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Review article

Somatization and Somatic Symptom Disorder and its overlap with dimensionally measured personality pathology: A systematic review

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ABSTRACT

Objective: Difficulties in the assessments of Somatoform Disorders (SD) and Personality Disorders (PD) regarding operationalization, arbitrary thresholds, and reliability led to a shift from categorical to dimensional models in the DSM-5. Empirical research data postulates a continuous level of severity in both groups of diseases. The aim of this systematic review was to investigate the overlap between somatization and personality pathology.

Methods: Until July 2020, we conducted a systematic literature search with PubMed, Web of Science and SCOPUS. We specifically reviewed current empirical data on the Alternative Model of Personality Disorders (AMPD) and Somatic Symptom Disorder (SSD) and SD. Data was drawn out using predefined data panels. Results were reflected in the context of the Hierarchical Taxonomy of Psychopathology (HiTOP) model. Risk of bias was assessed due to blinding, randomization, selective reporting, incomplete data, and attribution bias.

Results: A total of eight studies ($N = 2979$) met the inclusion criteria. Whereas categorical measures revealed mixed results, positive correlations between SD/SSD and dimensionally measured personality functioning were present in four studies ($N = 1741$). In three studies ($N = 2025$) correlations between SD/SSD and neuroticism/negative affectivity ($d = 0.22–1.041$) were present. Moreover, harm avoidant ($d = 0.526 – 0.826$) and self-defeating traits ($d = 0.892$) revealed significant associations with somatization.

Conclusions: Dimensional personality assessments are highly neglected in patients with SSD and warrant further research. However, in line with the HiTOP model, there is tentative evidence that somatization can be described as an independent personality trait, which shows most striking overlaps with self-pathologies (Criterion A) and the trait of negative affectivity (Criterion B).

1. Introduction

There is consensus on the high prevalence of somatization in primary care with 20–30% of primary care patients with somatization meeting the criteria for a somatoform disorder (SD) [1]. Regarding health care costs, patients with somatization in contrast to patients without somatization are high utilizer of the primary care system, and show, in the USA alone, estimated incremental medical care costs of about $256 billion a year [2].

Especially patients suffering from multiple somatization symptoms have highly increased coexistence or comorbidity with other mental disorders, especially anxiety, depressive and personality disorders (PDs) [3]. However, neither a diagnosis of anxiety disorder nor depression sufficiently covers a somatization syndrome, where a “physical experience of emotional distress” [4] in [5] is more pronounced [3,6]. Regarding patients with PD and somatization, both show an early onset of illness and a chronic illness course, but the question if somatization disorder should be better included under PDs is still uncertain [7,8]. Therefore, improvements in co-morbid diagnosing and early identification of somatization symptoms are crucial to reduce health care costs [2].

Acronyms: AMPD, alternative model of personality disorders|; APA, american psychiatric association|; BDD, bodily distress disorder|; CCG, clinical control group|; DSM, diagnostic and statistical manual of mental disorders|; DSQ, defense style questionnaire|; ERQ, emotion regulation questionnaire|; g-PD, general factor of personality disorder|; HC, healthy controls|; HiTOP, hierarchical taxonomy of psychopathology|; ICD, international classification of diseases|; LPF, level of personality functioning|; MUS, medically unexplained symptoms|; PD, personality disorder|; SD, somatoform disorder|; SSD, somatic symptom disorder|; TAS, Toronto alexithymia scale|; TCI, temperament and character inventory,; WHO, world health organization.

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1.1. The revised conceptualization of somatization in DSM-5

The latest revision of the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) [9] addresses these difficulties of comorbid somatization by replacing *somatoform disorders* (DSM-IV) [10] with the section *somatic symptom and related disorders*. Thereby, the previous diagnosis of *somatization disorder and pain disorder* is revised by the new diagnosis *somatic symptom disorder* (SSD). The subcategories from DSM-IV are removed in favor for measures of severity reaching from mild to moderate to severe [9]. Of note, SSD compared to SD no longer requires that the symptoms have to be medically unexplained [11]. This brings a theoretical shift from a focus on the absence of a medical explanation to focusing on the presence of maladaptive reactions (B criterion) to the somatic symptomatology [12]. The new concept of SSD with its inclusion of a new psychological B criterion aims to compensate stigmatization and eliminate the body-mind dualism in respect of a biopsychosocial approach [13]. Although the new, more dimensional diagnosis process seems to be more challenging (e.g., psychosomatic aspects of migraine) [14], giving a subject the diagnosis of a mental disorder only because of the lack of a physiological origin seems inappropriate [9]. With this theoretical shift the SSD group is now more heterogeneous. Therefore, the prevalence of SSD is expected to be higher (presumably around 5–7%) according to the DSM-5 compared to the prevalence of the DSM-IV somatization disorder (<1%) [9].

1.2. The overlap between PDs and somatization, and its dimensional nature

The discussion of correlations between PDs and somatization is not an all-new issue [e.g.,15–18]. Nevertheless, personality assessments in patients with somatization seem to be highly neglected, even though the high associations are known since decades. In 1995, Bass and Murphy [7] examined the association between SD and PDs and concluded that two in three patients with a SD also fulfill the criteria for a PD, whereas Naylor et al. [8] even assumes the existence of a *pain personality*. Despite this high comorbidity, only 4.2% of SD patients also depict a clinical diagnosis for PD [19]. Therefore, there is a huge discrepancy between the theoretical SD and PD comorbidity and the prevalence of this comorbidity in practice. This phenomenon is most probably built on a lack of adequately applying multidimensional diagnostic systems [20–22].

Although clinically derived, categorical assessments of personality in the DSM-5 [9] and in the International Classification of diseases, 10th edition (ICD-10) [23] have several shortcomings, among those highly stigmatizing the patients. Considering the heaped overlaps among diagnostic categories [e.g.,24–36], low reliability [37], limited convergent validity, arbitrary diagnostic thresholds and temporal instability of the diagnoses [38,39], this indicates that the dimensional nature of PDs is not adequately implemented. Thus, essential evidence has convened to favor the dimensional over the categorical conceptualization of PDs [37,39,40], which led to the Alternative Model of Personality Disorders in the DSM-5 section III (AMPD) [9]. This hybrid model addresses the clinical needs for categorical diagnoses as well as dimensional evidence-based data by assessing two Criteria for personality. In the AMPD, PDs are rated by assessing *the Level of Personality Functioning Scale* LPFS (Criterion A), including a self-domain (*identity* and *self-direction*) and an interpersonal domain (*empathy* and *intimacy*), and the *personality traits* (Criterion B) including *negative affectivity, detachment, antagonism, disinhibition and psychoticism* [9]. Compared to the Hierarchical Taxonomy of Psychopathology (HiTOP) [20], which assumes that nearly all mental-health problems can be arranged in six common spectra, and thus reduces heterogeneity, the AMPD is a model only focusing on personality pathology. In contrast, the HiTOP (see Fig. 1.) aggregates existing evidence on psychopathology on five hierarchical levels of complexity ranging from *signs and symptoms* to *symptom components* to *syndromes/ disorders* to *subfactors* (e.g., antisocial, substance use, fear, etc.), to *spectra*, and at the highest level to a *superspectrum* so called general factor of PD (g-PD). Moreover, somatoform is one of these spectra within HiTOP, but is not captured as an independent trait domain in neither the AMPD of the DSM-5 [9] nor the proposed ICD-11.

