Chapter 2

Measuring Body Awareness with the Scale of Body Connection: Structure and Reliability of the Dutch Translation

This chapter is in revision

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Abstract

**Background:** Awareness of the body may help to understand the relationship between physical symptoms and mental state due to life experiences. In order to prove this it is necessary to have a reliable and valid measure of body awareness.

**Aim:** In the present study the subscale ‘body awareness’ of the Scale of body Connection was examined on its structure and reliability.

**Methods:** Two student samples (n=217 each), a chronic pain sample (n=192) and a sample of 257 patients who were treated in primary care, participated in this study.

**Results:** Confirmatory factor analysis in the two patient samples indicated a one-factor solution. Internal consistency was adequate in all four samples as was the test-retest reliability in the chronic pain sample.

**Discussion:** The findings demonstrate that the instrument is one-dimensional and reliable in clinical populations, while the instrument was not psychometrically strong in the student sample.
Introduction

Self-management of health and illness is based on perception and interpretation of and acting on information from our bodies [1]. It is a complex process with interactions between biological, psychological and social aspects. It is therefore easily understandable that misperception, misinterpretation and consequently inadequate actions often occur. According to Bakal [2], patients with medically unexplained symptoms may describe the location and nature of a physical symptom in great detail and precision, but are unaware of the thoughts, feelings, and physical sensations that contribute to symptom onset. Conversely, they are even less aware of potentially healing sensations and feelings. They do not recognize the sensory and mental state in reaction to physical stimuli and are not aware of the connection between the sensory and mental state. Awareness of the body may help to understand this relationship between physical sensations and mental state due to life experiences for patients with several disorders, such as musculoskeletal disorders and pain [3]. Several interventions, such as Somatic Awareness [2], Body Awareness Program [4], Body Awareness Therapy [5, 6], mindfulness meditation [7], Affective Self-Awareness [8], and Yoga [9, 10] aim to improve body awareness. They claim to reduce somatic (e.g. pain severity, physical functioning) and psychological symptoms (e.g. depression, catastrophizing), improve health-related quality of life and increase self-efficacy. In order to relate these improvements to a change in body awareness, the first step is to prove that these interventions improve body awareness. In order to do this it is necessary to have a reliable and valid measure of body awareness. Mehling et al. [11] found only two psychometrically strong instruments that were used in more than a few studies, i.e. the Body Awareness Questionnaire [12] and the Body Consciousness Questionnaire [13]. However these instruments measure non-emotional physical cues such as hunger, fatigue, and energy level or focus on sensory awareness involving dry mouth, heartbeat, or a change in body temperature. These instruments do not take the connection between the sensory and mental state into account.

Price and Thompson [14] developed a self-report scale, the Scale of Body Connection (SBC), containing two subscales: body awareness and body dissociation, together measuring psychophysical awareness. Price and Thompson (14, p. 946) described the multifaceted concept ‘body awareness’ as “[involving] sensory awareness – the ability to identify and experience inner sensations of the body (e.g., a tight muscle) and overall emotional/physiologic state of the body (e.g., relaxed, tense). It also involves attending to bodily information in daily life, noticing bodily changes/responses to emotion and/or environment.” The concept of body dissociation is characterized by avoidance of internal experience, containing aspects of distraction and separation from bodily experience and/or bodily self and difficulty with identifying, expressing, and attending to
emotion [14]. This description seems to be more related to dysfunctional
attentional strategies and the concept of alexithymia [15] than to the concept of
body awareness. Furthermore, Price and Thompson [14] showed that the two
subscales were not correlated although they expected this with the construction
of the questionnaire. In this article the focus is on the concept of body awareness
and consequently on the subscale ‘body awareness’. Price and Thompson [14]
provided preliminary evidence of the construct validity and internal consistency
in a sample of undergraduates. The goal of the present study was to provide further
information on the structure and reliability of the subscale ‘body awareness’ of the
SBC. The structure will be examined in samples of healthy students, patients who
were suffering from chronic pain, and patients who were treated in primary care.
Test-retest reliability will be examined in the chronic pain sample.

