structure of the 32-item BSRS identified in Study 1.

Results: In *Study* 1, the EFA identified a 32-item three-factor solution as the best fit for the data. Factor 1 described a defeat response to bodily sensations, Factor 2 described an acceptance response, and Factor 3 described a sensitization response. In *Study* 2, the three-factor solution was shown not to be parsimonious. Rather, CFA identified that the 27-item BSRS had two interpretable factors (Defeat and Acceptance) that explained participants' psychological responses to bodily sensations. The Defeat subscale was moderately to strongly correlated with awareness of bodily sensations (i.e., Body Perception Questionnaire-Short Form scores) and depression, anxiety, and stress symptom severity (i.e., Depression Anxiety Stress Scales-21 scores), whereas the Acceptance subscale was unrelated or only slightly negatively correlated to awareness of bodily sensations and depression, anxiety, and stress symptoms.

Conclusion: The 27-item BSRS provides a psychometrically robust assessment of the way in which people psychologically respond to everyday bodily sensations. The measure can assist researchers to better understand how people psychologically process their salient bodily sensations and how this is linked to psychopathology.

Keywords
bodily sensation awareness, defeat, acceptance, sensitization, interoception, depression, anxiety, stress

Interoception involves the conscious awareness of internal bodily sensations (e.g., bowel fullness motivates controlled voiding) (Garfinkel & Critchley, 2013; Khalsa&Lapidus, 2016). It consists of three distinct dimensions: (1) interoceptive accuracy or the ability to accurately detect or discriminate body sensations; (2) interoceptive sensibility (IS) or the experience of and tendency to focus on body sensations; and (3) interoceptive awareness or the metacognitive correspondence between subjective confidence in the ability to accurately detect body sensations and objective interoceptive accuracy performance (Garfinkel et al., 2015). Interoceptive accuracy is most commonly assessed via behavioral tests (e.g., heartbeat tracking task; Schandry, 1981), IS through self-report scales (e.g., Body Perception Questionnaire; BPQ; Porges, 1993) or self-rated confidence in interoceptive accuracy (Garfinkel et al., 2015), and interoceptive awareness through the difference between self-rated confidence in interoceptive accuracy tasks and performance on the tasks (Garfinkel et al., 2015). Of the three dimensions, only IS assesses subjective awareness of bodily sensations, which is thought to most closely align with the subjective experience of emotion and psychological distress (Mehling, 2016).

Specifically, recent research has demonstrated that the perception of body sensation information underpins our sense of self-awareness, feelings/emotion, and complex social functions, such as empathy (Lamm & Singer, 2010; Singer et al., 2009). In part, this is due to the ability of the insular cortex to integrate this sensory information (i.e., "bottom-up" processes) with salient cognitive information (i.e., "top-down" processes; for example, fear of arousal sensations) that could have adaptive (or emotional) significance (Craig, 2014; Critchley & Garfinkel, 2015). In addition, interoceptive accuracy and IS differences have been detected in people with anxiety disorders and neurodevelopmental disorders that are characterized by emotion processing and/or emotion regulation problems such as alexithymia (Brewer et al., 2016; Domschke et al., 2010; Dunn et al., 2010; Khalsa et al., 2018; Mallorquí-Bagué et al., 2014; Murphy et al., 2017). Further, atypical interoceptive accuracy and IS have been detected in people with depressive disorders (Harshaw, 2015; Solano López & Moore, 2019), autism spectrum disorder (DuBois et al., 2016), post-traumatic stress disorder (van der Kolk, 2015), insomnia disorder (Wei et al., 2016), and suicidal ideation/behavior (Forkmann et al., 2019). However, in most cases, it is unclear how people with these disorders *psychologically process* the sensory information after it is perceived. Most of what we know relates to anxiety disorder development not the development of other psychopathologies linked to interoceptive dysfunction (e.g., depressed mood) (Domschke et al., 2010). Specifically, most studies have evaluated the cognitive processing of aversive bodily sensations (e.g., palpitations and rapid breathing) linked to anxiety disorders (e.g., Panic Disorder; Clark, 1986). Maladaptive cognitive responses to anxiety-related body sensations include an exaggerated focus on the sensations, magnification/amplification, rumination, and catastrophic outcome beliefs (Clark et al., 1997) and people who are fearful of panic- and anxiety-related body sensations tend to be hypervigilant to the sensations (Anderson & Hope, 2009; Olatunji et al., 2007). Thus, certain "top-down" processes (e.g., fear or anxiety-sensitivity) likely mediate between the exaggerated awareness of bodily sensations (i.e., IS; "bottom-up" process) and anxiety disorder development, consistent with the *Insular Model of Anxiety* (Paulus & Stein, 2010) and the *Embodied Predictive Interoceptive Coding* model (Barrett & Simmons, 2015).

Several scales have been developed to evaluate the psychological processing of panic-and anxiety-related sensations including the Body Sensations Questionnaire (BSQ; 18-item; Chambless et al., 1984); Body Sensations Interpretation Questionnaire (BSIQ; 27-item; Clark et al., 1997); and Physical Concerns subscale (7-item) of the Anxiety-Sensitivity Index (16-item; Reiss et al., 1986). However, these scales focus only on anxiety-related body sensations (not sensations linked to other types of psychopathology, for example, depression-related sensations). Further, the scales tend to use negatively valenced wording and reference aversive sensations and aversive psychological responses. This omission is pertinent as mindfulness practice, mindful-attention, and non-judgmental acceptance can increase a person's awareness of their body sensations (Mehling et al., 2011) but if this heightened awareness is paired with mindful-acceptance, the risk of experiencing affective distress can be mitigated (Price & Hooven, 2018). That is

to say, sensory hyper-awareness may result in positive psychological benefits (Price & Hooven, 2018) *or* affective psychopathology (Schulz & Vögele, 2015) depending on how the sensory information is processed psychologically.

In an attempt to fill the void (Mehling et al., 2012), developed the Multidimensional Assessment of Interoceptive Awareness (MAIA-2; 37-item; Mehling et al., 2018) to examine interoceptive awareness (i.e., body-listening, noticing), attention-regulation (e.g., attention-regulation and not-distracting), psychological processing of emotion-related stimuli (e.g., emotional awareness and self-regulation), and anxiety-related cognitions (e.g., not-worrying and trusting) using a mindfulness-based framework. Despite the many contributions of the MAIA-2 to the field, the MAIA-2 items are mostly anxiety-specific, negatively valanced (e.g., unpleasant sensations contributing to feeling overwhelmed), and focus on the psychological processing of anxiety-related body sensations.

Thus, existing scales can only evaluate cognitive responses to anxiety-related bodily sensations. There is no scale that (a) examines psychological responses to *all* bodily sensations not just the anxiety-related ones; (b) broadly assesses cognitive, emotional, and behavioral responses to bodily sensations not just the cognitive ones; and (c) systematically examines neutral, positive, and negative responses to bodily sensations not just the negative ones. Furthermore, the experience of affective distress (e.g., anxiety and depression) is strongly linked to the perception of low personal control (e.g., low self-efficacy; Muris, 2002; Tahmassian & Jalali Moghadam, 2011), but none of the aforementioned scales has explored the degree of agency that is felt when a person experiences their bodily sensations. In this regard, an instrument that could comprehensively capture the ways in which people psychologically process their body sensation information might assist researchers to better understand how interoceptive awareness—and the way it is psychologically processed-is linked to the development of *non*-anxiety psychopathologies.

