

Psychobehavioral Predictors of Somatoform Disorders in Patients With Suspected Allergies

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Objective: To explore a combination of health-related psychobehavioral features as potential positive criteria for somatoform disorders (SFD). Currently, SFD can only be diagnosed in the absence of sufficient organic symptom explanation, resulting in low criterion validity and delay of appropriate therapy. **Methods:** Cross sectionally, we studied various psychobehavioral characteristics of 197 inpatients with suspected allergies. At the beginning of the medical work-up, patients were interviewed and completed a set of self-rating questionnaires (Illness Perception Questionnaire-Revised, Whiteley Index-7, Cognitions About Body And Health Questionnaire, Scale for the Assessment of Illness Questionnaire, Health Attitude Survey, Reassurance Questionnaire, and Patient Health Questionnaire). Organic explicability of the presenting symptoms was assessed by allergists at the end of the work-up. Forty-eight patients with SFD were compared with 149 patients without SFD, and predictive models were set up. To control for effects of the work-up situation, we also investigated 47 patients with an established diagnosis of hymenoptera venom allergy. **Results:** In the work-up group, various self-reported psychobehavioral features discriminated patients with SFD from patients without SFD. In logistic regression analysis, self-reported dissatisfaction with medical care, disease conviction, reduced symptom controllability, and reduced body scanning independently predicted SFD. A predictive model based on these psychobehavioral characteristics had high sensitivity and specificity (area under the curve = 0.86, 95% Confidence Interval = 0.79–0.93; $p < .001$), which was comparable to the Patient Health Questionnaire-15, an established SFD screening tool assessing somatization. **Conclusions:** Psychobehavioral characteristics in patients with SFD cannot solely be attributed to the uncertainty of a work-up situation. Their predictive value is comparable to that of the traditional measuring of symptom number and severity; hence, they should be considered as SFD positive criteria in Diagnostic and Statistic Manual of Mental Disorders, 5th Edition. **Key words:** allergy, intolerances, organically unexplained symptoms, somatoform disorders, predictors, positive criteria.

SFD = somatoform disorder; **VIT** = venom immunotherapy; **DSM-IV** = Diagnostic and Statistic Manual of Mental Disorders, 4th Edition; **SCID** = Structured Clinical Interview for DSM-IV; **PHQ** = Patient Health Questionnaire; **GAD** = general anxiety disorder; **IPQ-R** = Illness Perception Questionnaire-Revised; **WI** = Whiteley Index; **CABAH** = Cognitions About Body And Health Questionnaire; **SAIB** = Scale for the Assessment of Illness Questionnaire; **HAS** = Health Attitude Survey; **RQ** = Reassurance Questionnaire; **TUM** = Technische Universitaet Muenchen.

INTRODUCTION

Fifteen percent to 30% of patients in primary and up to 50% in specialized care present with bodily symptoms insufficiently explained by structural pathology (1–3). If these symptoms are persistent and cause clinically significant impairment, a somato-

form disorder (SFD) is diagnosed according to Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV). Depending on symptom quantity and duration, DSM-IV distinguishes between “somatization disorder,” “undifferentiated somatoform disorder,” and “pain disorder.” Recently, a more inclusive definition of the rare somatization disorder, “multi-somatoform disorder” (MSD), has been suggested; it is diagnosed if at least three unexplained somatic complaints have been present for at least 2 years (4).

Positive psychobehavioral features are not part of SFD diagnostic criteria—but a diagnosis primarily “by exclusion” is methodically questionable and significantly adds to underrecognition and false treatments. The criterion of a lacking organic explicability is unspecific and depends on differing expert opinions; minor organic findings tend to be overestimated; it nourishes a misleading body-mind-dualism (5,6). There is preliminary expert consensus that the upcoming versions of DSM/International Classification of Diseases will have to contain positive criteria to improve criterion validity, practicability, and acceptability of SFD diagnoses (5,7).

Many studies have tried to predict SFD on the basis of number/type of symptoms, stressful life events, or a history of depression and anxiety (8–10). It is, however, clinically well known that patients with SFD also express characteristic health-related cognitions, emotions, and behaviors like excessive concern or preoccupation with symptoms. Evidence for such psychobehavioral descriptors is accumulating (5,11–16). Consequently, Noyes and colleagues recently suggested a reconsideration of SFD solely based on the extent of symptom-related distress, preoccupation and impairment as well as illness behavior (6).

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In this study, we set out to explore a combination of health-related psychobehavioral features as potential positive criteria for SFD. We chose the field of allergology because of the high rate of organically unexplained symptoms and SFD encountered here (17–26). We hypothesized that specific health-related psychobehavioral criteria predict SFD with sufficient specificity and sensitivity over and above the uncertainty of a work-up situation and the psychological burden of allergy (17,27–30).

