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Subjective cognitive concerns not related to objective impairment in patients with somatic symptom and related disorders

Robin M. M. M. Weijters[a], Mercedes Almela[b], Geert J. M. van Boxtel[b] and Lars de Vroege[a,c]

[a]Centre of Excellence for Body, Mind and Health, GGz Breburg, Tilburg, The Netherlands; [b]Department of Cognitive Neuropsychology, Tilburg University, Tilburg, The Netherlands; [c]Department Tranzo, Tilburg School of Social and Behavioral Sciences, Tilburg University, Tilburg, The Netherlands

ABSTRACT

Objectives: Patients with Somatic Symptom and Related Disorders (SSRD) report subjective cognitive concerns, and research indicates that they show objective cognitive impairment. This study explored the value of subjective concerns flagging objective impairment. Furthermore, we investigated whether coping moderated this relationship, and the role of depressive symptomatology.

Method: In a cross-sectional design, objective impairment was measured with an extensive neuropsychological assessment; subjective concerns with the Cognitive Failure Questionnaire; coping styles with the Coping Inventory of Stressful Situations; and symptoms of depression with the Patient Health Questionnaire- 9.

Results: The results show that subjective concerns are of limited value in signaling objective impairment in patients with SSRD. Regression analyses performed on data from 225 patients showed that symptoms of depression (β = .32) were the main predictor of subjective concerns, which were unrelated to objective impairment. Coping was not a moderator, but patients with emotion-oriented coping styles had more subjective concerns (β=.40), and conversely, patients with avoidance- and/or task-oriented coping styles had less (respectively, β=-.27 and β=-.24).

Conclusions: These results align with the Somatosensory Amplification Theory; patients with SSRD may amplify benign cognitive failures and experience them as intrusive, noxious, and more intense. In patients with SSRD, subjective cognitive concerns are more related to psychological constructs (symptoms of depression and coping styles) than to objective impairment.

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Objective cognitive impairments; subjective cognitive concerns; coping style; depression; somatic symptom and related disorders

Introduction

Somatic Symptom and Related Disorders (SSRD) are characterized by somatic symptoms that are associated with significant disruptions and distress in daily life (American Psychiatric Aassociation APA, 2013). Somatic symptoms are persistent, typically present for more than 6 months (APA, 2013). The most frequent symptoms include headaches, fatigue, exhaustion, pain in different body locations, and disturbances in organ systems (i.e., gastro-intestinal symptoms) (Güney et al., 2019; Henningsen et al., 2007). In SSRD, thoughts, feelings, and behaviors regarding somatic symptoms are excessive, persistent, or disproportionate (criterion B of the somatic symptom disorder diagnosis in the SSRD classification). Patients have high levels of worry and anxiety about illness, and in severe cases, this may play a central role in their lives (APA, 2013). The prevalence of SSRD in the general population is approximately 12.9% (Löwe et al., 2022, 2013), and 31.7% in primary care setting (Fergus et al., 2019).

These disorders entail high individual, medical, and societal costs to the extent that they have been identified as a challenge for the population and healthcare policies (van der Feltz-Cornelis et al., 2018). Diagnosis and treatment of patients with SSRD is complex. They are difficult to diagnose because they suffer from several somatic symptoms and comorbid psychosocial and mental disturbances (Güney et al., 2019; van Eck van der Sluijs et al., 2017). And precisely, these comorbid psychosocial and mental disturbances provoke the somatic symptoms to maintain and treatment becomes more difficult. It is, therefore, not surprising that SSRD are associated with high indirect and direct economic costs (Güney et al., 2019). Barsky et al. (2005) report that the medical care costs of somatizing patients were twice as high as that of non-somatizing patients. Research on factors that will help diagnose and treat these patients

CONTACT Lars de Vroege l.devroege@tilburguniversity.edu Centre of Excellence for Body, Mind, and Health, GGz Breburg, Warandelaan 2, Tilburg 5037AB, The Netherlands

has been called for in the proposed European Agenda for SSRD (van der Feltz-Cornelis et al., 2018).

