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## Development of the Body-Relatedness Observation Scale: A feasibility study

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### ABSTRACT

**Background:** One characteristic of somatoform (DSM-IV) and somatic symptom disorder (DSM-5) is the troubled relation of patients to their body. To assess body-relatedness, standardized observation by a physical therapist may add valuable information to questionnaires. **Purpose:** This study examines the feasibility of a physiotherapeutic observation instrument: the Body-Relatedness Observation Scale (BROS). **Methods:** Factorial validity and inter-rater reliability of observer scores were studied in 191 patients performing two short exercises, lying face up. Fourteen indicators of body-relatedness were selected, covering execution of instructions, perception of the body, muscle tension, and behavioral adaptation to somatic symptoms. **Results:** Inter-rater reliability values (Kappa or Intraclass correlation [ICC] according to model 1,1) were excellent for four observation scores, substantial for two, fair for two, and poor for six. Four out of five items relating to patients' ability to perceive the body had low inter-rater reliability values (ICC < 0.40 or Kappa < 0.20). Categorical principal components analysis with the eight reliable scores indicated a 1-factor structure including seven items with Cronbach's alpha 0.69. **Conclusion:** This initial analysis of a structured physical therapeutic observation for people with somatic symptom disorder indicated modestly sound psychometric quality of observations of execution of instructions, muscle tension, and behavioral adaptation, but not of patients' ability to perceive the body adequately. This shows that body-related observations are feasible and indicates the viability of further development of the BROS.

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Assessment; body-mind relations; physiotherapy; psychomotor performance; somatic symptom disorder

## Introduction

Patients with somatoform disorder (DSM-IV) (American Psychiatric Association, 2000) or somatic symptom disorder (DSM-5) (American Psychiatric Association, 2013) experience chronic distressing somatic symptoms. A common feature of these patients is their troubled relationship to their body (Kalisvaart et al., 2012; Sertoz, Doganavsargil, and Elbi, 2009). They are, for instance, considered to perceive their body as dysfunctional (Klemm et al., 2018; Röhricht, 2011) and to have difficulty acknowledging and understanding body signals and adapting their behavior to these signals (Creed, Henningsen, and Fink, 2011; Henningsen, Zipfel, Sattel, and Creed, 2018; Kalisvaart et al., 2012; Nijs, Paul, and Wallman, 2008). This “body-relatedness” can be a focus in the treatment of somatoform disorder (Houtveen et al., 2015). It has been defined as awareness of the body and self, by acknowledgment of bodily signals (i.e. understanding and accepting) and adjusting to them, by respecting and regulating the body, by trusting and esteeming oneself and by being

autonomous with regard to one's body (Kalisvaart et al., 2012). Assessment of disturbed body-relatedness in people with somatoform or somatic symptom disorder could be helpful in the process of indication and contraindication for specific treatments and evaluation of treatments (van Dessel et al., 2014). However, some domains of body-relatedness, such as acknowledgment of bodily signals, adjustment to somatic symptoms and regulation, are hard to measure with questionnaires. Physical therapists might help in assessing problems in body-relatedness by observing the patient while moving in a standardized situation.

Patients with somatoform disorder often struggle with their body (Lind, Delmar, and Nielsen, 2014; Payne and Brooks, 2016) and some authors suggested that they may be trying to take control of their physical symptoms by withdrawing (Luyten et al., 2013; Price and Mehling, 2016) or dissociating (Nijenhuis, 2000) from their bodies. The use of self-report questionnaires alone, addressing conscious aspects in a verbal way, may therefore not suffice to assess body-relatedness in its full range (Ganellen, 2007). The more implicit sides of body-

relatedness that are expressed in posture and movement patterns and automatic behavior are hard to self-report for the patient. In order to assess these implicit aspects of body-relatedness, nonverbal tools like physical tests and behavioral observations may reveal relevant information that is not available through self-report questionnaires. Physical therapists have a long tradition of observing and testing physical parameters like strength, balance, endurance, muscle tension, and motor coordination (De Vries, Hagenaars, Kiers, and Schmitt, 2014). Particularly physical therapists that specialize in mental or psychosomatic disorders, also incorporate the psychosocial factors that are inseparable from the bodily functioning in their treatment (Probst, 2017). In clinical practice, aside from using questionnaires to assess: self-reported body image (Pohlmann, Roth, Brahler, and Joraschky, 2014); somatoform dissociation (Nijenhuis, 2000); or body awareness (Mehling et al., 2018), a physical therapist will often interview the patient (Ahlsen, Mengshoel, Bondevik, and Engebretsen, 2018; Dansie and Turk, 2013; Wijma, van Wilgen, Meeus, and Nijs, 2016) and observe body-relatedness while interacting with the patient.