In summary, the new B criterion of SSD brings a focus of

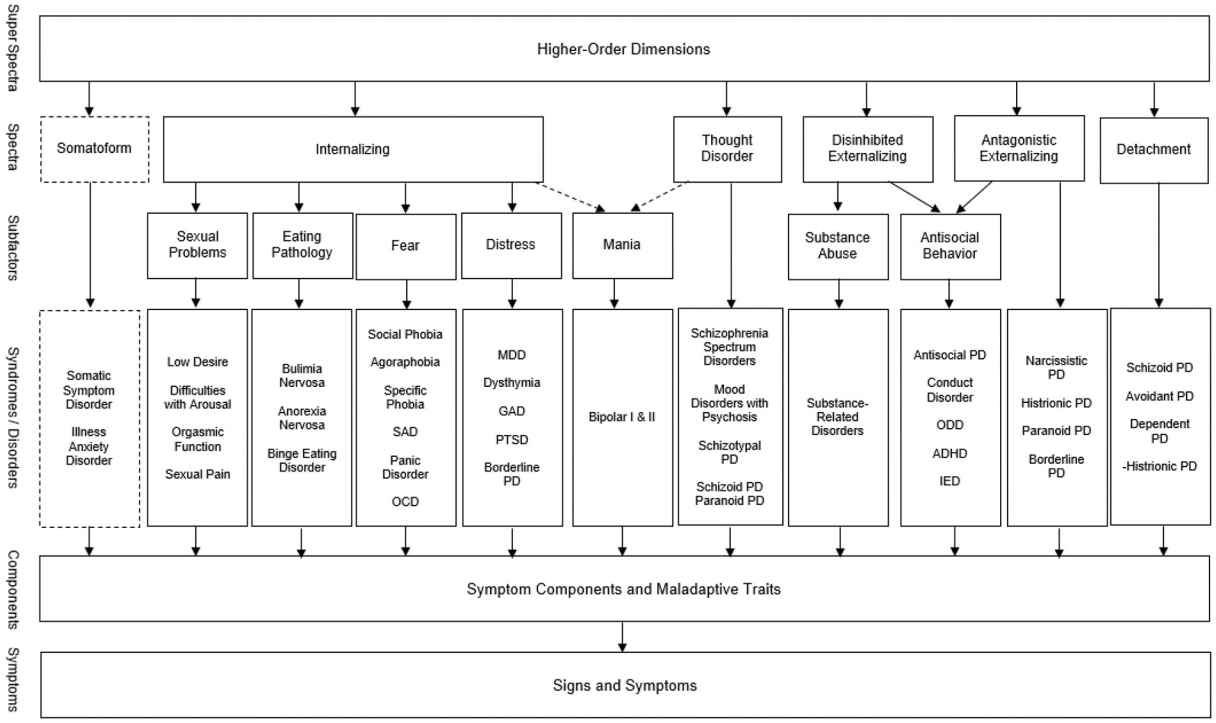

Fig. 1. Hierarchical Taxonomy of Psychopathology (HiTOP). *Note*: Adapted from "The Hierarchical Taxonomy of Psychopathology (HiTOP): A dimensional alternative to traditional nosologies", by R. Kotov et al., 2017, *Journal of Abnormal Psychology, 126*(4), 462. (https://doi.org/10.1037/abn0000258). Copyright (2017) by the American Psychiatric Association.

psychological maladaptive processes, which can also be linked to psychological maladaptive processes in PDs. With the knowledge of several overlaps between personality pathologies and somatization, as well as the dimensional nature of these overlaps, a multi-dimensional approach also covering somatization is necessary [20–22].

1.3. Objectives

The objectives of this article were (1) to systematically investigate available evidence regarding personality assessments in patients suffering from SD/SSD. Regarding the reconceptualization of SSD in the DSM-5, we sought (2) to review available evidence for overlaps of these concepts with the AMPD. Furthermore, results (3) were crucially reflected in the context of new dimensional models of psychopathology (HiTOP and AMPD). Thus, we want to emphasize the importance of personality pathology in SSD patients.

2. Methods

2.1. Eligibility criteria

Eligibility criteria for included studies were: (1) adult patients (18–79), (2) published in English, (3) clinical study population with DSM-IV/ ICD-10 diagnosis of somatization or SD or DSM-5 diagnosis of SSD and at least one clinical control group (CCG) or a healthy control group (HC), (4) at least one personality assessment instrument, (5) exclude hypochondriasis as in ICD-11. This distinguished DSM-5 from ICD-11 bodily distress disorder (BDD), where hypochondriasis will be moved to obsessive-compulsive and related disorder.

2.2. Information sources and search

Studies were identified by electronic database search on Scopus, PubMed, and Web of Science (Core Collection). The final search was carried out on 10 July 2020; at 2:50 p.m., Search terms contained a triple combination of words including Somatization, SD and SSD; personality, personality traits, pathological personality categories and dimensional personality terms; as well as dimensional diagnostic systems.

2.3. Study selection

Eligibility assessment followed a stepwise structure by screening all titles, then remaining abstracts and finally full-text. Two reviewers, who searched independently and mutually blind from each other, by a standardized procedure, screened all the studies. Final cross-referencing included studies resulted from database search, which were full-text screened; and theoretical studies without a clinical population were cross-referenced.

2.4. Data collection process

Data extraction contained an independent group formation of given studies by considering eligibility inclusion criteria. Disagreement between the two reviewers were discussed between them; if no agreement could be reached, a third author adjudicated.

2.5. Data items

Characteristics of the studies include: (1) information on study participants (including group composition, mean sex, mean age), (2) diagnostic instrument used, (3) control group (including either a HC or a CCG), (4) study design (including study aims, dependent and independent variables, main outcomes).

2.6. Risk of bias in individual studies

Risk of bias was assessed unblinded at study-level from two independent (C.M. and R.B. under supervision from J.W.) authors. The assessment of risk of bias was due to blinding, random sequence generation, selective reporting, incomplete data, attribution, and other bias. Data of the different studies was drawn out by predefined data panels.