Addressing this call, in this study, we investigated factors that could aid the diagnosis and treatment of these patients regarding a specific group of complaints, their cognitive concerns. Concretely, we investigated the correspondence between objective cognitive impairment (OCI) and subjective cognitive concerns (SCC) and the role of coping styles in this relationship. About half of the patients with SSRD suffer from objective cognitive impairments (de Vroege et al., 2018). These impairments are measured with neuropsychological assessments, which evaluate performance on several cognitive domains using specific tests and are often costly and time-consuming. Studies investigating OCI in patients with SSRD, found impairments within the domains of information processing speed, sustained attention, working memory, divided attention, verbal and visual memory, and phonological verbal fluency (Al-Adawi et al., 2010; Brown et al., 2014; de Vroege et al., 2018, 2021; Inamura et al., 2015; Niemi et al., 2002). Furthermore, these impairments were frequently associated with comorbid depression (de Vroege et al., 2021). This means that it is important to interpret neuropsychological results in these patients cautiously, hence psychiatric comorbidity is common, particularly depression (Mayou, 1993), and this may had a negative correlation with SCC and/or OCI.

In clinical practice, an indication to perform a full neuropsychological assessment could be the presence of SCC. SCC are the concerns that the patient experiences personally and are measured with self- reported methods (i.e., interviews and questionnaires). In patients with SSRD, measuring SCC would be most useful when they are in fact the result of OCI, because they will serve as a warning sign to alert clinicians to investigate further. However, SCC does not always correlate with OCI, measured with a neuropsychological assessment. In fact, the relationship between SCC and OCI appears weak and often influenced by underlying psychopathology, as shown by studies performed in different populations. For example, Burmester et al. (2016) concluded, after an extensive systematic review and meta-analysis, that the association between OCI and SCC is significant but small in the aging population, and is likely of less importance than between SCC and affective symptoms (mainly depression). In addition, in stroke patients, SCC does not always correlate with measured OCI (M. W. van Rijsbergen et al., 2017; M. W. A. van Rijsbergen et al., 2020). Recently, Finley et al. (2024) conducted a study on nongeriatric adults presenting for outpatient neuropsychological evaluation, which found that SCC was significantly related to internalizing psychopathology, including anxiety and depression, but not to OCI. To our knowledge, the correspondence between OCI and SCC in patients diagnosed with SSRD following DSM-5 criteria is unknown.

A possible lack of correspondence between OCI and SCC can be hypothesized based on the Somatosensory Amplification Theory (Barsky et al., 1988; Perez et al., 2015). This theory states that *benign* bodily sensations are experienced as intrusive, noxious, disruptive, and intense. Elements associated with amplification are the tendency to select relative infrequent and weak sensations, an enhanced focus on bodily sensations, and reacting more intensely to these sensations with thoughts and affect that make it more distressing and alarming (Barsky et al., 1988; Perez et al., 2015). We propose that this could be the same for cognitive symptoms, meaning that *benign* cognitive failures (e.g., forget where you placed the keys or glasses) are experienced as intrusive, noxious, and more intense. Consequently, this leads to augmentation of these concerns and therefore experience SCC as more distressing and alarming than they truly are, which would not always be in correspondence with measured OCI. Nevertheless, other models that aim to describe the interaction between mind and body may also explain the interplay between OCI and SCC, but future studies are needed to test these models.

To date, no studies explored the relationship between SCC and measured OCI in patients with SSRD. Since both OCI and SCC are important in a patient's clinical evaluation, it is needed to investigate the degree of correspondence between both. If this relationship between OCI and SCC is strong, it will be recommended to do a neuropsychological assessment (NPA) in all the patients who have SCC. A NPA will give a broad overview of the cognitive performance of patients and may therefore lead to more individualized treatments. However, previous studies in other patient populations have shown that SCC could be more related to psychological states and traits, such as coping styles and depression, rather than the presence of OCI (Burmester et al., 2016; Johansson et al., 2015).

The individual's typical way of dealing with stressful situations, referred to as coping, consists of several styles. Lazarus and Folkman (1984) distinguished two types of coping styles: problem-oriented and emotion-oriented. Problem-oriented coping styles are used to tackle the causes of the stressful situation or problem, consequently leading to a reduction of the experienced stress (i.e., after forgetting where you put your keys you install a box in which you keep your keys). They provide a long-term solution to the problem, are considered most effective, and reduce psychopathology (Lazarus & Folkman, 1984; Thomson & Jaque, 2017). On the other

hand, emotion-oriented coping styles are used to reduce stress negative emotional responses (i.e., fear about forgetting where you put your keys or anxiety about the cognitive symptoms you may experience), but at the same time are associated with emotional distress and considered less effective since the stress source is ignored (Rasmussen et al., 2010). Therefore, they do not provide a long-term solution but delay the confrontation with the stressor (Lazarus, 1991). Research has shown that emotion-oriented coping styles are related to higher levels of emotional exhaustion, psychological distress (such as anxiety and depression), and lower levels of personal accomplishment (Rasmussen et al., 2010). Another style of coping that is referred to in the literature is called avoidance-oriented coping and refers to a tendency to avoid stressor rather than dealing with them.