METHODS

Patients

To create a reasonably homogeneous and internally valid sample, the study was set up among inpatients of a medical subspecialty with a high rate of organically unexplained symptoms and good infrastructural conditions (longstanding cooperation, extensive medical work-up). Within 11 months (January 2007 to November 2007), we approached all patients who were admitted as inpatients to the Technische Universität München (TUM) allergy department for an allergy work-up because of symptoms that could not be diagnosed with sufficient certainty in an outpatient setting. Restricting patient recruitment to the inpatient setting guaranteed sufficient homogeneity of symptom severity and etiological ambiguity. The only inclusion criterion was presentation with physical symptoms due to assumed allergies. Exclusion criteria were a) age <18 years or >65 years; and b) insufficient command of the German language. A total of 245 consecutive allergy work-up patients were included in the study.

To control for effects of the work-up situation, we also included 55 inpatients with proven hymenoptera venom allergies hospitalized for allergen-specific venom immunotherapy (VIT). For this group (referred to as VIT), the same exclusion criteria applied.

Study Procedure and Instruments

Patients were informed about the study during their first contact with an allergist and contacted by the interviewer within the first 2 days of their hospital stay. They were informed about the aims and extent of the study and, on their approval, signed informed consent.

Study instruments consisted of a structured interview, a set of self-rating questionnaires, and a rating of organic explicability of presenting symptoms by the allergists at the end of the stay.

The interview took place within the first 2 days and was conducted by Board-certified psychiatrists (C.H. or S.B., both certified Structured Clinical Interview for DSM-IV [SCID] interviewers). It started with a set of standardized open questions on symptoms and past medical history, followed by section G (somatoform disorders) of SCID-I, the current gold standard for the diagnosis of SFD (31). In addition, criteria for MSD were applied (4). The SCID diagnosis of SFD is based on a systematic review of organ systems, the impairment caused by, and the organic explicability of the symptoms. Because the diagnosis is not restricted to presenting symptoms, it can be given either independent of the results of a current organic work-up (when diagnostic criteria are already met), or considered preliminary awaiting the results of an organic work-up. A SCID SFD diagnosis can be either the main diagnosis or, when organically explained, presenting symptoms coexist with organically unexplained symptoms, a secondary diagnosis. Every patient who fully met the criteria for a somatization disorder, MSD, pain disorder, or undifferentiated SFD was henceforth designated as an SFD patient. Work-up patients without an SFD were labeled as NoSFD.

Known allergies and other medical diagnoses (organic comorbidity) as well as duration of presenting symptoms were recorded, based on patient reports and chart reviews.

After the interview, patients were asked to complete a set of self-rating questionnaires within the next 2 days. These questionnaires covered various health-related cognitive, affective, behavioral, and interactional characteristics and were selected based on a literature review on psychobehavioral

features in SFD, according to their psychometric properties and their demonstrated ability to identify patients with SFD.

Questionnaires and Other Measures

The Illness Perception Questionnaire-Revised (IPQ-R) is a measure of illness perception. The validated German version consists of 32 items on seven subscales: 1) timeline (acute/chronic) (minimum score = 5, maximum score = 25, five items such as “My illness will last for a long time”); 2) consequences (score = 5–25, five items, e.g., “My illness has major consequences on my life”); 3) personal control (score = 4–20, four items, e.g., “Nothing I do will affect my illness”); 4) treatment control (score 4–20, four items, e.g., reversely coded, “My treatment will be effective in curing my illness”); 5) illness coherence (score = 5–25, five items, e.g., “My illness is a mystery to me”); 6) timeline cyclical (score = 4–20, four items, e.g., “My illness is very unpredictable”); and 7) emotional representations (score = 5–25, five items, e.g., “My illness makes me feel angry”) (32,33). All items are scored on 5-point Likert-scales from 1 = “strongly disagree” to 5 = “strongly agree.” On some scales (e.g., “consequences”), high scores reflect impairment whereas on other scales (e.g., “personal control”), low scores do so.

The Whiteley Index, short form (WI-7), is a seven-item measure of health anxiety and illness perception with two subscales and a sum score (the latter was not incorporated in this analysis). The subscale “disease conviction” covers three items (e.g., “Is it hard for you to believe the doctor when he/she tells you there is nothing for you to worry about?”); the subscale “illness worrying” has also three items (e.g., “Do you worry a lot about your health?”). All items are scored on 5-point Likert scales from 1 = “Not at all” to 5 = “A great deal” so that each subscale reaches a minimum of 3 points and a maximum of 15 points (11). The WI is an established instrument validated also in German (34).

The Cognitions About Body And Health Questionnaire (CABAH) is a measure of health-related cognitions with 31 items on five subscales: 1) The subscale “catastrophizing of bodily complaints” (score = 0–42; 14 items, e.g., “Bodily complaints are always a sign of disease”); 2) “autonomic sensations” (score = 0–12; four items, e.g., “I often feel my heart beating because my circulatory system is very sensitive”); 3) “bodily weakness” (score = 0–18; six items, e.g., “I’m physically rather weak and sensitive”); 4) “intolerance of bodily complaints” (score = 0–12; four items, e.g., “If I don’t observe my body often, I could become seriously ill without noticing it”); and 5) “health habits” (score = 0–9; three items, e.g., “I’m always careful to live really healthily”). All items are scored on 4-point Likert scales from 0 = “completely wrong” to 3 = “completely right.” The CABAH is originally validated in German; we obtained the German version from the authors (13).