Method

Participants and procedure
The data of three independent samples were used for the present study. Sample 1
(n=434) consisted of undergraduate students. Mean age was 20.6 years (SD=2.75)
and 74.7% was female.

Sample 2 (n=192) consisted of patients with chronic musculoskeletal pain who
were on a waiting list for treatment in three tertiary rehabilitation centers in the
Netherlands. Mean age was 43 years (SD= 10.8) and 74.7% was female. Main
pain sites reported were widespread pain and fibromyalgia (25.8%), neck (20.4%)
and (lower) back (18.8%). Average pain intensity score (range 0-10) was 5.69
(SD=1.66). Questionnaires, informed consent and an information letter were sent
by mail to patients to be completed at home. A part of the sample (n=66) received
the SBC a second time (retest).

Sample 3 (n=257) consisted of primary care patients who were treated by body-
mind therapists throughout the Netherlands [16]. The patients had a wide range
of complaints; the most common complaints were depression- or anxiety-
related or somatic complaints. The main focus of treatment was autonomy in
terms of stimulating the patient’s self-awareness, and supporting the sense and
consciousness of the body. Mean age was 43.3 years (SD=11.8) and 74.3% was
female. Their mean score on various subscales of the SCL-90 were ‘average’
according to norm values of Dutch primary care patients [17], except for their
total score (mean=178.0; SD=50.99) and the score on the subscale ‘sleeping
problems’ (mean=7.15; SD=3.54), which were ‘above average’.
Measuring body awareness with the Scale of Body Connection

**Instruments**

*The Scale of Body Connection* (SBC) [14] contains two subscales ‘body awareness’ (BA) (12 items) and ‘body dissociation’ (BD) (8 items). In this study only the subscale body awareness (SBCBA) was examined, which aims to measure awareness of inner body experiences. Respondents were asked to respond to questions regarding their body awareness (e.g. “If my body is tense, I am aware of this tension”) or their reaction to body awareness (e.g. “When I am uncomfortable about something, I try to find out what the cause might be”) in the past two months, on a five-point scale from 1 (not at all) to 5 (all of the time). Higher scores reflect more conscious attention to sensory cues. Price and Thompson (2007) evaluated the psychometric properties of the SBC in undergraduate students and reported medium to good internal consistency for the body awareness subscale (α=0.83). The SBCBA was translated into Dutch according to the backtranslation technique [18].

**Statistical analysis**

The factorial structure of the Dutch version of SBCBA was first examined in the student sample by using principal factor analysis (PFA) with principal axis factors because of non-normal distribution of the data [19], and oblique rotation. The number of factors to be retained for rotation was determined by the scree test. In addition, the factorial structure was re-examined by confirmatory factor analysis (CFA) using the student sample. For the purpose of both analyses, the student sample was randomly divided in two groups. CFA was also conducted on the sample of chronic pain patients and on the sample of primary care patients to explore invariance of the factor structure across students and different patient groups. CFAs were conducted for the three samples separately. The number of factors included was determined on the results of the PFA in the student sample. Goodness of fit was evaluated by assessing the Comparative Fit Index (CFI; cutoff criteria values close to 0.95 or higher), Tucker-Lewis Index (TLI; cutoff criteria values close to 0.95 or higher), the Root Mean Square Error of Approximation (RMSEA; cutoff criteria values close to 0.06 or lower) and the Weighted Root Mean square Residual (WRMR; cutoff criteria values close to 1.0 or lower) [20, 21]. The need for correlated errors was evaluated by the modification indices. Only clinically relevant correlated errors that improved the model fit significantly were included in the model [22]. CFA analyses were conducted in Mplus 7.11 using the robust Weighted Least Square Estimate, because of non-normal distribution of the data [22, 23].

Internal consistency was evaluated by calculating Cronbach’s alpha. Test-retest reliability was examined by intraclass correlation (ICC agreement) [24]. Test-retest stability was examined by the Bland Altman method. The mean of differences between the test and retest and the 95% confidence interval of the mean difference presents an indication of systematic changes. The Bland-Altman 95% limits of
agreement (LOA=mean of the difference ± 1.96 x standard deviation of the difference) indicate the magnitude of the random changes caused by natural within-patient variation and random measurement errors. Smaller limits of agreement indicate more stability.