In the current study, we propose that coping styles will affect the correspondence between OCI and SCC in patients with SSRD (M. W. van Rijsbergen et al., 2017; Witthöft & Hiller, 2010). Research with healthy elderly individuals showed that psychological factors such as coping styles make individuals more prone to experiencing cognitive concerns (Hänninen et al., 1994; Slavin et al., 2010). In patients with chronic pain, it was found that catastrophizing an emotion-oriented coping style, was significantly associated with more cognitive concerns (Roth et al., 2005). In addition, in patients with Multiple Sclerosis, it was found that disclosure of emotions, an emotion-oriented coping style, was related to an underestimation of their executive performance (van der Hiele et al., 2012). Lastly, Gold et al. (2003) stated that maladaptive coping strategies, such as lack of insight, overestimation, or denial, will be responsible for discrepancies between OCI and SCC. Furthermore, in stroke patients, it was shown that avoidance-oriented coping styles were associated with more SCC, whereas a task-oriented coping style was associated with less OCI (M. W. van Rijsbergen et al., 2017).

A recent study explored whether personality factors were related to cognitive functioning in patients with SSRD and reported that neuroticism, extraversion, and low openness were associated with more cognitive symptoms (de Vroege et al., 2022). However, no studies have yet explored the role of coping on the correspondence between OCI and SCC in patients with SSRD. It is important to investigate this effect, because if coping styles affect this relationship, e.g., patients with emotion-oriented coping styles show SCC without OCI, coping styles should be considered as a target for interventions. Therefore, the aims of this study were (1) to examine if OCI and SCC are associated in patients with SSRD and (2) to examine if coping style affects the correspondence between OCI and SCC in patients with this disorder. We expect patients with avoidance and/or emotion-oriented coping styles to show more SCC with less OCI.

Materials and methods

Participants and procedures

A cross-sectional design was used to investigate the correspondence between OCI and SCC, and the moderating role of coping styles. The initial study sample included 461 patients from the Clinical Center of Excellence for Body, Mind and Health. This clinical center is a specialized mental healthcare institution for SSRD patients at GGz Breburg, located in Tilburg, The Netherlands. Patients from this clinic are mostly referred from health and medical institutions because of insufficient treatment effects on their symptoms. A diagnosis of SSRD, which was diagnosed by a psychiatrist following Diagnostic and Statistical Manual-5 criteria (APA, 2013), was the main inclusion criterion for this study. Patients were excluded from the study if (a) used illicit drugs within the past 6 months, (b) were at direct risk of suicide, (c) consumed more than 21 units of alcohol per week, (d) insufficiently mastered the Dutch language, (e) were suspected of invalid test performance, or (f) refused to participate in the study.

The clinic used a standard intake procedure in which SCC concerns were measured using the Cognitive Failure Questionnaire. In addition, coping styles of patients were examined using the Coping Inventory for Stressful Situations and lastly, NPA was done to explore OCI. Due to changes in informed consent regulations, for a previous part of the study sample ($N = 435$), patients were informed in the intake letter about the possibility of using their records for scientific studies. Later, in the intake interview, a possibility for objection was raised and consent was given or not. Data from the patients that objected were not included in this study. A more recent part of the study sample ($n = 26$) was asked for permission to use their data for scientific purposes, and they signed an informed consent form.

The data of this study was stored at GGz Breburg in accordance with the guidelines for data management and storage. Each patient was assigned to a client number that can only be linked with personal data by the principal investigator. The Ethical Committee for Scientific Research at GGz Breburg approved this study (CWO2021–07).

Demographic variables

Demographic variables age (years), education, and sex (female/male) were obtained during the intake. Education level was described using the Verhage method (Verhage, 1983). This method categorizes education level in seven categories of increasing order (1 = less than six courses of primary education to 7 = University Study).