Within psychosomatic and psychomotor approaches (Meurle-Hallberg, Armelius, and von Koch, 2004), observational instruments have been developed that are based on the assumption that the body is inseparable from the mind (Gyllensten, Skar, Miller, and Gard, 2010). Body-examinations that use palpation and touch, like the Resource Oriented Body Examination (ROBE-II) (Meurle-Hallberg and Armelius, 2006), focus on postural patterns, respiration, reactions to physical touch, decreased movements, and muscular consistency in order to determine a “psychomotor profile”. Most of the subscales of the ROBE-II differentiate between persons referred for treatment of somatoform disorder and a group of health care professionals (Meurle-Hallberg and Armelius, 2006). Touch can be a powerful assessment tool since it is neurologically incorporated into the interoceptive pathway (Calsius, De Bie, Hertogen, and Meesen, 2016; Courtois, Cools, and Calsius, 2015). However, the experience of touch may feel intrusive to patients with a complicated body-history such as trauma (Scheffers et al., 2017a) and it may not provide relevant information about behavioral adaptation to somatic symptoms. “Hands-off” observations use standardized exercises and interviews to assess, for example: movement quality (Body Awareness Scale–Health [BAS-H]) (Gyllensten, Ekdahl, and Hansson, 1999); Body Awareness Rating Scale (BARS) (Skjaerven, Gard, Sundal, and Strand, 2015); and body experience in children (Emck and Bosscher, 2010; Emck, Plouvier, and van der Lee-Snel, 2012). These

observations have turned out to provide valid and clinical valuable information (Emck, Plouvier, and van der Lee-Snel, 2012; Skjaerven, Gard, Sundal, and Strand, 2015). However, a specific “hands-off” observation to assess body-relatedness in somatoform disorder or somatic symptom disorder has not been developed.

Healthy adaptation to somatic symptoms is described as body-informed functional movement effort (Johnsen and Råheim, 2010; Skjaerven, Gard, Sundal, and Strand, 2015), with a paced activity pattern and respect for physical and mental limitations (Nijs, Paul, and Wallman, 2008). Also, a flexible reaction of muscle tension and respiration and bodily balance are mentioned as characteristics of healthy movement (Gyllensten, Skar, Miller, and Gard, 2010; Skjaerven, Gard, Sundal, and Strand, 2015). In people with chronic pain and chronic fatigue syndrome patterns of overactivity, activity avoidance and a combination of both have been described (Andrews, Strong, and Meredith, 2015; Huijnen et al., 2011; Janssens et al., 2017), together with rigid reactions of muscle tension and respiration (Jafari et al., 2017). These maladaptive patterns may arise when the person has difficulty acknowledging and understanding body signals (Gyllensten, Skar, Miller, and Gard, 2010; Price and Mehling, 2016; Rochat, 2003), or to adapt behavior to these signals (Cramer et al., 2018; Payne and Brooks, 2016). Thus, to adequately support and understand patients with somatic symptoms and to provide appropriate treatment interventions, physical therapists are considered to be able to assess the severity of problems in body-relatedness, particularly the abilities to execute instructions and to perceive the body, patterns in muscle tension, and behavioral adaptation to the specific somatic symptoms. The aim of this study was to examine the feasibility of an instrument for the standardized observation of body-relatedness by a physical therapist in patients with somatoform or somatic symptom disorder. To that end, we developed and psychometrically evaluated a scoring tool for a physical therapeutic observation procedure that is commonly used in the diagnostic phase in a treatment center. The inter-rater reliability and factorial validity of the observer scores were examined, and the observer scores were tentatively correlated with self-report assessments of body-relatedness, viz. body image and somatoform dissociation. Feasibility criteria were inter-rater reliability and a meaningful solution in principal component analysis. In agreement with previous observations of small correlations between different sources of information (Ganellen, 2007), we expected small correlations between physical therapeutic observation scores that represent the therapist’s assessment of body-relatedness and questionnaire scores that assess the

patient's explicit awareness of body-related attitudes and behavior.