2.7. Synthesis of result and risk of bias across studies

Due to heterogeneous results and quite small numbers of identified and included studies, the decision was against quantitative meta-analyses and quantitative assessment of risk of bias. Conduction focused on qualitative synthesis of study results, id est. associations between personality pathology (categorical PDs and dimensional level of personality functioning and pathological personality trait expression) and SD or SSD. With these overlaps, we sought associations to dimensional models of psychopathology. The risk of bias across the included publications was qualitatively assessed and is estimated rather low.

3. Results

3.1. Study selection

In total eight studies were included in the review. The whole search on Scopus, Web of Science and PubMed consisted of 6042 citations. After removing duplicates 5946 publications were left, whereas 5417 of them were excluded after screening the title and a further 512 after screening the abstract. The remaining 17 records were full-text analyzed with regards to the inclusion criteria. At this step, 12 publications were excluded. Further cross-referencing of the 17 remaining records at level of full-text screening and cross-references of 12 theoretical publications, whereby three publications were additionally included. Cross-referencing was important because the focus in the search terms was on DSM-5/ICD-11 and dimensional personality diagnostics in SD/SSD, which only resulted in five articles. This led to an inclusion of eight studies in the systematic review, which met the inclusion criteria (see flow diagram, Fig. 2). Studies of somatic symptoms (e.g., migraine, fibromyalgia etc.) were not included, if they did not apply an additional measure for psychosomatic aspects or symptoms.

3.2. Study characteristics

The eight included studies [41–48] comprise in total a population of $N = 2979$ patients. None of the included studies included the AMPD. Details on the study characteristics depict Table 1, a summary of the study characteristics can be found in Table 3 (see appendix).

Subject to the research aim, the studies differed in respect to whether the dependent or the independent variable was either PD or SDD. In two studies [45,46] the dependent variables consisted exclusively of somatization variables and the independent variables of personality scales. In three other studies [41–43] the dependent and independent variables had the opposite direction, i.e., personality traits were the dependent and somatization the independent variable. The remaining three studies [44,47,48] show mixed personality and somatization scales relating to dependent and independent variables.

3.3. Risk of bias within and across studies

Across all the studies the most important bias, which were present in all eight studies, was due to no random sequence generation, incomplete data reporting, attribution and no blinding of participants. Blinding of care providers was included in two of the eight studies [43,45]. Study protocols of the included studies were not published or registered and therefore we could not estimate the risk of bias for selective reporting due to missing data or the risk for publication biases due to publication

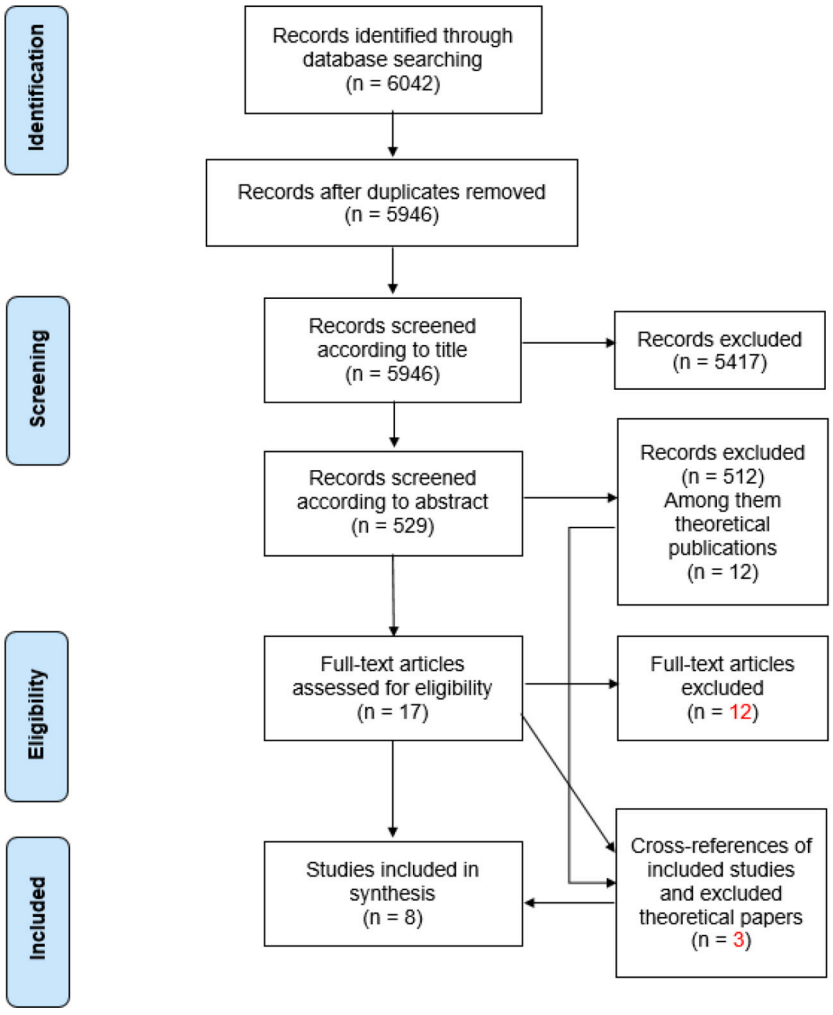

Fig. 2. Flow of information through the different phases of the systematic review.

preferences.

3.4. Results of individual studies and synthesis of results

The individual results of the eight remaining studies are depicted in Table 2. The results of this systematic review were reported from the perspective of the AMPD (objective 2). Results are heterogeneous and none of the included studies applied dimensional personality diagnostics as introduced in the AMPD of DSM-5. However, in the context of somatization several alternative dimensional measures of personality including parts of the level of personality functioning (Criterion A) or trait-based description (Criterion B) were applied.

Regarding *personality functioning*, four studies (N = 1741) [41,43,44,46] used measures for key functions of personality on domain level: The Temperament and Character Inventory (TCI) [49], the Greek version of Defense Style Questionnaire (DSQ) [50], the Emotion Regulation Questionnaire (ERQ) [51] and the Toronto Alexithymia Scale (TAS-20) [52]. The results of these four questionnaires reveal first, that chronic pain patients compared to a CCG show significant character impairments in self-directedness (d = −0.673, $p < 0.001$) and cooperativeness (d = −0.527, $p < 0.001$) [43]. Second, self-sacrificing (d = 0.451, $p < 0.001$), self-criticizing defense mechanisms (d = 0.292, $p < 0.001$) show significant associations with somatization in comparison to HC [46]. Third, SSD patients compared to HC show difficulties in the personality facets of emotion processing, more precisely in the identification ($\eta_p^2 = 0.381$, $p < 0.001$) and description of own feelings ($\eta_p^2 = 0.315$, $p < 0.001$), which fourth, in turn is related to high alexithymia (TAS-20) scores [44]. However, alexithymia and pain disorders might be independent constructs as, contrary to what was expected, pain patients in the study by Aragona et al. [41] revealed no group differences regarding alexithymia compared to somatic pain and no pain patients ($p = 0.964$).