Instruments

Objective cognitive impairment

A NPA was completed by all patients to measure OCI. During this assessment, a broad range of cognitive domains was explored, focusing mainly on cognitive domains where patients with SSRD have shown impairment in previous studies (Al-Adawi et al., 2010; Brown et al., 2013; de Vroege et al., 2018, 2021; Inamura et al., 2015; Niemi et al., 2002). The first card of the Stroop Color Word Test (SCWT) and TMT-A were used to assess information processing speed (Scarpina & Tagini, 2017; Stroop, 1935). Sustained attention was assessed using the d2 test (Bates & Lemay, 2004; Brickenkamp, 2002). The Trial Making Test -B (TMT-B) was used to assess divided attention (Lezak et al., 2012). The Dutch version of the Rey Auditory Verbal Learning Test (RAVLT) was used to assess verbal memory (Lezak et al., 2012). The Rey Osterreith Complex Figure Test (ROCFT) and Rivermead Behavioral Memory Test (RMBT) were used to assess visual memory (Lezak et al., 2012; Osterrieth, 1944). The Boston Naming Test (BNT) and Verbal Fluency Test (VFT) were used to assess language-related functioning.

Performance validity

Before administering the NPA, the Test of Memory Malingering (TOMM) was used to test if there was evidence for invalid test performance (Tombaugh, 1996). A score lower than 45 on either the first or second trial of the TOMM, is considered a sign of invalid test performance (Tombaugh, 1996). When the TOMM raised signs of invalid test performance, the Amsterdam Short-Term Memory Test (Dutch abbreviation: AKTG, Schmand et al. (1999)) was used to further investigate invalid test performance. A score of 84 or lower on the AKTG was indicated as sign of invalid test performance. When the results on both TOMM and AKTG were suggestive for invalid test performance, the assessment was canceled, and the patient was excluded from the study.

Subjective cognitive concerns

The SSC were measured with the Cognitive Failure Questionnaire (Bridger et al., 2013; Broadbent et al., 1982). This questionnaire has good predictive and criterion validity and internal reliability (Bridger et al., 2013) and consists of 25 questions about the frequency of cognitive mistakes that the patient experienced daily, for example, "reading something and shortly after you do not remember what you just read, and therefore have to read it again." The score on the CFQ ranges from 0 to 100, with higher scores indicating more cognitive concerns. In this study, the total score was used as the outcome measure.

Coping style

Coping style was measured using the Coping Inventory for Stressful Situations (Endler & Parker, 1990) which has good internal validity. It measured three coping styles, task-oriented, emotion-oriented, and avoidance-oriented coping. The questionnaire consisted of 48 items which can all be answered using a 5-point-likert-scale ranging from not at all to very strong (scores range from 48 to 240). An example of an item measuring task-oriented coping was "adjusting my priorities." An example of emotion-oriented coping was "getting very upset." Lastly, an example item about avoidance-oriented coping was "trying to sleep." The scores on task-oriented, emotion-oriented, and avoidance-oriented coping were determined by the total sum score of all the items measuring the corresponding coping style.

Depressive symptoms

The level of depressive symptoms in SSRD patients was measured using the Patient Health Questionnaire (PHQ-9), a self-report measure for depression (Kroenke et al., 2001). The PHQ-9 has good specificity and sensitivity (Kroenke et al., 2001) and consists of nine questions with following response options: (0) not at all, several days, (1) more (2) than half the days, and (3) nearly every day. An example item stated, "less

interest and joy in activities." The total score on this test was used in the statistical analyses.

Statistical analyses

First, descriptive statistics (e.g., age, sex, and education level) were calculated, and the distribution of the measured variables was checked. Not all participants had data on all questionnaires, but the analyses were performed with all the data available. This means that the n for each analysis is variable, and it is informed in the tables. To obtain an overall measure of OCI, a principal component analysis (PCA) was conducted with all the outcomes of the NPA. The Kaiser-Meyer-Olking statistic (KMO) indicated a satisfactory relationship between the number of variables and sample size (.815), and Bartlett's test of Sphericity showed that correlations between all the variables were sufficient to warrant a PCA, C^2 (105) = 2335.57, $p < .001$. The composite score for each participant was obtained using the regression method.