The Scale for the Assessment of Illness Behavior (SAIB) is a measure of various illness behaviors with 25 items on five subscales and a sum score (the latter has not been incorporated in this analysis): 1) “Diagnosis verification” (score = 5–20; five items, e.g., “I have a specialist confirm a diagnosis given by my general practitioner”); 2) “expression of symptoms” (score = 6–24; six items, e.g., “Everybody can see when I am suffering”); 3) “medication” (score = 5–20; five items, e.g., “I always have the most important medicines at home”); 4) “illness consequences” (score = 5–20; five items, e.g., “I am not able to concentrate on my work when suffering from physical complaints”); and 5) “scanning” (score = 4–16; four items, e.g., “I pay a lot of attention to the different processes going on within my body”). It is important to note that the SAIB items are scored on 4-point Likert scales from 1 = “I agree completely” to 4 = “I disagree completely” so that low scores resemble high impairment. The SAIB is originally validated in German; we obtained the German version from the authors (14,15).

The Reassurance Questionnaire (RQ) is a measure of reassurability in the medical context. It contains ten questions, e.g., “Do you think your physician is keeping something from you?” with one sum score; high scores resemble a low reassurability. Because each item is scored on a 5-point Likert scale from 0 = “No” to 4 = “mostly,” the sum score has a minimum of 0 and a maximum of 40. There are validated versions of the RQ in English and Dutch, but not in German; therefore, we conducted a back-and-forth translation in cooperation with the authors (16).

The Health Attitude Survey (HAS) is a measure on health attitudes developed for the assessment of somatizing patients. We included four sub-

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scales of the original version: 1) “Dissatisfaction with care” (score = 0–36; nine items, e.g., “Doctors do not seem to know much about the health problems I have had”); 2) “frustration with ill health” (score = 0–16; four items, e.g., “I have felt ill for quite a while now”); 3) “excessive health worry” (score = 0–12; three items, e.g., “I have trouble getting my mind off my health”); and 4) “psychological distress” (score = 0–16; four items, e.g., “Sometimes I feel depressed and cannot seem to shake it off”). All items are scored on 5-point Likert scales from 0 = “strongly disagree” to 4 = “strongly agree.” The HAS is validated in English but not in German; here, we also conducted a back-and-forth translation (12).

To assess the “classical dimensions” of SFD, i.e., somatization, depression, and anxiety, three modules of the widely used and well-established Patient Health Questionnaire (PHQ) were applied (validated German version): the PHQ-15 for somatization (15 items, 0–2, score = 0–30); the PHQ-9 for depression (nine items, 0–3, score = 0–27); and the general anxiety disorder (GAD)-7 for general anxiety (seven items, 0–3, score 0–21) (35–39). Afterward, sociodemographic data were requested by means of closed questions. Two days after the interview, the questionnaires were collected by the interviewer or an assistant.

All patients underwent a thorough work-up commensurate with their clinical problem including blood and skin testing, double-blind, placebo-controlled provocation tests with foods, additives, drugs, or contact/inhalative substances (e.g., latex), and consultations with other departments for differential diagnostic procedures.¹ According to the policy of the allergy department—mainly not to bias placebo testing—patients were told about their test results and final diagnosis in a closing discussion on the last day of their stay. For the present study, the degree of organic symptom explicability of the presenting symptoms was rated by the responsible allergist at the end of all medical examinations. This rating consisted of a systematic stepped review of all findings (from history to blinded provocation testing), and summarized the clinical decision on a five-step rating scale (from 0 = “not at all organically explained” to 4 = “fully medically explained”), later condensed into three steps, i.e., 0/1 = “not organically explained”; 2 = “partly organically explained”; and 3/4 = “organically explained.”

Because this instrument was specifically developed for this project, blind double ratings were requested in about every sixth case to assess interrater reliability.

Age, gender, and organic symptom explicability were recorded for all patients.

Ethics

All procedures were performed as approved by the Institutional Review Board, Medical Faculty, TUM.

Statistical Analysis

Statistical analyses were carried out with SPSS (version 16.0). Interrater reliability of the allergological rating was assessed with Cohen’s κ coefficient. Data were analyzed descriptively reporting absolute numbers and percentages for categorical variables, and mean $\pm$ standard deviation for continuous variables. Comparisons of frequencies between patient subgroups were performed by χ^2 test. One-way analyses of variance were used for mean comparisons between more than two independent samples, followed by pairwise comparisons using Mann-Whitney U tests in terms of a hierarchical test procedure. To assess predictive performance of single predictors, receiver operating characteristics were conducted, and areas under the curve (AUC) were reported. Intercorrelation of self-reported psychobehavioral variables was assessed with Spearman’s correlation coefficient (r); $r = \geq .4$ was considered a relevant correlation. Additionally, collinearity statistics were performed, and the variance inflation factor was calculated. To validate internally predictive models, we randomly split the work-up group data set into a training (model development) and a test (model validation) sample. In the 75% training sample ($n = 150$; 37 SFD, 113 NoSFD), first the “classical”

¹The TUM allergy department is an excellence center of the Global Allergy and Asthma European Network (GA2LEN) and follows the GA2LEN diagnostic guidelines (www.ga2len.net).