Regarding the potential association of somatization and *personality traits*, first, three studies (N = 2025) showed significant correlations of somatization and neuroticism (d = 0.22, $p < 0.001$) [46] (d = 0.813, $p < 0.0001$) [47] (d = 1.041, $p < 0.003$) [48]. Second, in addition to neuroticism, self-defeating (d = 0.892, $p < 0.0001$), negativistic (d = 0.694, $p = 0.0005$) and depressive (d = 0.699, $p = 0.0003$) personality traits also seem to be significantly higher in SD patients compared to a CCG [47]. Third, within the Big Five domain, agreeableness (d = −0.372, $p = 0.03$) has been found to be lower in young SD patients compared to a CCG [47], whereas higher agreeableness scores have been found in elderly patients with somatization (d = 0.018, $p < 0.040$) compared to HC [48]. Fourth, regarding temperament, introverted and anxious features/facets, such as harm avoidance (d = 0.826, $p < 0.0001$), fatigability (d = 1.146, $p < 0.001$), which is a facet of harm avoidance [42]; (d = 0.526, $p < 0.001$) [43], low novelty seeking (d = −0.366, $p = 0.002$), low reward dependence (d = −0.517, $p < 0.001$) [42], high sensitivity for anger (d = 0.40) and less investment in trust games (d = 0.73) [44] show significant associations with somatization compared to CCG [43] or HCs [42,44].

Regarding possible overlaps between somatization and categorical diagnoses of PD, 41–63% of SD/SSD patients have at least one comorbid PD [43,45,47]. In consideration of the different types of PD, mixed

Table 1
Characteristics of study population and content identified by systematic search.

	Author	Year	Journal	Study aim	Population (N)	Mean Age	Sex (% female)	Diagnostic instruments PD	SSD
Studies with a healthy control group	Erkic et al.	2018	Clinical psychology & psychotherapy	Investigating emotion processing in SSD and how these might interact	35 SSD patients 35 HC	SSD: 42.4 HC: 41.1	SSD: 57.1% HC: 57.1%	SCID- II (DSM-IV) (ERQ)	SCID-I (DSM-IV) DSM-5 SSD (clinical) PDI PHQ-15 SOMS-7 T TAS-20
	Huang et al.	2016	Journal of Affective Disorders	Comparing indicators of personality features and psychopathology in SD patients and HC	148 SD patients 146 HC	SD: 52.2 HC: 39.8	SD: 66.9% HC: 65.8%	TPQ	PHQ-15 HAQ SCID-I (DSM-IV)
	Hyphantis et al.	2013	Journal of Psychosomatic Research	Comparing potential associations of personality traits, hostility features, defense mechanisms with somatic symptom severity	810 chronic medical patients 411 HC	Patients: 53.1 HC: 34.4	Patients: 62.2% HC: 66.7%	ZKPQ (HDHQ/ DSQ/LSI)	SCL-90-R somatization subscale
	Van Dijk et al.	2016	European Psychiatry	Comparing personality profiles of older patients suffering from MUS with two comparison groups (MES, DD) and HC	96 patients with MUS 153 attenders with MES 255 DD patients 125 HC	MUS: 70.1 MES: 73.4 DD: 70.5 HC: 70.1	MUS: 66.7% MES: 43.1% DD: 64.3% HC: 61.6%	NEO-FFI	BSI-53 MINI (DSM-IV-TR) VAS (WI)
Studies with clinical control group (s)	Aragona et al.	2008	Pain Research and Management	Investigating the role of hysterical features in patients diagnosed as having a DSM-IV-TR pain disorder associated with psychological factors	48 pain disorder patients 48 SP patients 42 somatic controls, no pain	PDP: 51.8 SP: 49.3 NP: 50.1	PD: 68.8% SP: 70.8% NP: 54.8%	Diagnostic Interview (not specified) MMPI	Diagnostic Interview (DSM-IV-TR) tPRI TAS-20
	Conrad et al.	2007	Pain	1) Comparing personality profiles of chronic pain patients with pain-free controls 2) Investigating whether the TCI can validly identify the presence or absence of a PD	207 CPP 105 pain-free CCG	CPP: 45.8 Pain-free CCG: 47.1	CPP: 44.4% female Pain-free CCG: 42.9%	TCI SCID-II (DSM-IV)	BPI MINI Plus (DSM-IV)
	Garcia-Campayo et al.	2007	Journal of psychosomatic research	Assessing PD comorbidity in Somatization patients compared with psychiatric controls	70 Somatization disorder patients 70 mood and/ or anxiety disorder patients (CCG)	Somatization Disorder patients: 47.6 CCG: 48.7	Somatization Disorder patients: 88.5% CCG: 88.5%	IPDE (DSM-IV)	SPPI (DSM-IV)
	Noyes et al.	2001	Psychosomatics	Assessing the nature and extent of personality dysfunctioning related to somatization	141 Patients with Somatization 34 Patients without Somatization	Patients with Somatization 42.2 Patients without Somatization 45.5	Patients with Somatization: 78% Patients without Somatization: 79.4%	SIDP (DSM-IV) NEO-FFI	PRIME-MD SCID-I (DSM-IV, only somatoform) IWS

BPI = Brief Pain Inventory, BSI-53 = Brief Symptom Inventory, CCG = Clinical Control Group, CPP = Chronic Pain Patients, DD = Depressive Disorder, DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders fourth edition text revised, DSM-5 SSD = Somatic Symptom Disorder diagnosis according to DSM-5, DSQ = Defense Style Questionnaire, ERQ = Emotion Regulation Questionnaire, HAQ = Health Anxiety Questionnaire, HC = Healthy Controls, HDHQ = Hostility and Direction of Hostility Questionnaire, IPDE = International Personality Disorder Examination, IWS = Illness Worry Scale, LSI = Plutchik's Life Style Index, MES = Medically Explained Symptoms, MINI = Mini-International Neuropsychiatric Interview, MINI Plus = Mini-International Neuropsychiatric Interview-Plus, MMPI = Minnesota Multiphasic Personality Inventory, MUS = Medically Unexplained Symptoms, NEO-FFI = NEO-Five-Factor Inventory, NP=No Pain, PD = Personality Disorder, PDP = Pain disorder patients, PDI = Pain Disability Index, PHQ-15 = Patient Health Questionnaire, PRIME-MD = Primary Care Evaluation of Mental Disorders, SCID-I = Structured Clinical Interview for Axis I Disorders, SCID-II = Structured Clinical Interview for Axis II Disorders, SCL-90-R = Symptom Distress Checklist, SD = Somatoform Disorder, SIDP = Structured Interview for DSM-IV Personality, SOMS-7 T = Screening for Somatoform Disorders, SP = Somatic Pain, SPPI = Standardized Polyvalent Psychiatric Interview, SSD = Somatic Symptom Disorder, TAS-20 = Toronto Alexithymia Scale, TCI = Temperament and Character Inventory, TPQ = Tridimensional Personality Questionnaire, tPRI = total Pain Rating Index, VAS = Visual Analogue Scale, WI = Whitley Index, ZKPQ = Zuckerman-Kuhlman Personality Questionnaire.