The relationship between OCI and SCC, including the covariates and the moderating role of coping on this relationship, was analyzed separately with correlations and then together in a multiple hierarchical regression analysis. To check if the variables in the analyses were normally distributed graphs (Q-Q, histogram), skewness, kurtosis, and Kolmogorov–Smirnoff test were obtained. The inspection revealed that some variables were not normally distributed and therefore bivariate associations were examined using non-parametric Spearman correlations (rho). Next, multiple hierarchical linear regression analyses were done to examine whether OCI was associated with SCC, and if coping moderated this relationship controlling for age, sex, education level, and depression symptomatology. All variation inflation factor values were below 10, indicating no multicollinearity problems. Outliers and influential cases were checked by Cook's distances and the standardized residual scatterplots. These plots were also used to check for both heteroscedasticity and linearity. The Durbin–Watson statistic indicated that the residuals in the model were independent. In the regression analysis, in step one the following predictors were added: age, sex, education, symptoms of depression, OCI, and coping styles (e.g., emotion-, avoidance-, and task-oriented). In step two, the interaction term between OCI and one of the three types of coping styles were included to the model (OCI*emotion-, OCI*avoidance-, and OCI*task-oriented coping) as recommended by Aiken and West (1991).

To investigate if specific neuropsychological test scores were associated with SCC, a multiple hierarchical regression analysis was performed. To avoid multicollinearity, the correlations between all the individual neuropsychological tests were calculated. When correlations were higher than 0.7, the score that had a higher correlation with SCC was added to the analysis. The predictors in this regression were as follows: age, sex, education level, symptoms of depression, emotion-, avoidance, and task-oriented coping and the neuropsychological test scores. In all the regression analyses, all continuous predictors were standardized before they were entered in the regression. Regression coefficients (standardized

Table 1. Descriptive statistics of the total sample of patients with SSRD.

Variable	N (%)	Missing	M ± SD
Age (years)	388 (84.3)	72 (15.7)	42.6 ± 13.2
Sex	407 (88.5)	53 (11.5)	
Male	166 (40.8)		
Female	241 (59.2)		
Education (Verhage System)		66 (14.3)	5 ± 1.1
(1) Less than 6 years of primary education	2 (0.4)		
(2) Finished primary education	18 (3.9)		
(3) Primary education and less than 2 years of low-level secondary education	13 (2.8)		
(4) Low-level secondary education	72 (15.7)		
(5) Average-level secondary education	167 (36.3)		
(6) High level secondary education	103 (22.4)		
(7) University degree	19 (4.1)		
Symptoms of depression (PHQ-9)	398 (86.5)	62 (13.5)	14 ± 6.1
SCC (CFQ)	381 (82.8)	79 (17.2)	44.7 ± 17
Total score			
Coping (CISS)	358 (77.8)	102 (22.2)	
Task- oriented			54.6 ± 10.7
Emotion- oriented			48.9 ± 8.7
Avoidance-oriented			43.0 ± 10.9

Abbreviations: SSRD = Somatic symptom and related disorders; *N* = sample size; *M* = mean; SD = standard deviation; PHQ-9 = Patient Health Questionnaire; SCC = Subjective cognitive concerns; CFQ = Cognitive Failure Questionnaire; CISS = Coping Inventory for Stressful Situations.

betas) were presented as an indication of the strength of the association and Adjusted R^2 was used to describe the amount of explained variance for the specific models. For all analyses, the Statistical Package for the Social Sciences version 27 was used. A p value < .05 was considered as statistically significant.

Table 2. Principal component analysis with neuropsychological test scores: descriptives and factor loadings.

N = 258	M ± SD	Factor loadings
Information processing speed		
SCWT II	62.7 (16.4)	.584
SCWT III	99.0 (33.7)	.626
TMT-A	35.8 (16.4)	.697
Verbal Memory		
RAVLT (immediate recall)	43.1 (10.3)	−.750
RAVLT (delayed recall)	9 (3.0)	−.653
RBMT (imprinting)	17.4 (6.0)	−.618
RBMT (recognition)	14.3 (5.9)	−.651
Visual memory		
ROCFT (copy)	31.2 (4.7)	−.568
ROCFT (immediate recall)	19.7 (7.3)	−.624
ROCFT (delayed recall)	19 (6.7)	−.668
Divided attention TMT-B	79.6 (45.8)	.694
Sustained attention d2	147.3 (45.1)	−.698
Language		
BNT	159.3 (14.7)	−.516
VFT (n + a)	22.8 (8.9)	−.539
VFT (animals)	33.5 (8.4)	−.562

Abbreviations: *M* = mean; SD = Standard Deviation; SCWT = Stroop Card Sorting Test (II; card II, III; card III); TMT-A = Trial Making Test-A; RAVLT = Rey Auditory Verbal Learning Test; ROCFT = Rey Osterreith Complex Figure Test; TMT-B = Trial Making Test-B; BNT = Boston Naming Test; VFT = Verbal Fluency Test.