(PHQ-15, PHQ-9, GAD-7) and second all self-reported psychobehavioral variables were considered simultaneously in binary logistic regression analyses, using forward conditional selection procedures and a classification cut value of 0.2 to identify independent predictors of SFD. Resulting models were judged according to their goodness-of-fit, correct classification rate, and AUC, and tested in the 25% test sample ($n = 47$; 11 SFD, 36 NoSFD) (binary logistic regression, enter method). A combined binary logistic regression (enter method) including the resulting psychobehavioral and classical predictors was finally applied to the whole work-up sample. The dependent variable of all logistic regression analyses was the presence of a primary SFD (yes = 1 or no = 0). Goodness-of-fit was assessed with the Hosmer-Lemeshow test. Odds ratios (ORs) were calculated with 95% Confidence Intervals (CIs) and reported for every 1-point increase on the test scales.

For the purpose of an exploratory data analysis, statistical comparisons were made, using a two-sided 0.05 level of significance. To reduce overall probability of significant results by chance, Bonferroni adjustments of p values were conducted in variable-wise multiple group comparisons.

RESULTS

Participation Rate

Of the 245 work-up patients, 218 (mean age = 44 ± 13 years; 72% women) participated. There were 27 nonparticipants (49 ± 13 years; 78% women; participation rate = 89%). Nonparticipants were significantly older ($p = .03$), but comparable in terms of gender ($p = .65$).

Fifty of the 55 VIT patients (44 ± 11 years; 68% women) participated. There were five (9%) nonparticipants (52 ± 13 years; 80% women; participation rate = 91%). Older patients were also more likely to refuse, even if the difference was not statically significant ($p = .13$). Gender distribution was similar ($p > .99$).

Reasons for nonparticipation (27 work-up and 5 VIT patients) were as follows: 19 patients had no interest in the study, four claimed to be too busy, two could not take part for medical reasons, and seven did not participate for organizational reasons.

All 268 respondents completed the SCID interview; of these, 254 patients returned their questionnaires.

Prevalence of Somatoform Disorders and Selection of Study Sample

Table 1 summarizes the prevalence rates of SFD according to SCID; an SFD was diagnosed in 69 patients in the work-up group, and in three patients in the VIT group. Among these, the SFD diagnosis was considered the primary diagnosis in 48 patients in the work-up group, and in no patient in the VIT group. The other 21 SFD diagnoses among work-up patients and three SFD diagnoses among VIT patients were considered “secondary” due to organic explanations for the presenting symptoms (e.g., a true allergy to analgesics in a patient with somatoform pain disorder); these patients were excluded from further analyses.

Of the 48 patients with a primary diagnosis of SFS, 24 patients reported multiple symptoms from multiple organ systems, which had been shown to be organically unexplained in the past. In addition, their presenting “allergy-like” symptoms were judged to be organically unexplained by the allergists. In the other 24 of these patients, only the presenting symptoms formed the basis of a primary diagnosis of SFD, combining

TABLE 1. Prevalence of Somatoform Disorders

	Work-Up Patients			VIT
	Women/Men <i>n</i> = 218	Women <i>n</i> = 157	Men <i>n</i> = 61	Women/Men <i>n</i> = 50
Somatization disorder	3 (1.3%)	3 (1.9%)	0	0
Multisomatoform disorder	26 (11.9%)	19 (12.1%)	7 (11.5%)	0
Pain disorder	9 (4.1%)	6 (3.8%)	3 (4.9%)	1 (2.0%)
Undifferentiated somatoform disorder	31 (14.2%)	27 (17.2%)	4 (6.6%)	2 (4.0%)
Any somatoform disorder	69 (31.7%) ^a	55 (35.0%)	14 (23.0%)	3 ^a (6.0%)
SFD is primary diagnosis	48 (22.0%)	39 (24.8%)	9 (14.8%)	0

^a For all following group comparisons, the 21 work-up patients and the three VIT patients with secondary SFD were excluded.
VIT = venom immunotherapy; SFD = somatoform disorder.

results of allergy work-up (showing that symptoms are organically unexplained) and SCID (proving persistence and clinical impairment).

Subsequent analyses were carried out with 48 patients diagnosed with a “primary” SFD in contrast to 149 NoSFD patients and 47 VIT patients. Carrying out the analyses including patients with a “secondary” SFD diagnosis in the SFD group, however, did not alter the results (data not shown). This may be due to a generally biased illness perception in patients with SFD.

Sociodemographic Data, Organic Comorbidity, and Explicability of Presenting Symptoms

Table 2 illustrates that all three groups were comparable with respect to organic comorbidity and sociodemographic data.