The Current Study

To address these gaps in the literature, we developed the *Bodily Sensations Response Scale* (BSRS) to broadly examine people's cognitive, emotional, and behavioral responses to their bodily sensations. The BSRS is an adapted version of the Tinnitus Response Scales (TRS; Croft et al., 2013a) that assesses psychological responses to a single body sensation–chronic tinnitus. TRS development was informed by cognitive-behavioral models of tinnitus distress (McKenna et al., 2014, 2017) and theories linked to Mindfulness-Based Cognitive Therapy (Segal et al., 2013) and Acceptance and Commitment Therapy (Hayes et al., 1999). The TRS has a three-factor structure (i.e., defeat, control, and acceptance). Each subscale is different in terms of the degree of agency that is felt by people using each response pattern, and each is linked to a different pattern of tinnitus severity, tinnitus distress, depression, anxiety, and stress (Croft et al., 2013a). Specifically, defeat responses were associated with constant, severe, and distressing tinnitus, an exaggerated perception of tinnitus threat, and high

depression, anxiety, and stress levels. In contrast, control responses were related to tinnitus severity and tinnitus threat but not psychopathology, whereas acceptance was associated with chronic and/or less severe tinnitus and low tinnitus threat, and it was unrelated to depression, anxiety, and stress levels (Croft et al., 2013a).

In the BSRS, we replaced the words "tinnitus" and "tinnitus noise" with "bodily sensations." Similar to the TRS, the BSRS utilized a putative three-factor model (i.e., defeat, effortful control, and acceptance). *Defeat* is characterized by feelings of resignation, helplessness, and/or hopelessness related to bodily sensations that is linked to perceptions of little or no agency (e.g., Item 12: "*I feel helpless because of my bodily sensations*"). *Effortful control* is characterized by attempts to control the sensations or awareness of them (e.g., directing attention away from them) reflecting a higher degree of perceived agency in regards to the sensations (e.g., Item 7: "*I purposely change the way I think about my bodily sensations to improve my quality of life*"). *Acceptance* describes a neutral psychological response to the sensations reflecting that a person is neither concerned nor bothered by the sensations and lacks the need to control or react to them (e.g., Item 31: "*I willingly accept my bodily sensations*").

Our initial approach to scale development resulted in many usable items to tap cognitive and emotional responses to body sensations but fewer behavioral responses to the sensations. Consistent with behavioral theory and research (Groves & Thompson, 1970; Thompson & Spencer, 1966), we developed additional items to explore the effects of sensory awareness on behavior (e.g., exercise and substance use), sensitization, behavioral avoidance of the sensations (e.g., distraction), and discrimination between the sensations. We also developed items to tap participants' awareness of the stimulus characteristics that increase (or decrease) the chances of sensitization occurring (Rankin et al., 2009), including stimulus intensity (e.g., Item 19: "*My bodily sensations are vague and hard to describe*"), duration (e.g., Item 14: "*My bodily sensations last for a long time*"), frequency (e.g., Item 44: "*The more often I experience the bodily sensations the less important they are to me*"), and changes (e.g., Item 36: "*I notice it whenever my bodily sensations change*"). The latter items were included as people with a heightened awareness of their body sensations: (a) tend to notice salient attributes of the sensations (e.g., intensity) and (b) they may become behaviorally sensitized to them (McCurry et al., 2020). Thus, we expected there to be an additional BSRS factor (i.e., "sensitization") that was comprised of items tapping the effects of bodily sensations on behavior, behavioral avoidance and sensitization, and the stimulus characteristics of the sensations.

In two studies, we investigated whether the BSRS adequately described participants' cognitive, emotional, and behavioral responses to bodily sensations across four (putative) psychological response subscales: sensitization, effortful control, defeat, and acceptance. Each response pattern was expected to vary in regards to the degree of felt agency inherent in each response. Consistent with the prior literature, including that pertaining to the TRS, we hypothesized that:

1. BSRS items and its factor structure will describe participants' negative, positive, and neutral responses to their bodily sensations and vary in regards to the degree of their felt agency related to the sensations;
2. Defeat responses will be positively correlated with sensitization and effortful control responses; and defeat, sensitization, and effortful control will be negatively correlated with acceptance;
3. Sensitization, control, and defeat will be positively correlated with awareness of bodily sensations (i.e., BPQ subscales of Body Awareness [BA], Supradiaphragmatic Reactivity [SUPR] and Subdiaphragmatic Reactivity [SUBR]), whereas acceptance will be unrelated or slightly negatively correlated to this awareness; and
4. Defeat and sensitization responses will be positively correlated to depression, anxiety and stress symptoms (i.e., Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995), but not effortful control and acceptance.

Study 1: Scale Development and Exploratory Factor Analysis

Method

Initial Scale Development. The BSRS is an adapted version of the TRS that replaced the words "tinnitus" and "tinnitus noise" with "bodily sensations" and included items that putatively tapped defeat, effortful control, acceptance, and sensitization responses to bodily sensations. A panel of experts reviewed the 33 original scale items that were piloted on a small sample ($N = 10$) of postgraduate psychology students. The scale was then re-circulated to the expert panel for further comment, and based on their feedback, 17 additional effortful control and sensitization items were developed to comprehensively tap these responses, and some items were reworded to improve clarity. Pilot testing of the 50-item scale was conducted using a convenience sample of 147 undergraduate psychology students who reported the definition of bodily sensations and scale items were easy to understand and answer. The 50 items in the initial version of the BSRS are provided in (Appendix A).

Participants. Study 1 was conducted with full ethics approval from the Australian National University (ANU) Human Research Ethics Committee (Protocol Number 2018/430). Participants were indirectly recruited via online advertisements placed on an Australian university psychology student email list, webpages, and student research participation scheme, and email snowballing. Study inclusion criteria required participants to be 18-years or older and currently living in Australia. First- and second-year undergraduate psychology students could receive 1-hour course credit for their participation. No other remuneration or incentive was offered to participants. The study ran from March 2020 to July 2020.

Of the 396 people who clicked on the URL in the online study advertisement, we excluded the data from one participant who did not meet the age criterion, five who

were not Australian residents, and 93 who did not complete all study questions. The final 297 participants comprised 198 females (66.7%), 95 males (32%), and four people who identified their gender as "other." Mean age of the participants was 24.7 years (SD = 11.37; range: 18–77 years). More than three-quarters (79.5%, N = 236) of them were under 26-years of age, 16 were aged 26–29-years, 25 were aged 30–48-years, and 20 were aged 50-years or older. Most participants (56.9%, N = 169) were psychology students, 102 (34.3%) participants reported a formal diagnosis of an anxiety or depressive disorder and one (0.3%) diagnosis of Autism Spectrum Disorder.

Materials

The study was delivered online using the web-based survey software Qualtrics (version 2020). Participants were asked about demographics (gender, age, education, employment status) and if they had a current diagnosis of a mental health condition; and if so, they were asked to specify the disorder, category of health professional who diagnosed the disorder, and whether they were currently receiving treatment for the disorder. They were then asked to complete the BSRS.

Body Sensations Response Scale. Cognitive, emotional, and behavioral responses to awareness of bodily sensations were assessed using the draft version of the BSRS (50-item) that putatively consists of four response scales: (1) sensitization, (2) effortful control, (3) defeat, and (4) acceptance. In each item, respondents were asked to rate the frequency with which they responded to a single bodily sensations using 5-point scales ranging from 0 (*never*) to 4 (*always*). A definition of bodily sensations was provided at the start of the scale including examples of common bodily sensations (Appendix A).