Results

Descriptive statistics

For a detailed description on the available data per variable see Table 1. The database contained 166 males (40.8%) and 241 females (59.2%), with an average age of 42.6 years (Standard Deviation (*SD*) = 13.2). Most of the participants had a level of education beyond secondary school. Of the total sample, 381 (82.8%) patients completed the CFQ, 358 patients (77.8%) completed the CISS, and 398 (86.5%) patients completed the PHQ-9. Lastly, 26 (5.6%) patients were suspected of invalid test performance, 99 (24.3%) patients did not have information about this variable, and one (0.3%) participant did not sign the informed consent. The data of the participants suspected of invalid test performance, or did not sign the informed consent were eliminated for further analysis.

Preliminarily analyses

Descriptives and PCA factor loadings are displayed in Table 2. The outcomes of all the neuropsychological tests were summarized in one factor: OCI. The total variance explained by this factor was 40.1%.

The sample size used for the regression analyses existed of 225 patients. Demographic variables of this sub sample are displayed in Table 3. 40.9% of the sample were male and mean age was 42.2 years (*SD* = 12.7). Distribution with regard to education level, PHQ-9, CFQ, and CISS scores are displayed in row 4 to 6.

Table 3. Descriptive statistics of the sub-sample of patients with SSRD used for regression analyses (*n* = 225).

Variable	N (%)	M ± SD
Age (years)		42.2 ± 12.7
Sex	92 (40.9)	
Male	133 (59.1)	
Female		
Education (Verhage System)		5 ± 1.1
(1) Less than 6 years of primary education	1 (0.4)	
(2) Finished primary education	11 (4.9)	
(3) Primary education and less than 2 years of low-level secondary education	8 (3.6)	
(4) Low-level secondary education	34 (15.1)	
(5) Average-level secondary education	95 (42.2)	
(6) High level secondary education	68 (30.2)	
(7) University degree	8 (3.6)	
Symptoms of depression (PHQ-9)	398 (86.5)	14 ± 6.1
SCC (CFQ)		42.5 ± 15.5
Total score		
Coping (CISS)		
Task- oriented		55.1 ± 10.1
Emotion- oriented		48.5 ± 8.0
Avoidance-oriented		43.1 ± 10.2

Abbreviations: SSRD = Somatic symptom and related disorders; *M* = mean; SD = standard deviation; PHQ-9 = Patient Health Questionnaire; SCC = Subjective cognitive concerns; CFQ = Cognitive Failure Questionnaire; CISS = Coping Inventory for Stressful Situations.

Table 4. Correlations and multivariate linear regression analysis evaluating the association between OCI, SCC, and the moderating role of coping style.

	N	Rho[a]	Adj. R^2 (F)	β
Model 1			.210 (8.421)***	
Age	334	−.113*		−.079
Sex	337	−.035		.080
Education	328	.015		.134*
Symptoms of depression	328	.346***		.337***
OCI	234	.090		.117
Task-oriented coping	322	−.153**		−.210**
Emotion-oriented coping	322	.069		.353**
Avoidance-oriented coping	322	−.039		−.245*
Model 2 (interaction)[b]		ΔR^2		
Task-oriented coping x OCI		.006	.212(1.741)	.081
Emotion-oriented coping x OCI		<0.001	.206(0.023)	.009
Avoidance-oriented coping x OCI		<0.001	.206(0.073)	.017

Note. N of the regression analyses is 225. Abbreviations: OCI = Objective Cognitive Impairment.
[a]Spearman correlation between the predictors and SCC. [b]Tested in the three separate models. *Significant at $p < 0.05$. **significant at $p < 0.01$. *** significant at $p < 0.001$.