results are found. However, the most consistent correlations were reported for an association between SD/SSD and paranoid ($p < 0.001$) [43], (d = 1.224, OR = 9.2; 95% CI = 1.9–43,) [45] and obsessive-compulsive PD (d = 1.006, OR = 6.2, 95% CI = 1.2–53.6) [45], (d = 0.663, $\chi^2 = 8.30$, $p = 0.004$) [47], but also reveal significant correlations between borderline ($p = 0.001$), avoidant ($p = 0.009$), additional passive-aggressive ($p = 0.003$) [43] and histrionic PD (d = 0.706, OR = 3.6; 95% CI = 0.9–13.9) [45] and SD/SSD.

Table 2
Design characteristics and results of studies identified by systematic search.

	Author	Year	Independent variables	Dependent variables	Main results
Studies with a healthy control group	Erkic et al.	2018	1) SSD 2) association between emotion regulation and SSD 3) emotion recognition performance	1) different dimensions of emotion processing 2) alexithymia 3) alexithymia and emotion regulation deficits	- SSD patients > HC: difficulties in identification and description of own feelings (ηp2 = 0.381, F [1,68]= 41.93, $p < 0.001$ and ηp2 = 0.315, F [1,68]= 31.28, $p < 0.001$) - SSD patients: less cognitive reappraisal ($\eta_p^2 = 0.185$, F [1,68]= 15.47, $p < 0.001$), but more expressive suppression ($\eta_p^2 = 0.047$, F [1,68]= 3.36, $p = 0.071$) - SSD > HC: superior emotion recognition, especially sensitive for anger (d = 0.40) - SSD: less investigation in trust game (d = 0.73)
	Huang et al.	2016	1) SD and HC 2) somatic complaints, hypochondriacal ideation, depression, anxiety	1) different personality features 2) personality	- SD patients compared to HC: lower novelty seeking (d = −0.366, $p = 0.002$), reward dependence (d = −0.517, $p < 0.001$), higher harm avoidance (d = 0.826, $p < 0.001$) - Most powerful predictor of SD development: fatigability (d = 1.146, $p < 0.001$), which is a facet of harm avoidance
	Hyphantis et al.	2013	5 ZKPQ scales, 4 DSQ defense styles, 8 LSI defenses, 5 HDHQ components	SCL-90 somatization subscales in HC and patients with long-term medical conditions	- In both samples: higher neuroticism (d = 0.22, $p < 0.001$), adoption of the displacement defense (d = 0.078, $p < 0.001$) and depressive symptoms (d = 0.497, $p < 0.001$) correlate positively and independently with somatic symptom severity - Introverted features (i.e., self-sacrificing defensive style, d = 0.451, $p < 0.001$; self-criticizing defense style, d = 0.292, $p < 0.001$) were associated with higher somatic symptom severity in chronic medical patients
	Van Dijk et al.	2016	1) 4 groups: MUS; MES; DD; HC 2) MUS and MES 3) MUS and MES personality dimensions	1) Big Five Personality domains 2) Big Five Personality domains 3) WI and BSI-53	- The four groups differed on neuroticism (F = 135.5, df = 3.623, $p < 0.001$) and extraversion (F = 65.2, df = 3.623, $p < 0.001$), not on openness (F = 5.2, df = 3.616, $p = 0.161$), agreeableness (F = 2.7, df = 3.620, $p = 0.045$) and conscientiousness (F = 36.7, df = 3.622, $p = 0.193$) - MUS > HC higher neuroticism (d = 1.041, $p < 0.003$) and agreeableness (d = 0.018, $p < 0.040$); MUS > DD lower neuroticism (d = −0.931, $p < 0.002$) and higher extraversion (d = 0.713, $p < 0.003$) and agreeableness (d = 0.253, $p < 0.009$) - MUS and MES had a similar personality profile (all *P*-values between 0.035 and 0.799). - Health anxiety and somatization were associated with a higher level of neuroticism (WI: β = 0.48, $p < 0.001$ and BSI-23: β = 0.36, $p < 0.001$), a lower level of extraversion (WI: β = −0.04, $p = 0.010$ and BSI-23: β = −0.02, $p = 0.014$) and conscientiousness (WI: β = −0.24, $p < 0.001$and BSI-23: β = −0.23, $p < 0.001$), irrespective of the explanation of physical symptoms
Studies with clinical control group(s)	Aragona et al.	2008	3 groups: pain disorder; somatic pain; no pain	MMPI Hy and its 2 subscales: Ad and Dn	- Pain disorder > somatic pain & no pain group: higher MMPI Hy (F = 4.613, $p = 0.012$), Hs (F = 6.710, $p = 0.002$) and Hy-Ad (F = 8.702, $p = 0.0001$) - All groups: similar MMPI K (F = 0.096, $p = 0.909$) and Hy-Dn (F = 0.312, $p = 0.732$) and TAS-20 (F = 0.037, $p = 0.964$) scores - Pain disorder group: negative correlation between Hy-Ad and Hy-Dn ($r = −0.489$, $p = 0.001$, two-tailed)
	Conrad et al.	2007	1) 2 groups: CPP and HC	1) TCI and 12 PDs	- 60% of CCP and 0% of CCG fulfill criteria for somatoform disorder ($p < 0.001$,); 41% of CPP and 7% of CCG fulfill criteria for any PD ($p < 0.001$) - Most frequent PDs: 12% of CPP and 0% of CCG fulfill SCID-II criteria for paranoid PD ($p < 0.001$); 11% of CPP and 0% of CCG for BPD ($p = 0.001$); 8% of CPP and 1% of CCG for avoidant PD ($p = 0.009$); 8% of CPP and 0% of CCG fulfill criteria for additional passive-aggressive PD ($p = 0.003$) - Most significant difference (ANCOVA) in Temperament: Harm Avoidance (d = 0.526, $p < 0.001$) between CPP and CCG - Most significant difference (ANCOVA) in Character: Self-Directedness (d = −0.673, $p < 0.001$) between CPP and CCG; and Cooperativeness (d = −0.527, $p < 0.001$) between CPP and CCG. In CPPs: the symptom of all PD subtypes significantly related to low Self-Directedness and, to a lesser degree, low Cooperativeness. - In CPP: 75.8% of absence or presence of PD were correctly identified by TCI Self-Directedness and Cooperativeness character dimensions - Overall: Multiple hierarchical regression analyses (controlling for age, gender, depression and state anxiety): TCI scales predicted on average 23% in PD symptom counts.
	Garcia-Campayo et al.	2007	1) PD comorbidity 2) PD comorbidity	1) Somatization disorder 2) HC	- 62.9% PD comorbidity in Somatization disorder patients and 28.2% PD comorbidity in HC (d = 0.721, OR = 3.7; 95% CI) = 1.8–7.6). - The highest ORs of PD in Somatization disorder patients,