Procedure. Interested individuals clicked on the link imbedded in the study advertisement which provided information about the study, including its voluntary nature and the ability to withdraw from the study at any time by closing the browser window. They were then asked to provide their consent to participate, confirm they were 18-years or older and lived in Australia, and answer the questions asking about demographics and psychological responses to their bodily sensations (i.e., BSRS).

Data analysis. We investigated the factor structure of the 50-item BSRS using exploratory factor analysis (EFA) in IBM SPSS Statistics (version 26). The final sample size of 297 was deemed appropriate to identify a stable factor solution based on several criteria. (Allen et al., 2019) advise that there should be a minimum of five participants per item, suggesting that a minimum of 250 participants (5 × 50 items) is required, although around 300 participants constitutes a good sample size irrespective of the number of items (Comrey & Lee, 1992; Field, 2018; Tabachnick & Fidell, 2019).

In addition, many items correlated at ≥ .30 suggesting the presence of common underlying factors (Allen et al., 2019). The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was .90 indicating substantial common variance

(Kaiser, 1970, 1974), and Bartlett's test of sphericity was statistically significant [$\chi^2 = 7880.5$, $p < .001$] suggesting the items were interdependent and that redundancy exists (Bartlett, 1950). Accordingly, the sample was considered appropriate for EFA on the BSRS items.

Results

Exploratory Factor Analysis. To identify the number of underlying factors, the 50 items were subjected to principal axis factoring (PAF) (Allen et al., 2019; Field, 2018). PAF was selected in preference to Principal Components Analysis as PAF is able to estimate the underlying factors in a data set, which allows for the results to be generalisable as a theory. The screen test results (Cattell, 1978) showed inflexions justifying the retention of two or four factors, whereas parallel analysis (Horn, 1965) identified four factors with eigenvalues that exceeded the criterion values for a randomly generated data matrix (100 iterations) using 50 items and 297 participants. Therefore, a four-factor solution was selected for initial rotation using the direct oblimin method noting that these methods tend to over-dimensionalize with a larger number of items.

Four-Factor Solution. The initial 4-factor solution of the 50-item BSRS explained 43.90% of the total variance in BSRS scores. Items with a primary factor loading <.40 were removed and the analysis was re-run until all items met criterion for a primary factor loading ≥.40 (Hair et al., 1998). On this basis, 14 items were removed and the analysis was re-run on the remaining 36 items. The 4-factor model (rotated using direct oblimin) with 36-items explained 49.50% of the total variance. Factors 1, 2, and 3 had good internal consistency with Cronbach alpha coefficients of .95, .80, and .87, respectively. However, the four-factor solution was not considered viable as Factor 4 consisted of only three items, had poor internal consistency with a Cronbach alpha coefficient of .57, and explained only 3.2% of the score variance.

Three-Factor Solution. In the three-factor EFA, we removed 18 items that did not have a primary factor loading ≥.40, leaving 32 items. EFA was re-run on the 32 items and the 3-factor solution explained 48.80% of total score variance. All items loaded >.40 on the assigned factor and all Cronbach alpha coefficients were acceptable (see Table 1). *Factor 1* items described a negative psychological response to bodily sensations characterized by persistent awareness, perceived threat, feeling overwhelmed, despair, helplessness, defeat, distress, impaired concentration, and low acceptance. *Factor 2* items reflected a pattern of transient or reduced awareness of the sensations, acceptance of the sensations, not seeking to suppress, block out, avoid or control the sensations, not dwelling on or becoming distressed by the sensations, and a lack of consequences (e.g., did not interrupt activities or concentration). *Factor 3* items mostly loaded negatively onto the factor and described heightened awareness of the sensations, dwelling on the sensations, sensitization to the sensations, and difficulty managing thinking and adaptation to the sensations.

Table 1. Summary of Exploratory Factor Analysis for the Three-Factor Solution of the 32-Item Bodily Sensations Response Scale (N = 297).

	Rotated factor loadings		
Item	1	2	3
1. My bodily sensations are all too much	.83		
2. I often think I cannot take my bodily sensations anymore	.81		
3. I despair because of my bodily sensations	.79		
4. I am worn down by my bodily sensations	.78		
5. I feel helpless because of my bodily sensations	.77		
6. It distresses me that my bodily sensations prevent me from enjoying life	.76		
7. My bodily sensations have ruined my life	.75		
8. Focusing on my bodily sensations will eventually threaten my mental health	.73		
9. My bodily sensations have negatively influenced my close relationships	.72		
10. It is difficult to accept my bodily sensations	.71		
11. It is difficult to accept that I will always have the bodily sensations	.70		
12. My bodily sensations are the worst thing that has happened to me	.69		
13. I feel defeated by my bodily sensations	.68		
14. I cannot concentrate on anything because of my bodily sensations	.65		
15. My bodily sensations last for a long time	.64		
16. My bodily sensations distract me from doing other things, even if it is important	.61		
17. It takes effort to maintain concentration due to my awareness of the bodily sensations	.56		
18. I can get on with what I am doing despite the bodily sensations		.72	
19. I do not try to control my bodily sensations		.68	
20. Despite being aware of the bodily sensations, I can concentrate on tasks without needing effort or will		.64	
21. I simply let my bodily sensations be there in the background		.63	
22. I can feel peaceful and be aware of my bodily sensations		.61	
23. I willingly accept my bodily sensations		.54	
24. I do not need to suppress or block out my awareness of the bodily sensations		.52	
25. I am not aware of my bodily sensations when I am working		.52	
26. I do not use alcohol or drugs/exercise/electronic devices or other activities to manage my bodily sensations		.42	
27. I become less aware of the bodily sensations as time goes by			-.58
28. I get used to particular bodily sensations			-.55
29. I lose awareness of my bodily sensations over time			-.53
30. I try not to dwell on my bodily sensations in order to cope			-.52
31. Most days I try to manage my thoughts about my bodily sensations			-.51

(continued)

Table 1. (continued)

Item	Rotated factor loadings 1	2	3
32. When I become aware of the bodily sensations my awareness soon passes			-.50
% of variance	32.6	11.5	4.7
Cronbach alpha coefficient	.95	.85	.74

Note. Loadings reported from direct oblimin rotation pattern matrix. Factor loadings <.40 are not included.

Study 2: Confirmatory Factor Analysis and Reliability and Validity Analysis

Method

Participants. Study 2 was conducted with ethics approval from the applicable ANU Human Research Ethics Committee (Protocol Number 2018/430). Participants were indirectly recruited to the study via online advertisements placed on undergraduate psychology student email lists, student interest webpages, psychology student research participation scheme, and email snowballing. Participants were required to be 18-years or older and currently living in Australia to participate. First- and second-year psychology students could receive 1-hour course credit for their participation. No other remuneration or incentive was offered to participants. Study 2 ran from July 2020 to August 2020.

A total of 284 participants completed Study 2 including 218 females (76.8%), 57 males (20.1%), and nine people who identified their gender as "other" (3.2%). Mean age of participants was 24.74-years (SD = 7.89; range: 18–58 years), with more than three-quarters (77.1%, n = 219) of them being under 26-years of age. Most participants (95.8%, N = 274) were psychology students, and 108 (37.8%) participants reported a formal diagnosis of an anxiety or depressive disorder and one (0.3%) diagnosis of Autism Spectrum Disorder.