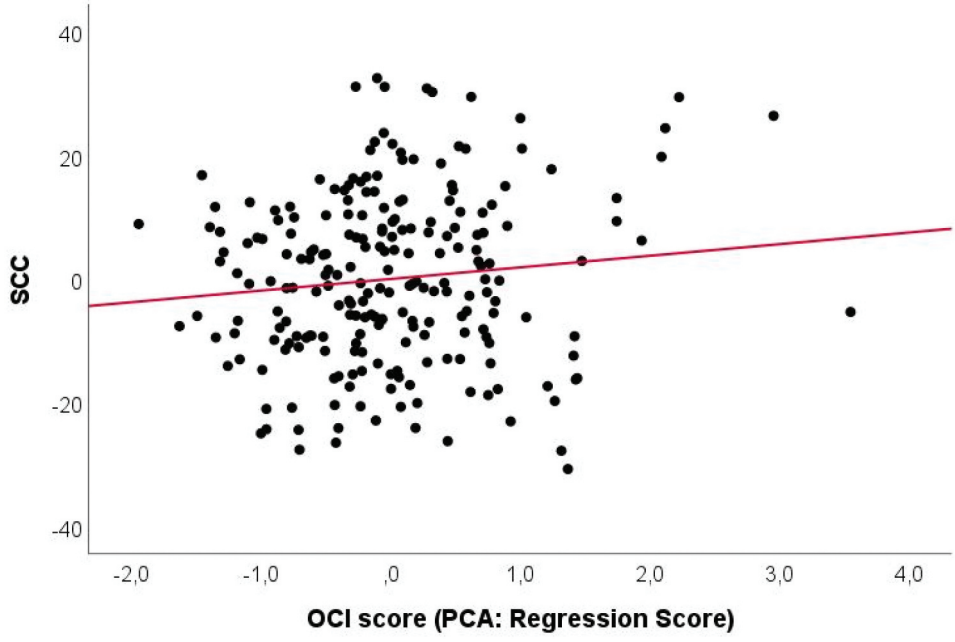

Figure 1. Partial scatterplots: relationship of OCI with SCC. Note: This figure shows the relationship between OCI score and SCC score (PCA: regression score). Abbreviations: OCI = Objective Cognitive Impairment; SCC = Subjective Cognitive Concerns; PCA = Principal Component Analysis.

Was OCI associated with SCC and did coping moderate this relationship?

Table 4 shows the results of the multiple hierarchical regression analyses. Model 1 explained 21% of the variance in SCC (*Adj.* R^2 =.210; F (8,216) = 8.421; p < .001). OCI was not associated with SCC (β=.117, p= .107), see Figure 1. The more emotion-oriented coping used, the more SCC were present (β= .353, p= .003); and conversely, the more task-and avoidance-oriented coping were used, the less SCC were present (β=-.210, p= .007 and β=-.245, p= .019, respectively), see Figure 2. The main predictor of SCC was depressive symptomatology, more depressive symptomatology was related to more SCC (β= .337, p< .001). Higher education was also related to more SCC (β=.134, p= .045). Age and sex were not significantly related to SCC. Finally, the addition of the moderation effects (coping styles as moderators of the relationship between OCI and SCC) in model 2 did not significantly increase the amount of variance explained in SCC. Thus, coping did not moderate the relationship between OCI and SCC.