Between SFD and NoSFD patients, the allergists' rating of organic symptom explicability differed widely and showed marked but not complete accordance with SCID diagnoses (Table 2). The symptoms of 25 NoSFD patients could not be explained. Interrater reliability of this new measurement instrument of symptom explicability, based on 41 double ratings, was substantial (Cohen's κ = 0.64).

Somatization, Depression, and Anxiety

In contrast to the comparable sociodemographic and comorbidity profiles, the three groups (SFD, NoSFD, VIT) clearly differed with respect to continuous measures of somatization (PHQ-15), depression (PHQ-9), and anxiety (GAD-7), all of them “classical” descriptors of SFD (Table 2). Two sample group comparisons revealed that relevant differences

TABLE 2. Sociodemographic Variables, Organic Comorbidity, Duration, and Explicability of Presenting Symptoms; Somatization, Depression, and Anxiety in 244 Interviewees

	SFD <i>n</i> = 48	NoSFD <i>n</i> = 149	VIT <i>n</i> = 47	<i>p</i>
Age in years ^a	43.0 (12.8)	43.2 (12.9)	43.1 (10.7)	.99
Sex				.18
Female	39 (81.2%)	102 (68.5%)	31 (66.0%)	
Male	9 (18.8%)	47 (31.5%)	16 (34.0%)	
History of other allergy				.31
Yes	22 (45.8%)	73 (49.0%)	17 (36.2%)	
No	26 (54.2%)	76 (51.0%)	30 (63.8%)	
Number of concurrent somatic diagnoses (other than allergy)				.48
0	27 (56.2%)	73 (49.0%)	32 (68.1%)	
1–2	19 (39.6%)	64 (43.0%)	13 (27.7%)	
≥3	2 (4.2%)	12 (8.0%)	2 (4.2%)	
Duration of presenting symptoms [years] ^a	8.8 (10.9)	5.9 (8.4)	6.1 (8.4)	.18
Organic explicability of presenting symptoms ^b				<.001
No (not or almost not)	36 (75.0%)	25 (17.0%)	0	
Partly (about 50%)	12 (25.0%)	28 (19.1%)	0	
Yes (fully or almost fully)	0	94 (63.9%)	47 (100%)	
Somatization (PHQ-15) ^a	11.2 (5.1)	5.8 (3.2)	4.9 (3.0)	<.001
Depression (PHQ-9) ^a	8.1 (4.3)	3.9 (2.9)	3.0 (2.8)	<.001
Anxiety (GAD-7) ^a	5.1 (3.3)	3.5 (2.6)	3.0 (2.6)	.001

Unmarked variables: number (percentage) and *p* value (two-tailed significance) of χ^2 test.

^a Marked variables: mean (SD) and *p* value of analysis of variance.

^b For two participating patients with NoSFD, no organic rating was available.

SFD = somatoform disease; NoSFD = no somatoform disease; VIT = venom immunotherapy; PHQ = Patient Health Questionnaire; GAD = general anxiety disorder.

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existed between SFD and NoSFD patients ($p < .001$ for the PHQ-15; $p < .001$ for the PHQ-9; and $p = .001$ for the GAD-7), but not between NoSFD and VIT patients ($p = .12$ for the PHQ-15; $p = .10$ for the PHQ-9; $p = .23$ for the GAD-7). Within the work-up group, a receiver operating characteristics-analysis revealed AUCs for SFD versus NoSFD of 0.82 (CI = 0.74–0.89; $p < .001$) for the PHQ-15; 0.79 (CI = 0.71–0.87; $p < .001$) for the PHQ-9, and 0.64 (CI = 0.55–0.73; $p = .005$) for the GAD-7.

Self-Reported Psychobehavioral Characteristics of Patients With SFD

Results from the self-report questionnaires (IPQ-R, WI-7, CABAHA, SAIB, RQ, and HAS) revealed numerous marked differences between SFD and NoSFD and between SFD and VIT patients, and some differences between NoSFD and VIT patients (Table 3).

The psychobehavioral variables demonstrated 41 relevant intercorrelations with $r = \geq .4$ and moderate multicollinearity (variance inflation factor between 1.2 and 3.2) (details not shown).

Predictors of SFD

a. Classical Model

A logistic regression model in the 75% training sample including somatization (PHQ-15), depression (PHQ-9), and anxiety (GAD-7) showed very good fit ($\chi^2 = 3.77$, $df = 7$, $p = .81$) and a moderate predictive sensitivity and specificity (AUC = 0.78; 95% CI = 0.68–0.87; $p < .001$). Only the PHQ-15 proved an independent predictor, correctly classifying 73% of SFD cases and 69% of NoSFD cases.