Results

Missing data

The percentage of missing data on the SBCBA was 0.75% for the student sample, 2.86% for the chronic pain patients and 0.65% for the primary care patients. The percentage of missing data was for the most part explained by the percentage missing data for item 8, “I am aware of internal sensation during sexual activity” (students 7.1%, chronic pain patients 15.1%, primary care patients 4.7%). A total score for body awareness without this item was calculated and the average score of persons who missed this item were compared to the average of persons who did not miss this item. No significant differences were found for the students and the primary care patients. However, a significant difference was found in the chronic pain patients (mean not missing = 3.34, SD= .55; mean missing = 3.06, SD=.53). Persons with missing values were not included in the analyses (39 students; 39 pain patients; 15 primary care patients).

Table 1: Factor loadings of SBCBA items as obtained by principal factor analysis, principal axis factors extraction (student sample, n=199)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Factor loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aware of tension</td>
<td>.542</td>
</tr>
<tr>
<td>3</td>
<td>Breathing becomes shallow when nervous</td>
<td>.080</td>
</tr>
<tr>
<td>4</td>
<td>Notice emotional response to caring touch</td>
<td>.273</td>
</tr>
<tr>
<td>6</td>
<td>Notice how body changes when angry</td>
<td>.290</td>
</tr>
<tr>
<td>8</td>
<td>Aware internal sensations during sexual activity</td>
<td>.327</td>
</tr>
<tr>
<td>9</td>
<td>Can feel breath travel</td>
<td>.500</td>
</tr>
<tr>
<td>12</td>
<td>Take cues from body</td>
<td>.555</td>
</tr>
<tr>
<td>13</td>
<td>Think about what might cause discomfort</td>
<td>.563</td>
</tr>
<tr>
<td>14</td>
<td>Listen from body about emotional state</td>
<td>.569</td>
</tr>
<tr>
<td>15</td>
<td>Notice stress in body</td>
<td>.484</td>
</tr>
<tr>
<td>17</td>
<td>Note where tension is in body</td>
<td>.498</td>
</tr>
<tr>
<td>18</td>
<td>Notice feeling different after peaceful experience</td>
<td>.425</td>
</tr>
</tbody>
</table>
**Factorial Structure**

In the student sample (n=199) used for PFA, two items showed significant deviations from a normal distribution. The inter-item correlations ranged from -0.083 to 0.498 with a mean of 0.18. The determinant of the correlation matrix suggested no multicollinearity. The KMO statistic was 0.75 (good), and KMO for individual items ranged from 0.62 to 0.84 (mediocre to very good), except for item 3 (KMO = 0.44, which is below the bare minimum). Bartlett’s measure was significant and therefore there was some relationship between variables and factor analysis is appropriate. Eigenvalues > 1 indicated four factors. According to the scree plot, it was decided to study the solution of one factor. Table 1 presents items and factor loadings. Although the one factor solution seemed to be the most suitable solution, item 4 (.273), 6 (.290) and 8 (.327) loaded quite low on this factor and item 3 did not load at all (0.08). An analysis without item 3 yielded comparable results.

The factor structure obtained by the PFA was tested by means of a CFA in the student sample, the chronic pain patients sample and the primary care patients sample. Results from the CFA of all three samples are detailed in Table 2. One correlated error was included in the final models between item 1 and 15. The overall fit statistics indicated an adequate-to-good fit. The student data showed a good RMSEA (0.059) but the patient data showed higher RMSEA (chronic pain 0.075; primary care 0.083). The patient data showed a good CFI (chronic pain 0.949; primary care 0.957) but the CFI of the students was below the cut-off value (0.0936). Also the WRMR of the patient data (chronic pain 0.833; primary care 0.948) was closer to 1 than the student data (0.806). All factor loadings were statistically significant except for item 8 in the student sample (Table 2).