(*continued on next page*)

Table 2 (*continued*)

Author	Year	Independent variables	Dependent variables	Main results
				compared with controls in paranoid (d = 1.224, OR = 9.2; 95% CI = 1.9–43.0), obsessive–compulsive (d = 1.006, OR = 6.2; 95% CI = 1.2–53.6), and histrionic (d = 0.706, OR = 3.6; 95% CI = 0.9–13.9) PDs.
Noyes et al.	2001	1) Patients with Somatization and Patients without Somatization 2) SIDP and NEO mean scores	1) SIDP and NEO-FFI 2) Somatization subtypes	- Patients with Somatization fulfill the criteria for a DSM-IV personality disorder more often than CCG (51% > 29%; χ^2 = 5.12; p = 0.02), especially for obsessive-compulsive personality disorder (d = 0.663, χ^2 = 8.30, p = 0.002). - Self-defeating (d = 0.892, $p < 0.0001$), depressive (d = 0.699, p = 0.0003), and negativistic (d = 0.684, p = 0.0005) personality traits were higher in patients with Somatization than in CCG. - Patients with Somatization show higher scores on neuroticism (d = 0.813, $p < 0.0001$) and lower scores on agreeableness (d = −0.372, p = 0.03) than CCG. - Patients with Facultative and initial somatization scored higher on personality pathology than patients with true somatization (p = 0.002).

Ad = Admission of symptoms, BPD = Borderline Personality Disorder, BSI-53 = Brief Symptom Inventory, CCG = Clinical Control Group, CPP = Chronic Pain Patients, DD = Depressive Disorder, Dn = Denial of symptoms, DSQ = Defense Style Questionnaire, HC = Healthy Controls, HDHQ = Hostility and Direction of Hostility Questionnaire, Hs = Hypochondriasis, LSI = Plutchik's Life Style Index, MES = Medically Explained Symptoms, MMPI Hy = Minnesota Multiphasic Personality Inventory Hysteria scale, MMPI K = Minnesota Multiphasic Personality Inventory Correction scale, MUS = Medically Unexplained Symptoms, NEO-FFI = NEO-Five-Factor Inventory, OR: odds ratio, PD = Personality Disorder, SCL-90-R = Symptom Distress Checklist, SD = Somatoform Disorder, SIDP = Structured Interview for DSM-IV Personality, SSD = Somatic Symptom Disorder, TAS-20 = 20-Item Toronto Alexithymia Scale, TCI = Temperament and Character Inventory, WI = Whitley Index, ZKPQ = Zuckerman-Kuhlman Personality Questionnaire.

4. Discussion

4.1. Summary of evidence

We systematically reviewed the literature regarding associations in the assessment of personality and somatization (SD/SSD). Overall, the evidence is very limited, with eight studies meeting our inclusion criteria and their quality being low. Until July 2020, to the best of our knowledge, there is yet no study that fully applied the AMPD model in order to identify dimensional overlaps between personality pathologies and somatization symptoms.

Regarding the LPF, across all eight included studies, there is tentative evidence that difficulties in self-domain measured with the TCI, DSQ, ERQ and TAS-20 highly correlate with the presence of SD/SSD. Similarly, associations between personality traits and somatization were found for neuroticism, agreeableness as well as introverted features like harm avoidant, low novelty seeking, self-defeating, negativistic and depressive traits.

Due to the heterogeneity and limitations in applying categorical personality diagnostics our results show that categorical approaches bring little clarity for the question of potential overlaps of personality pathology and SD/SSD. However, 41–63% of SD/SSD patients revealed at least one comorbid PD. Nevertheless, this underscores the importance of dimensional diagnostic approaches.

4.2. Strengths and limitations

4.2.1. Strengths and limitations at study level

Strengths at the level of the studies were: First, all studies used assessments for both, personality and somatization. Six studies used standardized or semi-standardized interviews and one did not specify the interview. One article only used self-report measurements.

However, we could not determine the different domains of LPF as well as the traits in SSD patients, as none of the included studies used the AMPD of DSM-5. Notably, the included studies disclose certain limitations, as first a missing randomization, as well as second a missing study protocol. Third, participants were not blind to their condition. Fourth, some results show attribution bias due to comorbidity with other psychiatric diagnosis, as mood or anxiety disorders. For detailed information, see Table 3 in the Appendix.

4.2.2. Strengths and limitations at systematic review level

Strengths at systematic review level include: First a relatively high number of participants, second a rather specific, but sensitive search term strategy and third strict inclusion criteria. However, as a first limitation, a high number of excluded studies bears the probable risk that relevant evidence for the research question under scrutiny has been excluded due to rigorous inclusion criteria, (e.g., control group, and disorder specific assessments). Second, due to heterogeneous results and study designs the implementation disqualified for a meta-analysis. Third, we only inspected studies published in English.

4.3. Personality dysfunctions and pathological traits in SSD patients

Until today, pinpointing personality dysfunctions and pathological traits in SD/SSD patients is difficult, as available studies did not make use of sufficiently operationalized models. However, available data of significant associations between somatization and personality pathologies can be re-interpreted using the AMPD model as a theoretical scaffold. As e.g., there is conceptual overlap in the area of self-direction in AMPD with self-directedness as defined in the TCI. Patients with somatization compared to patients without somatization more often show a comorbid PD, and reveal lower self-directedness and cooperativeness [43]. Low self-directedness as defined in the TCI refers to problems in defining and setting oneself meaningful goals accompanied with difficulties in adaptive coping and motivation. This corresponds with the self-domain within Criterion A in AMPD. Moreover, using (low) self-directedness and (low) cooperativeness in patients with somatization as a predictor for a categorical PD according to DSM-IV this correlates with all twelve PD-subtypes and was accurate in 75.8% [43]. Interpreting this data tentatively the other way around, this might indicate that approximately seven in ten patients with somatization can be identified by self-directedness and cooperativeness. Whereas self-directedness refers to the self-domain, low cooperativeness refers to interpersonal dysfunctions of empathy and intimacy in AMPD. Sleep et al. [53], a study not included in our systematic review due to strict inclusion criteria, supports this interpretation. By calculating bivariate correlations between SD and PD pathologies, Sleep et al. [53] showed large effect sizes for the self-domain (identity and self-direction) and medium effect sizes for the interpersonal domain (empathy and intimacy) of the AMPD. Of note, high somatic symptom severity in SD/SSD

Table 3
Summary of study characteristics identified by systematic search.