Materials. In addition to the 32 BSRS items that loaded strongly onto the three-factor solution in Study 1, we included the following external validity measures.

Body Perception Questionnaire-Short Form. Body awareness and autonomic nervous system (ANS)-reactivity were assessed using the Body Awareness (BA; 26-item), Supradiaphragmatic Reactivity (SUPR; 15-item), and Subdiaphragmatic Reactivity (SUBR; 6-item) subscales of the Body Perception Questionnaire-Short Form (BPQ-SF; Cabrera et al., 2018). The BA subscale assesses sensitivity to *all* bodily functions, SUPR assesses responses to sensations from autonomically innervated organs above

the diaphragm, and SUBR assesses responses to sensations from autonomically innervated gastrointestinal organs below the diaphragm. Respondents were asked to rate each item using five-point scales ranging from 1 (*never*) and 5 (*always*), with high scores indicating high BA, SUPR, and SUBR. The subscales are reported to have excellent internal consistencies with Cronbach alpha coefficients of .92–.96 for BA, .88–.94 for SUPR, and .77–.87 for SUBR (Cabrera et al., 2018). In this study, Cronbach alpha coefficients were .95 for BA, .91 for SUPR, and .83 for SUBR.

Depression Anxiety Stress Scales–2. Depression, anxiety, and stress symptom severity over the past week was assessed using the Depression Anxiety Stress Scales-21 (DASS-21; 21-item; Lovibond & Lovibond, 1995). Respondents were asked to rate each item using 4-point scales ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much or most of the time*), with high scores indicating more severe symptoms. According to (Antony et al., 1998), DASS-21 subscales have excellent internal consistency, with Cronbach alpha coefficients of .94 for depression, .87 for anxiety, and .91 for stress. In this study, Cronbach alpha coefficients were .91 for depression, .82 for anxiety, and .88 for stress.

All participants were invited to complete the survey twice approximately 90 days apart.

Data Analysis. The aim of Study 2 was to identify the strongest and most meaningful factor solution for the 32-item BSRS identified in Study 1. This analysis was undertaken by (i) confirming the factor structure of the BSRS using Confirmatory Factor Analysis (CFA) and (ii) comparing the relationships between each viable factor solution to the relevant external variables. The strongest and most meaningful factor solution was expected to have strong and robust CFA fit indices and to provide significant correlations with the external variables.

CFA with maximum likelihood estimation was conducted using Jamovi Statistical Software (version 1.2) to confirm the factor structure of the 32-item BSRS identified in Study 1. Study 2's sample size of 284 was considered sufficient to identify stable factor solutions (Allen et al., 2019; Comrey & Lee, 1992; Field, 2018; Tabachnick & Fidell, 2019). Three structural models were tested: a one-factor model in which all items loaded onto a single factor (1); a two-factor model (2); and a three-factor model (3). The capacity of each model to reproduce variance in the data was assessed by the following goodness-of-fit indices and values: Standardized Root Mean Square Residual (SRMR; Bentler, 1995) close to .05 or less (Byrne, 1998); Root Mean Square Error of Approximation (RMSEA; Steiger & Lind, 1980) close to .06 or less (Hu & Bentler, 1999); Comparative Fit Index (CFI; Bentler, 1990) close to .95 or greater (Hu & Bentler, 1999); and Tucker–Lewis Index (TLI; Tucker & Lewis, 1973) close to .95 or greater (Hu & Bentler, 1999).

The factor scores from each model were calculated in IBM SPSS Statistics (version 26) and used to assess the reliability, validity, and correlation to demographic variables in the sample. The test–retest reliability of the BSRS was examined by comparing the

Table 2. Model Fit Indices for the Original and Final Bodily Sensations Response Scale ($N = 284$).

Model		χ^2	df	χ^2/df	CFI	TLI	RMSEA	90% CI RMSEA LB	90% CI RMSEA UB	SRMR
1	Original	1810	464	3.90	.717	.687	.101	.096	.106	.098
	Final	367	161	2.28	.943	.933	.067	.058	.076	.043
2	Original	1322	463	2.86	.819	.806	.081	.076	.086	.086
	Final	692	317	2.18	.914	.904	.065	.058	.071	.055
3	Original	1172	461	2.54	.850	.839	.074	.069	.079	.087
	Final	838	396	2.12	.904	.895	.063	.057	.069	.068

Note. CFI = Comparative Fit Index, TLI = Tucker–Lewis Index, RMSEA = Root Mean Square Error of Approximation, CI = Confidence Interval, LB = Lower Bound, UB = Upper Bound, SRMR = Standardized Root Mean Square Residual. Model 1 = one factor, Model 2 = two factors, and Model 3 = three factors. Original models contain all 32 items, Final models have weak items (<.40) removed and error covariances estimates: Model 1 (20-items), Model 2 (27-items), and Model 3 (30-items).

scores of participants who completed the BSRS for a second time 90 days after completing it for the first time. Correlations between the factor scores and the subscales scores of the BPQ-SF and DASS-21 were examined to assess convergent validity.

Results

Confirmatory Factor Analysis. First, the viable factor structures of the 32 items identified in Study 1 were investigated using CFA (see Table 2). As the one-, two-, and three-factor models contained a number of items with weak factor loadings (<.40), the items were removed, and the models were re-run (Hair et al., 1998). This process resulted in the removal of 12 items from the one-factor model, five items from the two-factor model, and two items from the three-factor model. To account for similar item wording and content, we estimated several pairs of the item covariances (supported by significant modification indices): nine pairs for the one-factor solution, six pairs for the two-factor solution, and six pairs for the three-factor solution. Further, the modification indices for each model did not identify any alternate pathways.

The goodness-of-fit indices and values of the original and final versions of the three models are presented in Table 2. The final versions of Model 1 (i.e., the 20-item one-factor model) and Model 2 (i.e., the 27-item two-factor model) provided good fit for the data as assessed by the goodness-of-fit indices and values. The correlation between Factors 1 and 2 of the two-factor model was large and significant ($r = -.62$, $p < .001$). The final version of Model 3 (i.e., the 30-item three-factor model) provided a relatively poor fit for the data. The correlations between Factors 1 and 2 ($r = -.63$, $p < .001$) and Factors 2 and 3 ($r = .53$, $p < .001$) were large and significant; however, the correlation between Factors 1 and 3 was small and non-significant ($r = -.13$, $p = .067$). Given Model 3's poor goodness-of-fit statistics and the non-significant correlation between

Table 3. Correlations between the Three-Factor Models of Bodily Sensations Response Scale and the Body Perception Questionnaire-Short Form Subscales and the Depression Anxiety and Stress Scales-21 Subscales (N = 284).

BSRS Models		BPQ-SF Subscales			DASS-21 Subscales		
		BA	SUPR	SUBR	Depression	Anxiety	Stress
One-factor							
	Factor 1	.42**	.58**	.54**	.49**	.59**	.52**
Two-factor							
	Factor 1	.43**	.59**	.56**	.47**	.58**	.49**
	Factor 2	–.15*	–.09	–.09	–.07	–.13*	–.08
Three-factor							
	Factor 1	.43**	.59**	.56**	.47**	.58**	.49**
	Factor 2	–.18**	–.07	–.07	–.01	–.06	.01
	Factor 3	.01	.03	.01	–.02	–.09	–.08

Note. BSRS = Body Sensations Response Scale, BPQ-SF = Body Perception Questionnaire-Short Form, DASS-21 = Depression, Anxiety, Stress Scales −21, BA= Body Awareness, SUPR = Supradiaphragmatic Reactivity, SUBR = Subdiaphragmatic Reactivity.
* $p < .05$ (2-tailed). ** $p < .01$ (2-tailed).