b. New Psychobehavioral Model

A first logistic regression model including all psychobehavioral characteristics (subscales from IPQ-R, WI-7, CABAHA, SAIB, and HAS; $n = 139$) revealed five independent predictors (HAS dissatisfaction with care, WI-7 disease conviction, IPQ-R personal control, IPQ-R consequences, and SAIB body scanning); this five-factor-solution had, however, inappropriate fit ($\chi^2 = 14.51$, $df = 8$, $p = .07$). The best model in terms of fit, classificatory, and predictive properties was a four-factor-solution with HAS dissatisfaction with care (OR = 1.21; 95% CI = 1.11–1.33; $p < .001$), WI-7 disease

TABLE 3. Self-Reported Psychobehavioral Characteristics in 48 SFD Patients, 149 NoSFD Patients, and 47 VIT Patients

	Subscale Score (Min–Max) ^a	SFD M (SD) $n = 44$	NoSFD M (SD) $n = 142$	VIT M (SD) $n = 46$	p (ANOVA) All Groups	p (Man-Whitney U Test)			ROC Analysis: SFD Versus NoSFD	
						SFD Versus NoSFD	NoSFD Versus VIT	SFD Versus VIT	AUC (CI)	p
IPQ-R timeline (acute/chronic)	(5–25)	16.9 (4.5)	14.5 (4.8)	14.5 (4.1)	.008	.01 ^b	>.99 ^b	.05 ^b	0.64 (0.55–0.74)	.004
IPQ-R consequences	(5–25)	15.5 (4.3)	11.5 (4.2)	9.0 (3.1)	<.001	<.001 ^b	<.001 ^b	<.001 ^b	0.75 (0.67–0.83)	<.001
IPQ-R personal control	(4–20)	9.6 (3.2)	11.8 (4.3)	10.7 (4.2)	.006	.003 ^b	.30 ^b	.84 ^b	0.34 (0.26–0.42)	.001
IPQ-R treatment control	(4–20)	11.8 (3.3)	14.0 (3.0)	16.9 (2.2)	<.001	<.001 ^b	<.001 ^b	<.001 ^b	0.30 (0.21–0.39)	<.001
IPQ-R illness coherence	(5–25)	14.2 (5.9)	15.3 (5.8)	19.6 (6.1)	<.001	.87 ^b	<.001 ^b	<.001 ^b	0.45 (0.35–0.55)	.29
IPQ-R timeline cyclical	(4–20)	11.7 (3.4)	10.3 (3.8)	7.4 (3.2)	<.001	.11 ^b	<.001 ^b	<.001 ^b	0.60 (0.51–0.70)	.04
IPQ-R emotional representations	(5–25)	13.9 (4.5)	11.6 (5.4)	10.5 (4.0)	.004	.006 ^b	>.99 ^b	<.001 ^b	0.65 (0.57–0.74)	.002
WI-7 disease conviction	(3–15)	8.8 (2.9)	6.1 (2.4)	5.3 (1.9)	<.001	<.001 ^b	.17 ^b	<.001 ^b	0.77 (0.69–0.85)	<.001
WI-7 illness worrying	(3–15)	7.3 (2.7)	5.7 (2.3)	5.6 (2.2)	<.001	<.001 ^b	>.99 ^b	.006 ^b	0.68 (0.59–0.78)	<.001
CABAHA catastrophizing	(0–42)	11.9 (4.8)	11.4 (5.3)	12.0 (5.5)	.78	n.t.	n.t.	n.t.	0.51 (0.42–0.61)	.81
CABAHA autonomic sensations	(0–12)	3.6 (2.5)	3.3 (2.0)	2.5 (1.7)	.02	>.99 ^b	.06 ^b	.14 ^b	0.52 (0.41–0.62)	.76
CABAHA bodily weakness	(0–18)	7.3 (3.4)	4.9 (3.0)	3.3 (2.9)	<.001	<.001 ^b	<.003 ^b	<.001 ^b	0.71 (0.62–0.80)	<.001
CABAHA intolerance of bodily complaints	(0–12)	3.2 (1.6)	3.4 (2.0)	4.4 (2.0)	.005	>.99 ^b	.009 ^b	.01 ^b	0.49 (0.40–0.59)	.91
CABAHA health habits	(0–9)	5.2 (1.3)	5.3 (1.3)	5.4 (1.3)	.75	n.t.	n.t.	n.t.	0.47 (0.38–0.57)	.60
SAIB verification of symptoms	(5–20)	15.7 (2.6)	16.0 (2.6)	15.9 (2.5)	.85	n.t.	n.t.	n.t.	0.46 (0.36–0.56)	.44
SAIB expression of symptoms	(6–24)	19.2 (2.9)	19.1 (2.5)	18.7 (2.5)	.58	n.t.	n.t.	n.t.	0.51 (0.40–0.61)	.88
SAIB illness consequences	(5–20)	13.9 (2.3)	15.0 (2.4)	15.7 (1.9)	.001	.009 ^b	.18 ^b	<.001 ^b	0.36 (0.26–0.45)	.004
SAIB medication	(5–20)	14.3 (2.6)	14.4 (2.8)	13.8 (3.2)	.49	n.t.	n.t.	n.t.	0.49 (0.39–0.58)	.81
SAIB body scanning	(4–16)	12.3 (1.9)	11.9 (2.3)	11.4 (2.2)	.14	n.t.	n.t.	n.t.	0.55 (0.45–0.64)	.35
RQ sum score	(0–40)	17.3 (4.8)	12.8 (5.1)	13.1 (4.8)	<.001	<.001 ^b	>.99 ^b	<.001 ^b	0.74 (0.67–0.82)	<.001
HAS dissatisfaction with care	(0–36)	16.1 (5.2)	9.5 (5.1)	7.5 (4.8)	<.001	<.001 ^b	.04 ^b	<.001 ^b	0.82 (0.75–0.89)	<.001
HAS frustration with ill health	(0–16)	11.7 (3.4)	8.4 (3.7)	5.1 (3.4)	<.001	<.001 ^b	<.001 ^b	<.001 ^b	0.74 (0.65–0.83)	<.001
HAS excessive health worry	(0–12)	3.8 (2.1)	2.8 (2.5)	2.5 (2.4)	.03	.02 ^b	>.99 ^{bb}	.02 ^b	0.63 (0.55–0.72)	.008
HAS psychological distress	(0–16)	7.5 (2.8)	6.0 (3.1)	5.5 (3.0)	.003	.01 ^b	>.99 ^b	.006 ^b	0.64 (0.56–0.73)	.005