## Methods

### Participants

This study was conducted at a tertiary mental health center, specializing in the treatment of somatoform disorder and somatic symptom disorder. Patients admitted to this institution have had somatic symptoms on average for 10 years, have received about 5 previous treatments for somatoform disorder in primary or secondary care and have a comorbid mood, anxiety, or personality disorder in about half of the cases (Van der Boom and Houtveen, 2014). People referred to treatment for somatoform disorder completed self-report questionnaires and were assessed by a physical therapist as part of the diagnostic procedure. At the time of data collection in this study, somatoform disorder was diagnosed by trained psychologists according to DSM-IV-TR criteria (American Psychiatric Association, 2000) and confirmed by the resident medical doctor and psychiatrist.

The study was conducted in accordance with the principles of the Declaration of Helsinki (World Medical Association, 2013) and it was approved by the Institutional Review Board of the mental health center (2014-01/oz1329). All participants provided written informed consent for use of the data for scientific purposes.

Observation data from 191 patients referred for treatment of somatoform disorder were analyzed. This sample size was based on the number of persons available during this study's time period. Fifty-three patients completed one or more questionnaires within the 2 months before their physical therapeutic observation. From the other 139 patients, questionnaire data were not used because of a longer time period between self-report and observation ( $n = 83$ ) or missing data ( $n = 55$ ).

### Instruments

#### BROS

Motivated by the observation that not all aspects of body-relatedness as defined earlier (Kalisvaart et al., 2012) could be measured with questionnaires, development of the Body-Relatedness Observation Scale (BROS) was initiated by one of the physical therapists in order to standardize physical therapeutic observation of body-relatedness. A team of seven physical therapists who were specialized in somatoform disorder then further refined and implemented the observation. In a first meeting, the physical therapists discussed

observations that they executed with six persons with somatic symptom disorder, and the formulation of items that might assess acknowledgment of bodily signals, adjustment to somatic symptoms, and regulation, as defined in earlier research (Kalisvaart et al., 2012). Therapists tested the usability of all relevant items and preliminary scoring categories in clinical practice. In a second consensus meeting, they discussed their clinical experience with the formulated items, and adapted and tested them on another six persons with somatic symptom disorder. Fourteen items with considerable inter-rater agreement were selected. These comprised four categories: 1) ability to execute the instructions (EI); 2) perceive the body (BP); 3) perceive the muscle tension (MT); and 4) make behavioral adaptation (BA) to the specific somatic symptoms (Table 1). The items were formulated in such a way that inter-rater agreement between the seven therapists was expected to be optimal. The scoring scales were chosen so that they best fitted the items, resulting in categorical and ordinal scales.

**Table 1.** The 14 initial items and inter-rater reliability values in order of strength of Kappa or ICC (according to model 1,1).

IRR	Item	Inter-rater reliability	95% CI
Excellent	EI1 Is the exercise executed exactly as instructed or following patient's own interpretation?	K = 1.0	*
	MT1 Does the patient hold the tension?	ICC = 0.90	0.71 to 0.97
	MT2 Can the patient try out gradations of muscle tension?	ICC = 0.78	0.42 to 0.93
	BA1 Does the patient respect his/her physical limitations?	ICC = 0.77	0.39 to 0.93
Substantial	BA2 How careful is the patient with him/herself?	K = 0.75	*
	EI2 Does the patient understand the instructions?	ICC = 0.65	0.17 to 0.88
Fair	BP1 Can the patient feel more after directions from the physical therapist?	ICC = 0.44	-0.13 to 0.79
	BA3 Is the patient starting movement from action or from rest?	K = 0.38	*
Poor	BP2 Can the patient perceive his/her physical limitations?	ICC = 0.35	-0.23 to 0.76
	BA4 Is there a tendency to persevere or to hold back?	K = 0.17	*
	BP3 Can the patient sense the body as a whole?	ICC = 0.13	-0.46 to 0.65
	BP4 Can the patient feel what he/she is doing?	ICC = 0.10	-0.46 to 0.62
	BP5 Are bodily signals noticed by the patient?	ICC = -0.31	-0.72 to 0.29
	BA5 How big is the discrepancy between the behavior during the exercise and during everyday life?	ICC = -0.33	-0.75 to 0.30

\*No 95% confidence interval is given for Kappa scores  
EI = execution of instructions, MT = muscle tension, BP = body perception, and BA = behavioral adaptation, CI = confidence interval, ICC = intra-class correlation coefficient, IRR = inter-rater reliability, K = Kappa.