Factors 1 and 3, the three-factor model was not a considered a viable factor solution and removed from future analyses.

Both Models 1 and 2 had acceptable internal reliability statistics. Model 1 had a McDonald's omega coefficient of .95, while Model 2 had a McDonald's omega coefficient of .95 for Factor 1 and a Cronbach's alpha coefficient of .85 for Factor 2. Model 1 had a test–retest reliability of .76, and Factors 1 and 2 of Model 2 had test–retest reliability of .76 and .72, respectively.

Validity Analyses. Pearson's correlation coefficients were calculated to investigate the relationships between the BSRS factors in the final version of each model and all the BPQ-SF and DASS-21 subscales (Table 3). The one-factor model and Factor 1 in the two-factor and three-factor models was moderately to strongly positively correlated to all BPQ-SF and DASS-21 sub-scores. Factor 2 in the two-factor model was weakly negatively correlated to BA (in the BPQ-SF) and Anxiety (in the DASS-21) but uncorrelated with SUPR and SUBR (in the BPQ-SF) and DASS-21 Depression and Stress. In the three-factor model, Factor 2 had similar correlations to that observed in the two-factor model, although Factor 3 was not significantly correlated to any BPQ-SF or DASS-21 sub-scores.

When comparing the models, the goodness-of-fit statistics were acceptable for both Model 1 (the one-factor model) and Model 2 (the two-factor model). Both models had excellent internal consistency and acceptable test–retest reliability. The correlations with the BPQ-SF and DASS-21 subscales suggested that Model 2 provided a conceptually more meaningful understanding of the relationship of the two primary

responses to bodily sensations, that is, defeat and acceptance. The one-factor model may be less useful in understanding the nature of both responses, in addition to a dialectic response pattern that measures both acceptance and defeat simultaneously. Therefore, we proceeded with the 27-item two-factor solution.

Given the strength of the two-factor interpretation, we further investigated its structure. Factor 1 (the Defeat subscale) of the two-factor BSRS model described a negative cognitive, emotional, and behavioral response to bodily sensations including persistent awareness of the sensations, negative thinking and affect (i.e., threatening, despair, helplessness, defeat, distress, and overwhelmed), cognitive consequences (e.g., difficulty concentrating), little acceptance of the sensations, and resignation that was linked to little perceived control over the sensations. In contrast, Factor 2 (the Acceptance subscale) described a neutral cognitive, emotional, and behavioral response to bodily sensations, including acceptance of the sensations, reduced awareness of the sensations, low need to engage in negative thinking or experience negative affective consequences, and little need to control the sensations.

From the original item-pool developed for Study 1, 12 items that were written to assess "defeat" responses (Items 4, 9, 12, 13, 15, 23, 27, 40, 43, 45, 47, and 48), two "acceptance" items (Items 28 and 39), two "sensitization" items (Items 14 and 17), and one "effortful control" item (Item 11) loaded onto the 17-item Defeat subscale of the two-factor model. Three "acceptance" items (Items 31, 33, and 37), six "sensitization" items (Items 21, 24, 35, 38, 46, and 49) and one "effortful control" item (Item 42) loaded onto the 10-item Acceptance subscale. The two "acceptance" items (Items 28 and 39) that loaded onto the Defeat subscale describe negative responses to bodily sensations (Item 28 is "It is difficult to accept that I will always have bodily sensations" and Item 39 is "It is difficult to accept my bodily sensations") and were more appropriately characterized as "defeat" items. Therefore, all items had appropriate content for their scale and loaded appropriately (>.40) (Table 4).

Descriptive Statistics. Descriptive statistics for the 27-item two-factor BSRS are presented in Table 5. Scores on Factor 1 (the Defeat subscale) were not normally distributed as assessed by skewness and kurtosis statistics, visual examination of Q-Q plots, and Kolmogorov–Smirnov test ($p < .001$), whereas Factor 2 (the Acceptance subscale) scores were normally distributed. Thus, we utilized non-parametric techniques that do not rely on assumptions of score normality (i.e., McDonald Omega, Mann–Whitney U Test, and Kruskal–Wallis Test) to assess the reliability and validity of Factor 1, and parametric techniques to assess the reliability and validity of Factor 2 (i.e., Cronbach's alpha, independent-samples t-tests, and one-way between-groups ANOVA).

Mental Health Diagnosis Differences. One-hundred-eight participants self-reported having a current mental health problem. A Mann–Whitney *U* Test revealed a statistically significant difference in the Defeat subscale scores of participants who self-reported a mental health problem ($Md = 15.00$, $n = 108$) and those not reporting a

Table 4. Confirmatory Factor Analysis Standardized Factor Loadings of the 27-Item Bodily Sensations Response Scale (N = 284).

	Standardized factor loadings	
Item	Defeat	Acceptance
1. I feel defeated by my bodily sensations (4)	.75	
2. It distresses me that my bodily sensations prevent me from enjoying life. (9)	.79	
3. It takes effort to maintain concentration due to my awareness of the bodily sensations. (11)	.59	
4. I feel helpless because of my bodily sensations. (12)	.84	
5. My bodily sensations are the worst thing that has happened to me. (13)	.73	
6. My bodily sensations last for a long time. (14)	.72	
7. I cannot concentrate on anything because of my bodily sensations. (15)	.75	
8. My bodily sensations distract me from doing other things even it is important. (17)	.74	
9. My bodily sensations have ruined my life. (23)	.67	
10. I despair because of my bodily sensations. (27)	.80	
11. It is difficult to accept that I will always have the bodily sensations. (28)	.73	
12. It is difficult to accept my bodily sensations. (39)	.71	
13. My bodily sensations have negatively influenced my close relationships. (40)	.62	
14. I often think I cannot take my bodily sensations anymore. (43)	.69	
15. My bodily sensations are all too much. (45)	.78	
16. I am worn down by my bodily sensations. (47)	.77	
17. Focusing on my bodily sensations will eventually threaten my mental health. (48)	.67	
18. I become less aware of the bodily sensations as time goes by. (21)		.40
19. I get used to particular bodily sensations. (24)		.45
20. I willingly accept my bodily sensations. (31)		.70
21. I simply let my bodily sensations be there in the background. (33)		.66
22. I am not aware of my bodily sensations when I am working (35)		.54
23. I can feel peaceful and be aware of my bodily sensations. (37)		.78
24. I can get on with what I am doing despite the bodily sensations (38)		.73
25. I do not try to control my bodily sensations (42)		.52
26. Despite being aware of the bodily sensations, I can concentrate on tasks without needing effort or will. (46)		.73
27. I do not need to suppress or block out my awareness of the bodily sensations (49)		.51

Note. Numbers in brackets after item content refers to the original item number.

Table 5. Descriptive Statistics for the 27-Item Bodily Sensations Response Scale Subscales, Body Perception Questionnaire-Short Form Subscales and the Depression, Anxiety, and Stress Scales—21 Subscales (*N*=284).