	Study characteristics	Study(ies)
Age	1 study had patients aged below 45 years	2004; Erkic et al., 2018
	1 study had patients aged above 70 years	van Dijk et al., 2016
	6 studies had patients aged between 45 and 54 years	Aragona et al., 2008; Conrad et al., 2007; Garcia-Campayo et al., 2007; Hyphantis et al., 2013; Noyes et al., 2001; Huang et al., 2016
Sex	1 study had a majority of male patients	Conrad et al., 2007
	7 studies had a majority of female patients	Aragona et al., 2008; Huang et al., 2016; Erkic et al., 2018; Garcia-Campayo et al., 2007; Hyphantis et al., 2013; Noyes et al., 2001; van Dijk et al., 2016
Comparison groups	4 studies compared patients with somatization with healthy controls	Erkic et al., 2018; Hyphantis et al., 2013; van Dijk et al., 2016; Huang et al., 2016
	4 studies compared patients suffering from somatization with other psychiatric patients	Aragona et al., 2008; Conrad et al., 2007; Garcia-Campayo et al., 2007; Noyes et al., 2001
Diagnostic assessment (form)	4 studies used standardized or semi-structured interviews for both disorders (PD and SSD) (most used: Structured Clinical Interview for Axis I, Axis II Disorders, and the Mini-International Neuropsychiatric Interview)	Conrad et al., 2007; Erkic et al., 2018; Garcia-Campayo et al., 2007; Noyes et al., 2001
	1 study used diagnostic interviews (not further specified)	Aragona et al., 2008
	2 studies used an interview for SSD (but not personality)	van Dijk et al., 2016; Huang et al., 2016
	1 study used questionnaires for both disorders	Hyphantis et al., 2013
	No study used the AMPD	Hyphantis et al., 2013
Diagnostic assessment (classification)	4 studies used categorical interviews for personality pathology (SCID-II, IPDE and SIDP)	2004; Conrad et al., 2007; Erkic et al., 2018; Garcia-Campayo et al., 2007; Noyes et al., 2001
	7 studies used self-questionnaires for dimensional personality diagnostic	Aragona et al., 2008; Conrad et al., 2007; Erkic et al., 2018; Hyphantis et al., 2013; Noyes et al., 2001; van Dijk et al., 2016; Huang et al., 2016
	3 studies used categorical and dimensional personality diagnostic	Erkic et al., 2018; Conrad et al., 2007; Noyes et al., 2001
	1 study used categorical personality diagnostic only	Garcia-Campayo et al., 2007
	3 studies used dimensional personality diagnostic only	Hyphantis et al., 2013; van Dijk et al., 2016; Huang et al., 2016
	1 study used a dimensional questionnaire (no information regarding type of classification)	Aragona et al., 2008

patients also correlates with high expressions of self-sacrificing and self-criticizing defense mechanisms [46]. These self-pathologies could be best matched in the self-esteem facet of the identity subdomain within the AMPD model.

Furthermore, Erkic et al. [44] and Pedrosa et al. [54] found emotion processing to be restricted in SD/SSD patients. In specific, we allocate this restricted emotion processing to the AMPD identity's facet of tolerating and regulating emotions.

Difficulties in identifying and describing one's own feelings and those of others [44,54] are directly associated to high alexithymia scores [44]. As a consequence, SD/SSD patients with compared to HC significantly higher alexithymia scores also reveal poor social functioning that, other than the problems in identifying emotions, also has been related to low cooperativeness and self-reflection [55]. *Re*-interpreting the alexithymia construct in the light of the AMPD model, related personality dysfunctions in SD/SSD patients appear to be distributed across all four subdomains. In detail, alexithymia's weak emotion processing aspect matches with facets of the identity subdomain, alexithymic low self-reflection matches with the self-direction subdomain, impaired mentalization with the empathy subdomain, and low relationship depth in alexithymia with the intimacy subdomain. The alexithymia concept serves to explain a link between pathological somatic sensation and disturbed emotion processing in SD/SSD patients who depict a somatosensory distortion [56]. Even though alexithymia seems to cover facets of personality dysfunctions in all four subdomains, disturbed emotion processing primarily relates to dysfunctions in identity and self-direction. Increases in bodily sensations and illness feelings may in turn lead to more negative emotions and less trust, hence finally impair social interactions and lead to interpersonal dysfunction in empathy and intimacy, which influences the self-domain again and so on [44].

Moreover, a recent study [57] could demonstrate a vicious circle between alexithymia and emotional neglect and physical abuse, which is a known predictor for PDs [58]. In contrast, one included study of our review [41] did not show group differences regarding alexithymia between patients with somatization and patients without somatization, which may be a result of the strict exclusion criteria (i.e. no comorbid anxiety or depression) of the patients' sample used therein.

The mentioned vicious circle of emotion processing deficits could explain why co-occurring somatization in psychotherapeutic treatments of any theoretical background leads to difficulties in the therapeutic relationship, irrespective of whether there is a diagnosis for PD. For this reason and the associated low trait levels of agreeableness [47], the doctor-patient relationship is of conflictual nature and thus a limiting factor of therapeutic outcome [59], which may be associated to high suicidality in SD patients [60].

Apart from personality dysfunctions, our review also found data on pathological trait expressions in SD/SSD patients. SD/SSD patients depict high level of neuroticism [46–48]. Neuroticism matches with the negative affectivity domain of Criterion B in the AMPD model. This is supported by Sleep et al.'s [53] finding of patients with somatization showing large effect sizes on negative affectivity that is highly correlated to the Big Fives' neuroticism. Interestingly, in the DSM-5 SSD section it is stated that the personality trait of negative affectivity is an independent risk factor for SSD [9,61–63]. Negative affectivity is interrelated with personality dysfunctions in the self-domain, which is manifest in high effect convergent trait load on identity as well as self-direction [53]. This suggests that patients with somatization show impaired self-functioning and salient negative affectivity scores, and that a firm delineation between Criterion A and B seems unrealistic [64].