One item was added concerning the amount of movement limitations. This was done to be able to control the influence of physical limitations on the BROS score. Construction criteria were that the observation scale should make it possible to distinguish between levels of body-relatedness and that it should be suitable for patients with all kinds of physical complaints. Moreover, fast administration of the observations should be possible. Finally, physical therapists with routine expertise should be able to perform the observations.

The test consists of two short exercises (10 minutes total) in which the patient lies face up on a bench with knees bent and feet flat on the surface. First, the patient is asked to move both knees from left to right. Next, the patient is asked to straighten one leg after another, while keeping knees level. No instruction is given about pace, movement range, and duration. The physiotherapist observes with little comments and asks questions about the physical experience. By doing so, the therapist brings the patient's attention toward the body, muscle tension, and other options in movement and behavior. The therapist asks, for example, what parts of the body participate in this movement and if the patient can execute the exercise in a more comfortable way or with less effort. To gain insight into the inter-rater reliability, assessments of 12 patients were recorded on video and scored a second time by one of the other physical therapists (randomly chosen).

### Questionnaires

To evaluate self-reports of body-relatedness, the Dresden body image questionnaire (DBIQ-35) and Somatoform dissociation questionnaire (SDQ-20) were used.

**Dresden body image questionnaire (DBIQ-35).** The DBIQ-35 (Pohlmann, Roth, Brahler, and Joraschky, 2014; Scheffers et al., 2017b) is a 35-item questionnaire with positively and negatively worded items comprising five subscales: body acceptance (e.g. "I wish I had a different body"), vitality (e.g. "I am physically fit"), physical contact (e.g. "Physical contact is important for me to express closeness"), sexual fulfillment (e.g. "I am very satisfied with my sexual experiences"), and self-aggrandizement (e.g. "I use my body to attract attention"). Level of agreement with items is scored on a 5-point Likert scale ranging from 1 = "not at all" to 5 = "fully". Higher scores indicate a more positive body experience. Internal consistency of the subscales in a group of patients with somatoform disorder varied from Cronbach's  $\alpha = 0.78$  for "physical contact" and "self-aggrandizement" to 0.92 for the subscale sexual

fulfillment; patients with somatoform disorder scored substantially lower on these scales than a non-clinical sample (Scheffers et al., 2018). In this study the total score of the DBIQ is used.

**Somatoform dissociation questionnaire (SDQ-20).** The SDQ-20 (Nijenhuis et al., 1996) measures the severity of "somatoform dissociation" by asking to rate 20 symptoms such as analgesia ("Sometimes my body, or part of it, is insensitive to pain"), kinesthetic anesthesia ("Sometimes it is as if my body, or part of it, has disappeared"), and motor inhibitions ("Sometimes I am paralyzed for a while"). The items are scored on a 5-point Likert scale ranging from 1 = "not at all present" to 5 = "very much present". The instrument has good psychometric characteristics and differentiates between dissociative disorders (high scores), somatoform and eating disorders (medium scores), and affective and anxiety disorders (lower scores) (Nijenhuis, 2000; Nijenhuis et al., 1996).

### Data analysis

SPSS Version 22 was used for all statistical analysis. Inter-rater reliability values were computed using Cohen's Kappa (Landis and Koch, 1977; Siegel, 1988) for nominal variables, and intra-class correlations (model 1,1 one-way random, single-measures) for ordinal and continuous variables (Hallgren, 2012). In order to derive dimensions from the observation items, categorical principal components analysis was used. This procedure transforms the nominal and ordinal scores into continuous, normal distributed scores. The criterion for excluding items for factor analysis was a factor loading  $<0.40$  or a loading  $>0.32$  on two or more factors (Costello and Osborne, 2005). Subsequently, the transformed variable scores were converted into item scores that were used to examine the internal consistency of the scales with Cronbach's alpha. The total score was computed by summing these item scores. To test the sampling adequacy Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) was calculated. A KMO value  $> 0.6$  was considered acceptable (Field, 2018). Associations between the dimension score of the BROS and questionnaire scales were computed using Spearman's  $\rho$  for non-normal and ordinal distributions.