**Reliability**

Internal consistency for SBCBA in both student samples (PFA and CFA), chronic pain patients and primary care patients were adequate (Cronbach’s α = .71, .72, .77 and .82 respectively). Deleting the weakest item (item 3) yielded comparable results. For test-retest analysis 64 chronic pain patients (sample 1) were available. For a number of patients the test-retest period was not clear (n=11), too short (1-4 days) or too long (37-42 days) (n=7), which resulted in 46 patients for this analysis. The test-retest period was on average 13 days. The mean scores of the two assessments were 3.44 (SD = .50) and 3.36 (SD = .49). The difference was non-significant.
The intraclass correlation coefficient for agreement was 0.78. The mean difference, 95% CI of the mean difference and the 95% LOA are graphically shown in Figure 1. The mean difference was close to zero, 0.082. The 95% CI of the mean difference ranged from -0.015 to 0.178 and the 95% limits of agreement were -0.57 to 0.73. Furthermore, the Bland-Altman plot (Figure 1) shows that when the average of test and retest scores increases, and the difference between test and retest scores does not increase, error measurement was independent of the magnitude of the SBCBA score (homoscedasticity).

Table 2: Factor loadings of the confirmatory factor analysis in all three samples

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Students (n=196)</th>
<th>Chronic pain (n=153)</th>
<th>Primary care (n=242)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aware of tension</td>
<td>0.512</td>
<td>0.472</td>
<td>0.564</td>
</tr>
<tr>
<td>3</td>
<td>Breathing becomes shallow when nervous</td>
<td>0.292</td>
<td>0.193</td>
<td>0.138</td>
</tr>
<tr>
<td>4</td>
<td>Notice emotional response to caring touch</td>
<td>0.328</td>
<td>0.376</td>
<td>0.448</td>
</tr>
<tr>
<td>6</td>
<td>Notice how body changes when angry</td>
<td>0.333</td>
<td>0.425</td>
<td>0.405</td>
</tr>
<tr>
<td>8</td>
<td>Aware internal sensations during sexual activity</td>
<td>0.070</td>
<td>0.208</td>
<td>0.466</td>
</tr>
<tr>
<td>9</td>
<td>Can feel breath travel</td>
<td>0.367</td>
<td>0.435</td>
<td>0.505</td>
</tr>
<tr>
<td>12</td>
<td>Take cues from body</td>
<td>0.671</td>
<td>0.668</td>
<td>0.768</td>
</tr>
<tr>
<td>13</td>
<td>Think about what might cause discomfort</td>
<td>0.483</td>
<td>0.687</td>
<td>0.755</td>
</tr>
<tr>
<td>14</td>
<td>Listen from body about emotional state</td>
<td>0.661</td>
<td>0.781</td>
<td>0.767</td>
</tr>
<tr>
<td>15</td>
<td>Notice stress in body</td>
<td>0.413</td>
<td>0.635</td>
<td>0.638</td>
</tr>
<tr>
<td>17</td>
<td>Note where tension is in body</td>
<td>0.658</td>
<td>0.840</td>
<td>0.756</td>
</tr>
<tr>
<td>18</td>
<td>Notice feeling different after peaceful experience</td>
<td>0.464</td>
<td>0.433</td>
<td>0.636</td>
</tr>
</tbody>
</table>

Students: $\chi^2 = 92.64; 53 \, df; \, p<.001$. Fit indices: root-mean-squared error of approximation = 0.059 (confidence interval = 0.038 – 0.078); comparative fit index = 0.936; Tucker-Lewis index = 0.921; weighted root mean residual = 0.806.

Chronic pain: $\chi^2 = 110.15; 53 \, df; \, p<.001$. Fit indices: root-mean-squared error of approximation = 0.075 (confidence interval = 0.055 – 0.095); comparative fit index = 0.949; Tucker-Lewis index = 0.937; weighted root mean residual = 0.833.

Primary care: $\chi^2 = 147.43; 53 \, df; \, p<.001$. Fit indices: root-mean-squared error of approximation = 0.083 (confidence interval = 0.067 – 0.099); comparative fit index = 0.957; Tucker-Lewis index = 0.946; weighted root mean residual = 0.948.