The direction indicating psychobehavioral distress appears in bold font.

^a Range of possible subscale scores (minimum–maximum).

^b Bonferroni-adjusted.

SFD = somatoform disorder; NoSFD = no somatoform disorder; VIT = venom immunotherapy; M = mean; SD = standard deviation; ANOVA, analysis of variance; ROC = receiver operating characteristic; AUC = area under the curve; CI = Confidence Interval; n.t. = not tested; IPQ-R = Illness Perception Questionnaire-Revised; WI = Whiteley Index; CABAHA = Cognitions About Body And Health Questionnaire; SAIB = Scale for the Assessment of Illness Questionnaire; RQ = Reassurance Questionnaire; HAS = Health Attitude Survey.

conviction (OR = 1.38; 95% CI = 1.12–1.71; $p = .003$), IPQ-R personal control (OR = 0.86; 95% CI = 0.76–0.98; $p = .03$), and SAIB body scanning (OR = 1.38; 95% CI = 1.04–1.83; $p = .03$), which had good fit ($\chi^2 = 8.78$, $df = 8$, $p = .36$) and good predictive sensitivity and specificity (AUC = 0.86; 95% CI = 0.79–0.93; $p < .001$). It correctly classified 85% of SFD cases and 71% of NoSFD cases.

c. Model Validation

Both models were validated separately in a 25% test sample ($n = 43$). The PHQ-15 reached an AUC of 0.93 and correctly classified 90% of the SFD cases and 91% of the NoSFD cases. The psychobehavioral model (four-factor solution) reached an AUC of 0.93 and correctly classified 90% of the SFD cases and 88% of the NoSFD cases.

d. Final model

The final combined model included the following variables: dissatisfaction with care (HAS), disease conviction (WI-7), personal control (IPQ-R), body scanning (SAIB), and somatization (PHQ-15). In the original sample of 197 work-up patients ($n = 182$), this model had very good fit ($\chi^2 = 4.19$, $df = 8$, $p = .84$) and an AUC of 0.91 (0.87–0.96; $p < .001$). It correctly classified 84% of SFD cases and 82% of NoSFD cases. WI-7 disease conviction, however, no longer proved an independent predictor (Table 4).

DISCUSSION

This cross-sectional study among patients with supposed allergies is the first empirical study of its kind, demonstrating the high predictive value of a number of previously suggested psychobehavioral characteristics that discriminate between patients with and those without SFD, as diagnosed by SCID. The study also differentiated between hitherto suggested characteristics in terms of their predictive values. A predictive model combining the most robust psychobehavioral characteristics (dissatisfaction with care, personal control, and body scanning) with the PHQ-15 clearly outperformed the PHQ-15 alone. Therefore, our study

lends support to the integration of selected psychobehavioral characteristics as positive criteria for SFD in DSM-V and International Classification of Diseases-11.

Considering an OR of 1.22 for every 1-point increase and the actual raw score difference of 6.6 between SFD and NoSFD, the cognitive-interpersonal feature of “dissatisfaction with care” (HAS) was an especially potent independent predictor of SFD. Although the literature increasingly focuses on the importance of the doctor-patient relationship and also attachment style in general in SFD (6,40,41), interactional features are not part of the current diagnostic criteria. This study stresses the importance of including such—apparently essential—aspects in future definitions of SFD.

Surprisingly, little is known about the notion of controllability (especially locus and degree of symptom control) in SFD. A predominantly external locus of control has been shown to be characteristic of certain “organically unexplained” conditions, such as irritable bowel syndrome or pseudoseizures (42,43). Furthermore, a high internal locus of control has been shown to be associated with a more favorable course in patients suffering from chronic headache or cardiovascular disease (44,45). Our study confirms the essential role that is played by reduced personal symptom controllability in SFD.