### Results

The mean age of the 191 participants was 42.1 years (SD = 13.1, range 18–68) and 68% was female. All participants had somatic symptoms and the detailed diagnoses were: undifferentiated somatoform disorder

(39.0%); conversion disorder (19.8%); pain disorder (31.6%); other primary diagnoses (i.e. affective, anxiety, and personality disorder) (9.6%); and 14 diagnoses were missing. Concerning the movement limitations as observed by the physical therapists: 45% of the participants moved easily; 37% moved somewhat less easily; and 19% moved with difficulty.

The 53 persons that were included in the correlational analysis with questionnaire scores were representative for the whole group considering age and questionnaire data, but more women were included compared to the group that did not fill out questionnaires within the 2-months period (81.1% versus 63.9%) ( $p = .03$ ).

### Inter-rater reliability

Inter-rater reliability (Table 1) was excellent for four observation scores ( $ICC > 0.75$  or  $Kappa > 0.80$ ), substantial for two scores ( $0.60 < ICC < 0.75$  or  $0.60 < Kappa < 0.80$ ), and fair for two scores ( $0.40 < ICC < 0.60$  or  $0.20 < Kappa < 0.40$ ). Six items had poor reliability ( $ICC < 0.40$  or  $Kappa < 0.20$ ) and were not used in further analysis. Four of them concerned perceiving the body (BP2 to BP5) and two concerned adapted behavior (BA4 and BA5).

### Factor analysis

Categorical principal components analysis was executed with the eight fair to excellent reliable items. Because of the small number of items a one factor solution was chosen to test homogeneity within the whole instrument (Table 2). The item “Does the patient understand the instructions?” was deleted due to a low factor loading ( $< 0.40$ ). The final factor solution consisted of seven items (explained variance 36.1%, Eigenvalue 2.53, Kaiser-Meyer-Olkin index 0.66). Internal consistency of the final items of this factor, Cronbach’s alpha, was 0.69 and did not increase when any item was deleted. The final sum score contained one item about execution of the instructions, two about flexibility in muscle tension, three about adapted behavior, and one about perception of the body. The seven items that were not included concerned body perception (four items, BP2 to BP5), adapted behavior (two items, BA3 and BA4), and execution of instructions (EI2). The item “Is the exercise executed exactly as instructed or following patient’s own interpretation?” (EI1) had a negative factor loading. Therefore coding of its final item score was reversed.

### Descriptives

Table 3 shows the frequencies of scores on the final items of the BROS. The range of the total sum score (i.e. the sum of the final item scores) was one to eleven with a median of five. A higher score means a positive body-relatedness as assessed by the physical therapist. Tentatively exploring this final score, no differences were found neither between women and men nor between diagnostic groups. A small correlation was found with age (Spearman’s  $\rho = -0.15$ ,  $p = .05$ ,  $n = 182$ ), with younger patients scoring more positive on the BROS than older patients. The BROS total score had no correlation with movement limitations (Spearman’s  $\rho = -0.01$ ,  $p = .85$ ,  $n = 183$ ).

### Self-report questionnaires

In the group of 53 patients that had body-related observations within the 2 months after their self-report assessment, the correlations of the BROS factor score with “body image” (Spearman’s  $\rho = 0.06$ ,  $p = .73$ ,  $n = 39$ ) and “somatoform dissociation” (Spearman’s  $\rho = 0.21$ ,  $p = .15$ ,  $n = 50$ ) were not significant.

### Discussion

This feasibility study shows that, in patients with somatoform disorder, the Body-Relatedness Observation Scale has fair to excellent inter-rater reliability for most scores concerning the execution of instructions, muscle tension, and adapted behavior but not for items concerning perception of the body. Categorical factor analysis with the reliable items produced a one-dimensional solution with seven items. The internal consistency of this factor did not quite reach (0.69) an acceptable level of 0.70. The observed BROS score did not correlate with self-report scores of “body image” or “somatoform dissociation”.

Strengths of this study are the large sample of patients with somatoform disorder, the practice-based development of the BROS by physical therapists with years of expertise in working with this group, and the use of hands-off observations of behavior. While other studies assess movement quality and focus on functional movement (Skjaerven, Gard, Sundal, and Strand, 2015) and bodily characteristics such as respiration, posture, muscular consistency, and balance (Gyllensten, Ekdahl, and Hansson, 1999; Meurle-Hallberg and Armelius, 2006), they do not appraise behavior in relationship to physical symptoms. Methodological weaknesses are that not enough reliable items were included to achieve an adequate internal consistency for this first version, the

**Table 2.** Component matrix with factor loadings of the reliable items of the body-relatedness observation scale, score categories, transformed item scores after categorical principal components analysis, and final item scores (scores in 191 patients).