	M	*SD*	Skewness	Kurtosis	Min	Max
Defeat	13.05	12.08	1.17	.98	0.00	55.00
Acceptance	21.49	7.61	–.13	–.42	1.00	40.00
BA	60.99	21.28	.46	–.56	26.00	116.00
SUPR	24.13	8.70	1.22	.98	15.00	56.00
SUBR	10.64	4.28	1.01	.59	6.00	26.00
Depression	5.92	5.22	.91	.14	.00	21.00
Anxiety	5.00	4.31	.77	–.39	.00	18.00
Stress	7.78	4.97	.24	–.81	.00	20.00

Note. BSRS = Body Sensations Response Scale, BA= Body Awareness, SUPR = Supradiaphragmatic Reactivity, SUBR = Subdiaphragmatic Reactivity.

mental health problem ($Md = 7.00$, $n = 176$), $U = 6045.50$, $z = -5.15$, $p < .001$, with a medium effect size ($r = .30$).

An independence-samples t-test was conducted to compare the Acceptance subscale scores for participants who reported a mental health problem compared to those who did not report a mental health problem. There was a statistically significant difference in Acceptance scores for participants who reported a mental health problem ($M = 19.55$, $SD = 8.16$) and those who did not ($M = 22.69$, $SD = 7.01$; $t(282) = -3.45$, $p < .001$, two-tailed). The magnitude of the difference in the means (mean difference = −3.14, 95% CI [−4.94, −1.35]) was moderate (eta squared = .04).

Gender Differences. A Kruskal–Wallis test revealed no statistically significant difference in Defeat subscale scores across gender categories (male: $n = 57$; female: $n = 218$; other: $n = 9$), χ^2 (2, $N = 284$) = 5.93, $p = .052$). A one-way between-groups analysis of variance indicated that there was no statistically significant difference in Acceptance scores for the three gender categories: F (2, 281) = 1.81, $p = .165$.

Age Differences. A Kruskal–Wallis test indicated a significant difference in Defeat subscale scores across four different age groups (Group 1, $n = 219$: 18–25 years; Group 2, $n = 18$: 26–29 years; Group 3, $n = 40$: 30–49 years; Group 4, $n = 7$: 50+ years), χ^2 (3, $N = 284$) = 8.11, $p = .044$. The youngest age group (18–25 years) recorded a significantly higher median Defeat score ($Md = 11.00$) than the 30–49 year old group ($p = .017$) which recorded a median value of 5.00.

A one-way between-groups analysis of variance revealed a statistically significant difference at the $p < .05$ level in Acceptance scores for the four age groups: $F(3, 280) = 3.07$, $p = .028$. The effect size, calculated using eta-squared, was .03. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for Group 1 ($M = 20.80$, $SD = 7.48$) was significantly different from that of Group 3 ($M = 24.23$, *SD*

= 8.13). Group 2 (M = 22.28, SD = 7.06) and Group 4 (M = 25.43, SD = 6.08) did not differ significantly from each other or from Group 1 or Group 3.

Mindfulness Differences. Seventy-three participants (25.7%) reported regularly practicing mindfulness-based meditation. A Mann–Whitney U Test revealed no significant difference in Defeat subscale scores between participants who self-reported practicing mindfulness-based meditation (Md = 8.00, n = 73) compared to those who did not regularly practice mindfulness-based mediation (Md = 10.50, n = 210), U = 8077.00, z = .69, p =.49, r = .04.

An independence-samples t-test indicated no statistically significant difference in Acceptance scores between participants who regularly practiced mindfulness-based mediation (M = 22.22, SD = 8.11) and those who did not (M = 21.24, SD = 7.44; t (281) = .95, p = .35, two-tailed). The magnitude of the difference in the means (mean difference = .98, 95% CI [−1.06, 3.02]) was very small (eta squared = .003).

Discussion

The aim of the study was to better understand how we psychologically process bodily sensation information, specifically whether certain response profiles are linked to an exaggerated awareness of the sensations (i.e., IS) and stress/affective distress symptoms. We developed the BSRS to examine people's cognitive, emotional, and behavioral responses to all their bodily sensations. The BSRS contains two dimensions, acceptance and defeat, with our analyses suggesting that these two dimensions underpin psychological responses to bodily sensations. Similar to the TRS (Croft et al., 2013a), each BSRS subscale differed in its perceived agency and its associated levels of IS (as measured by BPQ-SF) and affective distress (as measured by DASS-21). BSRS item development was informed by expert opinion, cognitive theories (e.g., Cognitive Model of Panic; Clark, 1986), behavioral theories (e.g., classical conditioning; Groves & Thompson, 1970), interoceptive theories (e.g., Embodied Predictive Interoceptive Coding; Barrett & Simmons, 2015) and acceptance-based therapy approaches including Mindfulness-Based Cognitive Therapy (Segal et al., 2013) and Acceptance and Commitment Therapy (Hayes et al., 1999).

In *Study 1*, the 50 initial BSRS items were subjected to EFA and a 32-item three-factor solution was found to best fit the data. Factor 1 described a "defeat" response to bodily sensations, Factor 2 described an "acceptance" response, and Factor 3 described a "sensitization" response. In *Study 2*, the 32-item BSRS was subjected to CFA and a 27-item two-factor model was identified as the preferred factor solution. Factor 1 (i.e., 17-item Defeat subscale) consisted of a negative psychological response to bodily sensations that tapped sensory-related distress and discomfort, whereas Factor 2 (i.e., 10-item Acceptance subscale) described a neutral cognitive, emotional, and behavioral response to the sensations that involved little or no awareness of the sensations or psychological discomfort related to them.

Thus, contrary to Hypothesis 1, the factor structure of the BSRS was different to that obtained in the TRS (Croft et al., 2013a), which was likely due to the BSRS items tapping *all* bodily sensations (including slightly salient ones) whereas the TRS evaluates a single, often highly intrusive pathological sensation (i.e., tinnitus noise). Therefore, of the four hypothesized BSRS factors, our CFA failed to detect an effortful control or sensitization factor. Only two effortful control items were retained in the final BSRS: Item 3 which loaded onto the Defeat subscale and Item 25 which loaded onto the Acceptance subscale. The results may reflect that (a) people do not seek to actively control their body sensations if they perceive them as being "natural" (rather than pathological) (Ehrenreich, 2017) and/or (b) the need to control the sensations may result in feelings of defeat (Taylor et al., 2011).

Similarly, a sensitization factor was not detected in the 27-item BSRS. However, two sensitization items (Items 6 and 8) loaded onto the Defeat subscale and six sensitization items (Items 18, 19, 22, 24, 26, and 27) loaded onto the Acceptance subscale. Similar findings were reported by (Croft et al., 2013b) who found that sensitization items tended to load onto TRS-defeat and habituation items loaded onto TRS-acceptance. Thus, the results may indicate that when a person becomes sensitized to their body sensations they are at an increased risk of experiencing defeat, similar to that seen in people with chronic tinnitus. However, if they can come to accept the sensations, they may tend to habituate to them. This premise is supported by recent empirical findings suggesting that a failure (or delay) in habituating to internally derived or external stimuli is linked to a range of psychopathologies including anxiety and depressive disorders (Matthews et al., 2017).