High expressed harm avoidance is also prevalent in the temperament of patients with somatization [42,43]. This trait refers to a tendency of being anxious, sensitive to criticism, pessimistic and in need of more reassurance [8]. Of note, harm avoidance and self-directedness, strongly load on the neuroticism/negative affectivity trait [21,53,65]. In this regard, tentative evidence points to a relationship between harm avoidance, self-directedness, neuroticism and anxiety, which may compose a common personality factor given the high amount of shared variance [66,67].

Concerning further pathological personality traits in patients suffering from somatization, our results reveal different findings regarding agreeableness of the Big Five model. Thereby strikingly,

agreeableness has been found to be lower in young SD patients compared to a CCG [47], whereas higher agreeableness scores have been found in elderly patients with somatization compared to HC [48]. This might be related to the acceptance and expectations of pain as a consequence of aging in older patients with medically unexplained symptoms (MUS). In theory, this might cause less psychological distress in older compared to younger patients, and even positive personality dimensions in elderly patients have been suggested [48]. In fact, elderly MUS patients score higher on agreeableness compared to depressive patients. Regardless whether medically explained or unexplained, both types of SD/SSD patients show similar personality profiles in advanced age [48].

Although the categorical personality approach has many limitations and heterogeneity, previous research discussed the overlap of Cluster B (impulsive) PDs and SD extensively [42,68,69]. With regard to our results of high harm avoidance, low novelty seeking and reward dependence; we see a greater overlap of SD with Cluster C (fearful) PDs. There is tentative evidence that low reward dependence is related to Cluster A (odd-eccentric) PDs, novelty seeking to Cluster B PDs and harm avoidant to Cluster C PDs [43].

4.4. Comparison of AMPD and HiTOP and the difficulty of embedding a separate somatoform spectrum

Dimensional conceptualizations of psychopathology evaluate mental dysfunction on a range of continua. In reviewing the evidence of possible overlaps and associations between SD/SSD and personality pathologies, we aim at facilitating the discussion about whether to include a separate personality trait domain, e.g., somatoform spectrum, in the hierarchical measurements of mental health problems as proposed by the HiTOP model, but not proposed in the AMPD.

Both, the AMPD and the HiTOP seem to have quite similar core elements, but also vary with respect to the number of levels. Whereas the AMPD is more process-focused, the HiTOP model is more description-focused [70]. With respect to the structure of these two models, the AMPD assumes an overlap between Criterion A and B, whereas the HiTOP proposes an increasing specificity from bottom to the top of the model [70]. The HiTOP spectra have similarity with the Criterion B of AMPD, and the HiTOP's g-PD can be interpreted as a more complex factor, however still comparable with its counterpart in AMPD, the Criterion A [21].

The hierarchical concept of the HiTOP places the g-PD factor on top of the model, which would plead for incremental validity of Criterion A over B [71,72]. Nevertheless, the additional benefit and incremental validity of Criterion A has been put into question [21,73]. Although we see incremental validity of LPF in previous research [71,74,75] and in our results on SD/SSD and LPF, many studies continue to focus on trait expression (e.g., 84.8% of publications; [73]). Criterion A is not designed to capture specific PDs, but severity of impairment and may thus be the most important domain to assess [76], potentially informing about the intensity and duration of a psychological treatment [77].

Although trait domains of AMPD do generally align with the HiTOP spectra, there is no identical congruence, e.g., in contrast to HiTOP there is no separate trait dimension for somatization in AMPD [21]. With respect to HiTOP, there is an ongoing discussion if the somatoform spectrum is independent or can be classified under the spectrum of internalizing. Similarly, our results reveal high levels on self-dysfunction, which is loading strongly on the higher-order internalizing spectrum, but also impaired interpersonal functioning (e.g., cooperativeness), which is loading on the externalizing factor of the HiTOP [66]. In contrast to the notion to subordinate somatoform conditions within the internalizing spectrum [78,79], data also support the somatoform spectrum as a separate sixth dimension [22]. Kotov et al. [80] argues in that favor as the correlations between the internalizing and the somatoform spectra are of only modest nature, and McNulty and Overstreet [81] could show evidence for a six-factor solution for psychopathology. Therefore, personality characteristics of SD/SSD patients seem to be unique, which we also saw with respect to the high risk of suicide in SD patients, which is still present after controlling for comorbid depression and PD [60]. Subsequently, because of rather weak associations of somatoform condition under internalizing, this hypothesis was currently rejected; delimitation therefore, the somatoform spectrum has been provisionally included in the HiTOP and requires a placement in the AMPD trait domain.

5. Implications

We synthesized evidence from a high number of studies by conservatively including studies, which used a CCG or HC and systematically measured SD/SSD problems and personality pathologies. As none of our included studies applied a recent, fully dimensionally operationalized model of personality, we highlight the importance of dimensional diagnostic processes, which include a systematic assessment approach of personality pathologies as proposed by AMPD in SD/ SSD patients. By measuring self- and interpersonal impairments [e.g.,82,83] as well as maladaptive personality traits more detailed, therapists can inform patients suffering from SSD about their misinterpretations and misattributions in their personal life, reducing stigmatization in SSD [84]. In turn, we expect that this also will foster better treatment of the patient's misinterpretation-routed physiological sensations. Thus, patients can receive an adequate therapy, which implicates both, diagnostic-guided improvements in personality dysfunctions and SSD symptomatology. We emphasize to consider the more heterogeneous and thus more demanding criteria of SSD of DSM-5 and therefore antagonize the body-mind dualism. This might strengthen the therapeutic relationship, because less mistrust is processes, alluding to the high comorbidity of categorical paranoid PD and somatization. More specifically, patients with SSD may be relieved because medically explainable symptoms are also included in the SSD diagnosis.

6. Conclusions

We systematically reviewed the evidence on personality pathologies in SD/SSD patients, which was overall very limited. Research using categorical personality measures reveal that SSD patients show overlaps with PDs from all clusters. Due to the low specificity of categorical diagnoses, in searching for potential evidence of overlaps between these two groups of patients, dimensional approaches in the HiTOP and AMPD are much more informative, but absent. Matching existing evidence on dimensionally measured personality pathologies in SD/SSD with the AMPD model, we found impairments in the self-domain of the LPF most robust. However, SD/SSD patients also reveal high trait loads in neuroticism/negative affectivity. A compound profile, including LPF impairments and high specific personality trait loads, has been suggested, but is not adequately based on solid research. Informed by a discussion of hybrid and fully dimensional models of personality assessment, we theoretically reflected our systematic review that empathizes the necessity of dimensional personality models in relation to SSD.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2021.110646.

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