Despite negligible raw score differences on the SAIB subscale, a reduced self-reported readiness to scan and check the own body turned out to be an independent predictor of SFD. Contrarily, earlier SAIB investigations had demonstrated higher self-reported body scanning in individuals with somatization syndrome and/or depression (14,15). The clinical relevance of this finding can therefore be questioned; pronounced body scanning and checking may be rather a feature of hypochondriasis than of “classical” SFD.

We consider our data to be representative: SFD prevalence rates corresponded to the numbers known from clinical populations (4,46,47). There was no sample bias, as sociodemographically, and in terms of organic comorbidity, both work-up and the VIT samples were comparable. The duration of presenting symptoms was similar, refuting bias through longstanding illness burden. Data were not biased by organic work-up results, as all self-reported information was obtained before their disclosure. The high participation and low dropout rates indicate that a self-rating approach early in the course of a work-up is acceptable for patients.

Our study has also several limitations. First, generalizability of our findings still has to be proven. Patients assigning unexplained medical symptoms to allergies might be not “representative” for SFD in a wider population, but rather differ in their illness experiences, worries, behaviors, and other psychobehavioral features from patients assigning their symptoms to other (e.g., viral) conditions.

Second, because the study design was cross-sectional, the directionality between variables is questionable. Does diminished lack of personal control provoke somatoform symptoms due to higher distress or do somatoform symptoms induce a feeling of having less control over (allergy) symptoms? The

TABLE 4. Binary Logistic Regression (Enter Method)^a Off “Classical” and “New” SFD Predictors in Original Work-Up Sample ($n = 182$)

Variables Selected	OR	95% CI	β	df	p
PHQ-15 somatization	1.35	1.17–1.56	0.30	1	<.001
HAS dissatisfaction with care	1.22	1.11–1.35	0.20	1	<.001
IPQ personal control ^b	0.84	0.73–0.96	–0.18	1	.01
SAIB scanning ^b	1.30	1.01–1.67	0.26	1	.04
WI-7 disease conviction	1.15	0.93–1.42	0.14	1	.20
Constant	0.000		–8.54	1	<.001

^a Included variables: IPQ-R personal control, WI-7 disease conviction, SAIB body scanning, HAS dissatisfaction with care, PHQ-15.

^b Reversed scaled.

OR = odds ratio for 1-point increase; CI = Confidence Interval; PHQ = Patient Health Questionnaire; HAS = Health Attitude Survey; IPQ = Illness Perception Questionnaire; SAIB = Scale for the Assessment of Illness Questionnaire; WI = Whiteley Index.

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predictive value of positive psychobehavioral characteristics has yet to be shown prospectively.

Third, the study focuses on patient-reported data. These data can be regarded reasonably valid and reliable (48), but they may be less reliable in the still stigmatized, “illegitimate” SFD.

Fourth, most of the selected instruments are rather new, and heterogeneous in their approaches (e.g., questions versus statements) as well as scaling (e.g., 4- versus 5-point Likert scales; high versus low scores resembling distress), resulting in limited comparability.

Fifth, the condensation of the investigated psychobehavioral variables to (few) certain independent predictors may be incidental due to notable intercorrelations and multicollinearity between investigated variables. We could show, however, the clinical relevance of several psychobehavioral aspects independent of, and, in addition to, somatization.

Sixth, having medically (yet) unexplained symptoms is unsettling per se—especially in the field of adverse food or drug reactions where symptoms sometimes tend to be diffuse, testing is complex, and only placebo testing in highly specialized institutions can establish, or rule out, a diagnosis. Thus, to some degree, psychobehavioral characteristics could be interpreted as effects of the work-up situation, which we tried to control for by including the VIT control group. We frequently observed a steady gradient from SFD to NoSFD to VIT patients (e.g., concerning a self-concept of bodily weakness). Thus, several features may be sensitive, but not specific to the identification of SFD. However, in symptoms with an easier work-up (e.g., back pain), those characteristics may have differentiated SFD and NoSFD even better, so we may rather have underestimated their discriminating values.

Seventh, despite the high multistep effort of highly specialized allergists that went into the rating of organic explicability, interrater reliability was substantial but not optimal. This is, however, a dilemma inherent to dualistic symptom allocation (6,49,50).

Finally, multiple testing and the post hoc completion of several hypotheses clearly are statistical limitations of this study. Although *p* values were Bonferroni-adjusted in multiple variable-wise group comparisons, the overall rate of obtaining significant results by chance may considerably exceed the .05 level.

CONCLUSION

Patients with SFD described themselves in a very different manner than patients without SFD. Before knowing their work-up results, they reported specific health-related characteristics that predicted SFD at least comparably to the classical approach of counting organically unexplained, bothering symptoms. These findings should be utilized for a better, and earlier, diagnosis. In this study, we make a case for the redefinition of SFD by relativizing the significance of an inconclusive medical work-up. We argue in favor of the integration of health-related positive psychobehavioral characteristics in future SFD criteria.

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