	Factor loading	Score categories	Transformed item score	Final item score
BA1 Does the patient respect his/her physical limitations?	0.73	No Partly Yes	-1.14 -.03 1.56	0 1 2
BA2 How careful is the patient with him/herself?	0.71	Rough Carefully Fearfully	-.94 1.09 1.09	0 2 2
MT2 Can the patient try out gradations of muscle tension?	0.67	Not/hardly I On average I Very well	-1.83 -.04 .18 1.87 2.38	0 1 1 2 2
BA3 Is the patient starting movement from action or from rest?	0.62	From action From rest	-.48 2.11	0 2
BP1 Can the patient feel more after directions from the physical therapist?	0.48	No Partly Yes	-1.65 -1.44 .67	0 0 1
EI1 Is the exercise executed exactly as instructed or following patient's own interpretation?*	-0.46	According to personal		
Exactly as instructed	1.55	0 1		
MT1 Does the patient hold the tension?	0.46	Yes No, the patient relaxes during moments of rest	-.44 2.31	0 1
EI2 Does the patient understand the instructions?	-0.38	Yes Partly No	**	**

\*Due to a negative factor loading the final item score of this item is reversed.  
 \*\*No item scores were assigned because the factor loading was < 0.40.  
 \*\*\*The final sum score is computed by summing all final item scores.  
 Extraction Method: Principal Component Analysis.  
 1 component extracted. Explained variance = 36.1%, Eigenvalue = 2.53, Cronbach's alpha = 0.69, Kaiser-Meyer-Olkin index = 0.66.  
 EI = execution of instructions, MT = muscle tension, BP = body perception, and BA = behavioral adaptation.

absence of a golden standard instrument to examine construct validity, the lack of a test-retest comparison, and the small group (n= 53) used to analyze the association with self-reports. The explained variance of the factor solution was low, which might be due to the low number of items and the choice for only one factor. This indicates that it is better to include more observational items in the final BROS. Unclear is the external validity beyond patients with complex problems, high psychiatric comorbidity and a long disease and treatment history. Where activation, graded exercise, and distraction are recommended for patients with mild or moderate symptoms (Henningsen, Zipfel, Sattel, and Creed, 2018), therapists in this tertiary care center emphasize body awareness and respecting physical limitations before

**Table 3.** Frequencies of the items of the final BROS sum score with median, range, and 25th and 75th percentiles of sum score in 191 patients.

	Item categories with final item scores	Frequency %
BA1 Does the patient respect his/her physical limitations?	0 No	31.9
	1 Partly	44.0
	2 Yes	24.1
BA2 How careful is the patient with him/herself?	0 Rough	53.5
	2 Careful	20.3
	2 Cautious	26.2
MT2 Can the patient try out gradations of muscle tension?	0 Not/hardly	15.7
	1 I	38.2
	1 On average	33.5
	2 I	11.5
	2 Very well	1.0
BA3 Is the patient starting movement from action or from rest?	0 From action	81.6
	2 From rest	18.4
BP1 Can the patient feel more after directions from the physical therapist?	0 No	6.3
	0 Partly	25.1
	1 Yes	68.6
EI1 Is the exercise executed exactly as instructed or following patient's own interpretation?	0 According to personal interpretation	29.1
	1 Exactly as instructed	70.9
MT1 Does the patient hold the tension?	0 Yes	84.2
	1 No, the patient relaxes during moments of rest	15.8
	Total sum score	5
Median	0-11	
Range	3	
Percentile 25	7	
Percentile 75		

EI = execution of instructions, MT = muscle tension, BP = body perception, and BA = behavioral adaptation, BROS = body-relatedness observation scale.

activating the patient. Therefore, assessing and treating disturbed body-relatedness may differ for patients with mild to moderate and severe somatoform or somatic symptom disorder.