Given the strong evidence for two underlying factors, we did not investigate Hypothesis 2 regarding the relationship between four factors and the external criterion variables. However, the prediction that "defeat" will be negatively correlated with "acceptance" was supported ($r = -.62$, $p < .001$). Further, consistent with Hypotheses 3 and 4, the Defeat subscale was moderately to strongly positively correlated to BPQ-SF subscales and DASS-21subscales, whereas the Acceptance subscale was unrelated or slightly negatively correlated to BPQ-SF and DASS-21 subscales. Additionally, people who reported a current mental health problem (e.g., anxiety and depression) reported higher BSRS defeat and lower acceptance scores than those who did not report such a problem. Taken together, the results suggest that defeat responses were linked to a heightened awareness of bodily sensations, especially autonomic arousal sensations, as well as psychological stress, affective distress (i.e., anxiety and depression) and mental health problems whereas acceptance responses were not.

Theoretical Implications

The study results are broadly consistent with cognitive models of anxiety development (e.g., Cognitive Model of Panic; Clark, 1986), theories of interoceptive dysfunction and depression (Harshaw, 2015), acceptance-based theories of affective disorder development (Dalrymple et al., 2014), and behavioral theories applied to anxiety disorder

development (Martell et al., 2001). That is, the results support the assertion that cognitive (i.e., acceptance vs. defeat), behavioral (i.e., sensitization vs. habituation), and interoceptive processes (i.e., IS) collectively underpin the development of affective distress (Tsakiris & Critchley, 2016). Thus, a person's awareness of their body sensations and their psychological response to them (i.e., feeling defeated by them) may be central to the experience of stress, anxiety, and depression (Paulus & Stein, 2010), although little is known about how these processes are integrated together to contribute to affective distress. However, it has been theorized that "top-down" processes (e.g., acceptance vs. defeat) are integrated together with "bottom-up" processes (e.g., interoceptive awareness) to contribute to affect distress (Khalsa et al., 2018; Schulz & Vögele, 2015; Tsakiris & Critchley, 2016). In this context, the BSRS can assist researchers in the exploration of the putative linkages between interoceptive awareness, psychological responses to bodily sensations, and affective distress.

In regards to behavioral theory, the items tapping the stimulus features linked to sensitization (i.e., novelty, intensity, frequency, and variability) mostly failed to load onto the BSRS except for items that tapped stimulus chronicity. Thus, the results may indicate that only persistent awareness of the sensations was psychologically salient to the participants. Other internally derived sensory attributes (e.g., stimulus intensity, novelty, and frequency) may not have been so psychologically salient and/or they may be more closely linked to IS (e.g., stimulus intensity is strongly linked to conscious awareness of body sensations) (Wallman-Jones et al., 2021).

Clinical Implications

The two-factor BSRS parsimoniously explained the way in which participants responded psychologically to their bodily sensations: they could either accept them (*Factor 2*) or else feel overwhelmed and defeated by them (*Factor 1*). As the Defeat and Acceptance subscales were highly negatively correlated, it infers that people who cannot accept their bodily sensations are more likely to feel defeated by them, in which case, they are more likely to report an exaggerated focus on the sensations (especially arousal sensations) and affective distress. Thus, conceptually, defeat was characterized by persistent awareness of the sensations, little perceived control over them, difficulty accepting them, feelings of resignation/helplessness and stress/affective distress whereas acceptance was characterized by little awareness of the sensations, little expressed need to control them and little or no somatic distress, affective distress, or mental health problems.

Young people were more likely to feel defeated by their bodily sensations whereas older people were more likely to accept them. However, we did not find a significant gender difference in BSRS defeat or acceptance, but the p-value (.052) from the Kruskal–Wallis test for defeat barely exceeded the test's significance level of .05. Thus, it is difficult to say whether females (or a subset of them; for example, young females) were more likely to feel defeated by their bodily sensations than males. The results are consistent with prior research showing that a negative correlation exists between age

and body awareness (Khalsa et al., 2009; Murphy et al., 2018) but not with research showing that females tend to score higher on IS (using the BPQ-SF) than males (Cabrera et al., 2018). However, there was no BSRS score differences in people who did/did not practice mindfulness meditation (or mindful-acceptance), although few participants practiced mindfulness in the study. Thus, it is unclear if the acceptance of bodily sensations is facilitated by the practice of mindfulness meditation or acceptance approaches.

Study Limitations

Several study limitations warrant mention. Females (77%), psychology undergraduate students (96%), and people under 26-years of age (77%) were over-represented in the convenience samples, limiting the generalisability of the results. In particular, anxiety is more common in the aforementioned groups; thus, their psychological response may have been biased towards anxious responding (Bitsika et al., 2010). Second, a clinical sample would have provided important information on the nature of BSRS symptomatology. Third, despite the psychometric strength of the DASS-21 (Antony et al., 1998), clinical interviews would have provided more nuanced information about participants' psychopathology (e.g., formal diagnosis of anxiety and depressive disorders). Thus, future research should utilize clinical interviews to better understand the processes by which responding to bodily sensations (BSRS score) can affect mental health and daily functioning. However, given the strong internal consistency of the BSRS, and the capacity of the Defeat subscale to predict IS and affective distress, future longitudinal research should aim to examine its relationship to interoceptive awareness and mental health, in a sample of people with diagnosed and undiagnosed mental health problems. Finally, following completion of the study, it was noted that three items in the original 50-item BSRS (items 3, 43, and 44) and one item in the final 27-item BSRS (item 22) included the word "often." It was considered that use of a term of frequency, such as "often," in some items may skew responses for these items as the 5-point rating scale in the BSRS should be the sole index of frequency of responses to bodily sensations. Accordingly, we have removed the word "often" from item 22 of the final 27-item BSRS.

Conclusion and Future Direction

The 27-item BSRS comprehensively captured participant's cognitive, emotional, and behavioral responses to their awareness of bodily sensations in a balanced manner, comprising two responses: defeat and acceptance. Defeat was moderately to strongly positively correlated to awareness of all bodily sensations, including ANS sensations, and symptoms of affective distress (i.e., depression, anxiety, and stress) whereas acceptance was either not related or only slightly negatively related to them. Results suggest that if a person becomes aware of their bodily sensations, they may tend to feel defeated by them, and if so, they may experience stress and affective distress. However,

if they can accept the sensations, then they will not tend to focus on the sensations or become stressed or distressed by them. Furthermore, the results broadly accord with prior research indicating that the way a person psychologically experiences and regulates their emotions is influenced by their subjective experience of their bodily sensations (Critchley & Garfinkel, 2017). The 27-item BSRS can assist researchers and clinicians in better understanding the way in which people psychologically respond to their bodily sensations and how this is related to psychopathology.