Note: One correlated error was included for all three samples between items 1 and 15.
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Figure 1: Bland-Altman plot of agreement between test and retest scores of SBCBA. A solid line represents the mean of the difference, bold dashed lines representing the 95% limits of agreement (LOA) and normal dashed lines representing the 95% confidence interval (CI) of the mean of the difference.

Discussion

Being aware of one's body may help to understand the relationship between physical symptoms and life experiences and improve health-related quality of life. To study which interventions improve body awareness and the relation between body awareness and health-related quality of life a reliable and valid instrument is needed. The subscale body awareness of the SBC aims to measure awareness of the inner body experience, which incorporates the connection between the sensory and mental state. The purpose of this study was to assess structure and reliability of the Dutch version of the subscale body awareness of the SBC.
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The PFA demonstrated a one-factor solution as the most suitable. The CFA showed an adequate fit in all three samples, with the best fit for the primary care patients according to the fit indices CFI and WRMR. The internal consistency and the test-retest reliability were moderate to good. The PFA resulted in one factor with low loadings for a few items (3, 4, 6, and 8). However, the loadings of these items in the CFA were only weak in the student sample. In the chronic pain sample items 3, 4 and 8 had low loadings and in the primary care sample only item 3 had a low loading. Although item 3 had low loadings in all three samples, analyses without this item showed comparable results on structure and internal consistency.

Item 8 on awareness during sexual activity had many missings, especially in the chronic pain patients sample. Price and Thompson scored item 8 for persons missing this item as “not at all” (1), but we chose not to impute missing data. In the chronic pain patients sample there was a significant difference between completers and non-completers. Researchers asked the chronic pain patients on several occasions why the item was left blank, and most patients answered that they did not have sex at all because of the pain. Therefore Price and Thompson already suggested to develop additional items aimed at body awareness during sexual activity or intimacy. Excluding the item from the scale would result in the loss of an important context concerning body awareness. Moreover, sexual trauma is often co-occurring with chronic pain [25] and sexual activity or intimacy could be very distressing.

There was a discrepancy between the different samples on the fit indices. The primary care patients showed the best fit according to the CFI and the WRMR, but the worst fit according to the RMSEA. Also the values of CFI and WRMR in the chronic pain data were better than in the student data, but the student data had the best RMSEA. This may be explained by the observation that patients with medically unexplained symptoms have a low body awareness in combination with a heightened but selective attentional focus on symptoms [26]. This would result in a more skewed distribution in the patient samples of the items of the SBCBA compared to a more “normal” distribution in the student sample which is confirmed by the frequency distribution in this study (see figures in appendix). In the student sample used for CFA, only 2 items showed significant deviations from a normal distribution, while in both patient samples 5 items showed significant deviations from a normal distribution. It has been suggested that in particular the RMSEA is sensitive to non-normal distribution [22]. Reliability analyses demonstrated moderate to good internal consistency (Cronbach’s alpha’s) for the three samples, with the highest alpha for the primary care data. The test-retest results for the chronic pain patients were satisfactory for group comparison [27]. Moreover this study demonstrated that test-retest stability remained stable across a 4-week period. This is clinically relevant.
since it usually takes some time after intake before treatment starts. The Bland-Altman plot also showed good agreement between test and retest values, and no association between measurement error and the magnitude of the measurement. In conclusion, the present study provides evidence that the subscale body awareness of the Scale of Body Connection is a reliable measure in a Dutch population of primary care patients seeking mental health support, chronic pain patients and in a lesser extent for healthy students. This indicates that the instrument might be more suitable for the clinical population.
References


Appendix

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Appendix 1: Frequency distribution of items 3, 8, 9, 13 and 15 of the subscale body awareness of the Scale of Body Connection for the three different samples.

Student data did not show significant deviations from a normal distribution on these items. Chronic pain data showed significant deviation from normal distribution on items 8, 9 and 13. Primary care data showed significant deviation from normal distribution on items 3, 8, 15.

In all samples there was a significant deviation from normal distribution on items 1 and 18.