Especially the items referring to body perception showed a low inter-rater reliability, perhaps partly due to combining two modes of observation, live and by video. The inter-rater reliability of body perception items of our observation procedure is also clearly at odds with comparable assessments in children that showed excellent inter-rater reliability for observations of abilities to attend to bodily sensations, to perceive and become aware of bodily feelings, and to accept and interpret bodily signals (Emck, Plouvier, and van der Lee-Snel, 2012). However, this is a procedure beyond mere observation that integrates verbalizations of what the person is experiencing to assess the ability to perceive and be aware of the body (Skjaerven, Gard, Sundal, and Strand, 2015). It is questionable whether a similar extensive procedure with three sessions as used by Emck and coworkers (Emck, Plouvier, and van der Lee-Snel, 2012) is usable and valid in adults. It is also questionable whether such a complex concept as body perception can be assessed by just observing. The specific situation (i.e.

lying on a bench and being observed) may invoke atypical awareness of the patient, and different therapists may be sensitive to varying cues. For an eventual extension of the BROS, we propose to add items about body perception that are observable. For example, our item “Can the patient feel what he/she is doing?” could be replaced with “Does the face of the patient show feelings when moving the body?” and the item “Are bodily signals noticed by the patient?” could be replaced with “Does the patient show tension, tiredness or pain when moving?”.

The observation scores of physical therapists were not significantly correlated with patients’ self-report scores of body image and somatoform dissociation. In previous studies, correlations of body-related observation scales and self-report questionnaires show a mixed pattern. Medium to strong associations of body-related observation scales with self-report scales of symptoms, distress, and quality of life such as the short-form health survey (SF-36) or the Symptom Check List (SCL-90) were found (Brunner et al., 2018; Gyllensten, Ekdahl, and Hansson, 1999; Skjaerven, Gard, Sundal, and Strand, 2015). In contrast, more body-oriented self-report scales assessing body image, somatoform dissociation, and kinesiophobia (Brunner et al., 2018) were indicated to be not correlated with observation scales. This difference in correlations might suggest that the overlapping part of observation scores and self-report scores of symptoms, distress, and quality of life reflect individual differences in a similar underlying variable (e.g. experienced and expressed disease severity) while in contrast the lack of overlap between body-related observations by the physical therapist and body-related self-reports of the patient may reflect that they represent different aspects of body-relatedness. This underscores the need to use an observation scale of body-relatedness besides self-report experience scales. Of course, both modes of assessment need further validation.

The internal consistency of the brief 7-item BROS of 0.69 was not quite high enough to get the label “adequate”, which would be achieved with a Cronbach’s alpha of 0.70. Research in a sample that is more mixed in terms of complexity of pathology might show higher reliability. Moreover, items could be added to increase the accuracy of the BROS. Although the sample size of the current study seems adequate for exploratory factor analysis with eight items and one dimension, confirmatory factor analysis with a new sample is needed in subsequent tests of the factor structure (Osborne, 2014). Especially the assessment of body perception remains challenging and might be enhanced by including items that are better observable. Overall, the BROS seems to assess aspects of body-relatedness that are not

captured in self-report questionnaires and that may help to improve evaluation of patient characteristics and treatment effectiveness. Other next steps would be studying test-retest reliability and sensitivity and specificity by comparing this group with other populations such as a general population sample or persons with chronic pain. Although no golden criterion for body-relatedness exists, it appears worthwhile to compare observational results of the BROS with other measures. Behavioral adaptation as reflected in flexibility, pace, frequency, and other aspects of movements may be validated using video technology as has been done to capture biomechanical characteristics of walking (Molina-Garcia et al., 2019). Moreover, muscle tension aspects of the BROS could be associated with electromyographic assessments (Raez, Hussain, and Mohd-Yasin, 2006) and for criterion validation of body perception, a body awareness questionnaire such as the multi-dimensional assessment of interoceptive awareness might be used (Mehling et al., 2018). In clinical practice, further research is also needed regarding sensitivity to change, the diagnostic value of the BROS for the treatment process, and the generalizability to patients with mild or moderate disorders. In conclusion, this initial analysis of a structured physical therapeutic observation for people with somatoform disorder or somatic symptom disorder indicated modestly sound psychometric quality of observations of execution of instructions, muscle tension, and behavioral adaptation, but not of patients’ ability to perceive the body. This shows that these observations are feasible when restricted to observable behavior and it indicates the appropriateness of further development of the BROS.

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## Disclosure statement

The authors report no conflict of interest.

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