Appendix A: Original 50-Item BSRS

Bodily sensations response scale

We would like to know how you *currently experience* your bodily sensations. Bodily sensations are feelings from your body that include rapid heartbeat, butterflies in the stomach, muscle tension, feeling out of breath, feeling flushed, bloated, relaxed, fatigued, burning, itching, hungry, or thirsty

Below is a list of statements about bodily sensations. Please read the statements carefully and select the rating from the 5-point scale that best describes how often you experience the bodily sensations in the way that is described

0 Never
1 Occasionally
2 Sometimes
3 Usually
4 Always

1	I am so used to my bodily sensations that I hardly notice them. (A)	0 1 2 3 4
2	I Have learnt that I can manage my bodily sensations (C)	0 1 2 3 4
3	I am not aware of my bodily sensations, even though they are still there. (H/S)	0 1 2 3 4
4	I feel defeated by my bodily sensations. (D)	0 1 2 3 4
5	I feel detached and distant from my bodily sensations. (H/S)	0 1 2 3 4
6	I can easily attend to the sensations anywhere in my body. (H/S)	0 1 2 3 4
7	I purposely change the way I think about my bodily sensations to improve my quality of life. (C)	0 1 2 3 4
8	I do not think too much about my bodily sensations (H/S)	0 1 2 3 4
9	It distresses me that my bodily sensations prevent me from enjoying life. (D)	0 1 2 3 4
10	I keep myself busy so that I do not dwell on my bodily sensations (C)	0 1 2 3 4
11	It takes effort to maintain concentration due to my awareness of the bodily sensations. (C)	0 1 2 3 4
12	I feel helpless because of my bodily sensations. (D)	0 1 2 3 4
13	My bodily sensations are the worst thing that has happened to me. (D)	0 1 2 3 4
14	My bodily sensations last for a long time. (H/S)	0 1 2 3 4
15	I cannot concentrate on anything because of my bodily sensations. (D)	0 1 2 3 4

(continued)

(continued)

16	When I become aware of the bodily sensations my awareness soon passes. (A)	0 1 2 3 4
17	My bodily sensations distract me from doing other things even if it is important (H/S)	0 1 2 3 4
18	I feel like I am in control of my bodily sensations (C)	0 1 2 3 4
19	My bodily sensations are vague and hard to describe (H/S)	0 1 2 3 4
20	I am frequently aware of my bodily sensations and they do not bother me. (A)	0 1 2 3 4
21	I become less aware of the bodily sensations as time goes by (H/S)	0 1 2 3 4
22	I try not to dwell on my bodily sensations in order to cope. (C)	0 1 2 3 4
23	My body sensations have ruined my life. (D)	0 1 2 3 4
24	I get used to particular bodily sensations (H/S)	0 1 2 3 4
25	Most days I try to manage my thoughts about my bodily sensations. (C)	0 1 2 3 4
26	When I become aware of my bodily sensations, I simply notice them. (H/S)	0 1 2 3 4
27	I despair because of my bodily sensations. (D)	0 1 2 3 4
28	It is difficult to accept that I will always have the bodily sensations. (A)	0 1 2 3 4
29	I try to distract myself (e.g., talking to a friend and going for a walk) so that I do not dwell on the bodily sensations (C)	0 1 2 3 4
30	I lose awareness of my bodily sensations over time (H/S)	0 1 2 3 4
31	I willingly accept my bodily sensations. (A)	0 1 2 3 4
32	I do not use alcohol or drugs/exercise/electronic devices or other activities to manage my bodily sensations (C)	0 1 2 3 4
33	I simply let my bodily sensations be there in the background. (A)	0 1 2 3 4
34	I use a range of strategies to stop dwelling on my bodily sensations. (C)	0 1 2 3 4
35	I am not aware of my bodily sensations when I am working. (H/S)	0 1 2 3 4
36	I notice it whenever my bodily sensations change (H/S)	0 1 2 3 4
37	I can feel peaceful and be aware of my bodily sensations. (A)	0 1 2 3 4
38	I can get on with what I am doing despite the bodily sensations (H/S)	0 1 2 3 4
39	It is difficult to accept my bodily sensations. (A)	0 1 2 3 4
40	My bodily sensations have negatively influenced my close relationships. (D)	0 1 2 3 4
41	I can easily distinguish between different bodily sensations (H/S)	0 1 2 3 4
42	I do not try to control my bodily sensations (C)	0 1 2 3 4
43	I think I cannot take my bodily sensations anymore. (D)	0 1 2 3 4
44	The more I experience the bodily sensations the less important they are to me. (H/S)	0 1 2 3 4
45	My bodily sensations are all too much. (D)	0 1 2 3 4
46	Despite being aware of the bodily sensations, I can concentrate on tasks without needing effort or will. (H/S)	0 1 2 3 4
47	I am worn down by my bodily sensations. (D)	0 1 2 3 4
48	Focusing on my bodily sensations will eventually threaten my mental health. (D)	0 1 2 3 4
49	I do not need to suppress or block out my awareness of the bodily sensations. (H/S)	0 1 2 3 4
50	The longer I experience the bodily sensations the less important they become. (H/S)	0 1 2 3 4

Appendix B: Final 27-Item BSRS

Bodily Sensations Response Scale

We would like to know how you *currently experience* your bodily sensations. Bodily sensations are feelings from your body that include rapid heartbeat, butterflies in the stomach, muscle tension, feeling out of breath, feeling flushed, bloated, relaxed, fatigued, burning, itching, hungry, or thirsty

Below is a list of statements about bodily sensations. Please read the statements carefully and select the rating from the 5-point scale that best describes how often you experience the bodily sensations in the way that is described

0 Never
1 Occasionally
2 Sometimes
3 Usually
4 Always

1 (4)	I feel defeated by my bodily sensations. (D)	0 1 2 3 4
2 (9)	It distresses me that my bodily sensations prevent me from enjoying life. (D)	0 1 2 3 4
3 (11)	It takes effort to maintain concentration due to my awareness of the bodily sensations. (D)	0 1 2 3 4
4 (12)	I feel helpless because of my bodily sensations. (D)	0 1 2 3 4
5 (13)	My bodily sensations are the worst thing that has happened to me. (D)	0 1 2 3 4
6 (14)	My bodily sensations last for a long time. (D)	0 1 2 3 4
7 (15)	I cannot concentrate on anything because of my bodily sensations. (D)	0 1 2 3 4
8 (17)	My bodily sensations distract me from doing other things even if it is important. (D)	0 1 2 3 4
9 (21)	I become less aware of the bodily sensations as time goes by. (A)	0 1 2 3 4
10 (23)	My body sensations have ruined my life. (D)	0 1 2 3 4
11 (24)	I get used to particular bodily sensations. (A)	0 1 2 3 4
12 (27)	I despair because of my bodily sensations. (D)	0 1 2 3 4
13 (28)	It is difficult to accept that I will always have the bodily sensations. (D)	0 1 2 3 4
14 (31)	I willingly accept my bodily sensations. (A)	0 1 2 3 4
15 (33)	I simply let my bodily sensations be there in the background. (A)	0 1 2 3 4
16 (35)	I am not aware of my bodily sensations when I am working. (A)	0 1 2 3 4
17 (37)	I can feel peaceful and be aware of my bodily sensations. (A)	0 1 2 3 4
18 (38)	I can get on with what I am doing despite the bodily sensations. (A)	0 1 2 3 4
19 (39)	It is difficult to accept my bodily sensations. (D)	0 1 2 3 4
20 (40)	My bodily sensations have negatively influenced my close relationships. (D)	0 1 2 3 4
21 (42)	I do not try to control my bodily sensations. (A)	0 1 2 3 4
22 (43)	I think I cannot take my bodily sensations anymore. (D)	0 1 2 3 4
23 (45)	My bodily sensations are all too much. (D)	0 1 2 3 4

(continued)

(continued)

24 (46)	Despite being aware of the bodily sensations, I can concentrate on tasks without needing effort or will. (A)	0 1 2 3 4
25 (47)	I am worn down by my bodily sensations. (D)	0 1 2 3 4
26 (48)	Focusing on my bodily sensations will eventually threaten my mental health. (D)	0 1 2 3 4
27 (49)	I do not need to suppress or block out my awareness of the bodily sensations. (A)	0 1 2 3 4

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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