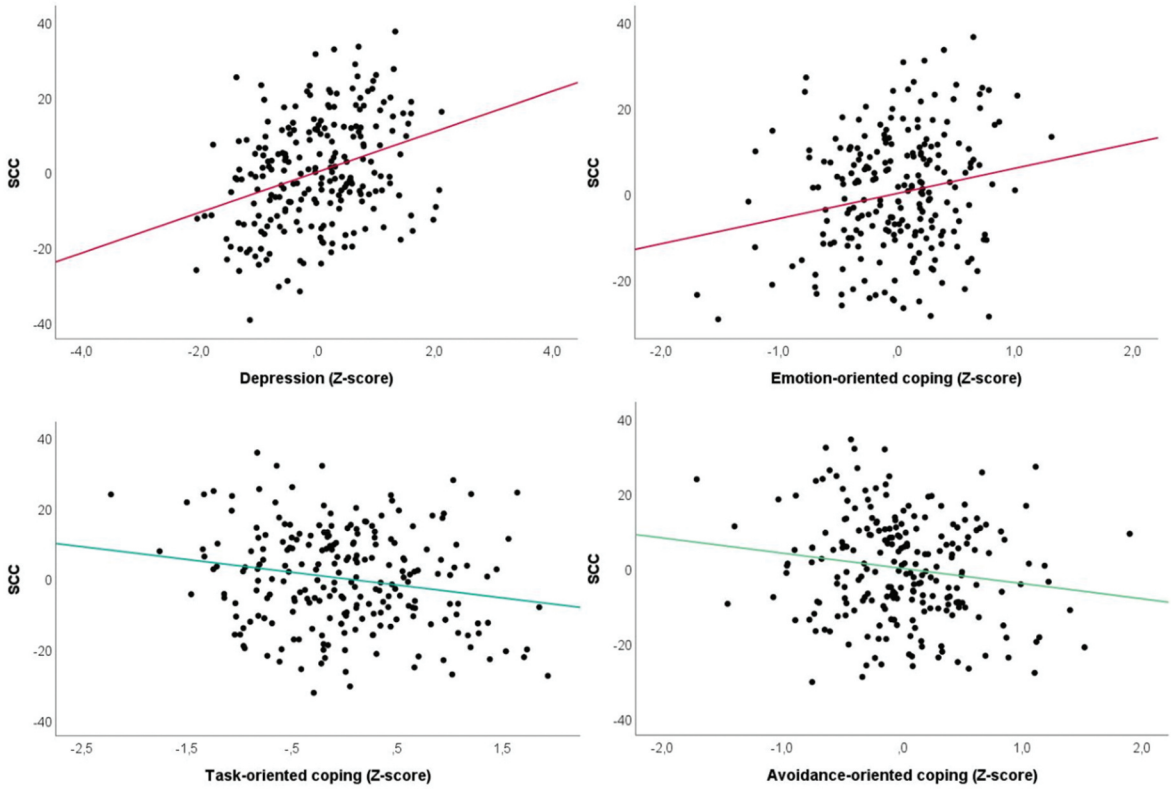

Figure 2. Partial scatterplots: depressive symptomatology, relationship of task-, emotion- and avoidance-oriented coping with SCC. *Note*: This figure shows the relationship between the SCC score and either depressive symptomatology, task-, avoidance- or emotion-oriented coping (Z-scores). Abbreviation: SCC = Subjective Cognitive Concerns.

Table 5. Correlations and multivariate linear regression analysis evaluating the association between neuropsychological test scores and SCC.

	N	Rho[a]	Adj. R^2 (F)	β
Model			.212 (4.180)***	
Age				−.115
Sex				.133
Education				.115
Symptoms of depression				.318***
Task-oriented coping				−.240**
Emotion-oriented coping				.396**
Avoidance-oriented coping				−.270*
TMT-A	255	.032		.156
TMT-B	256	.096		−.114
SCWT III	256	.094		.014
d2	248	−.068		−.140
RAVLT (immediate recall)	259	−.039		−.045
RAVLT (delayed recall)	258	−.066		−.064
RMBT (imprinting)	257	−.034		.018
ROCFT (copy)	252	.085		−.049
ROCFT (direct recall)	251	.066		.124
BNT	254	−.015		.016
VFT (n + a)	251	−.035		−.113
VFT (animals)	250	−.013		.142

A single model for each neurocognitive subtest was executed. Tests scores that were not entered in the regression analysis were excluded because of strong correlations with one or more other tests (Spearman's rho ≥ .70). N of the regression analysis is 226. Abbreviations: SCC=Subjective Cognitive Concerns; SCWT = Stroop Card Sorting Test; TMT-A= Trial Making Test-A; TMT-B = Trial Making Test-B; RAVLT = Rey Auditory Verbal Learning Test; ROCFT = Rey Osterreith Complex Figure Test; TMT-B = Trial Making Test-B; BNT = Boston Naming Test; VFT = Verbal Fluency Test.

[a]Spearman correlation between the neuropsychological tests and SCC.

*significant at $p < 0.05$. **significant at $p < 0.01$. ***significant at $p < 0.001$.

Were neuropsychological test associated with SCC?

Finally, we investigated whether individual performance test scores were associated with SCC. Table 5 displays the results of the multiple hierarchical regression analysis with NPA test scores as predictors. The results showed that no test score was significantly associated with SCC (all *ps* > 0.085).

Discussion

The present study investigated the relationship between OCI and SCC in patients with SSRD, and if coping styles moderated this relationship. The results showed that OCI was not related to SCC and that coping styles did not moderate this relationship. This was confirmed in a secondary analysis showing that no individual neuropsychological test score were associated with SCC. In this study, symptoms of depression were the main predictor of SCC, with more depressive symptomatology leading to more SCC. After controlling for depressive symptoms, the second main predictor was coping styles. The implementation of an emotion-oriented coping style led to higher SCC, and conversely, adapting an avoidance and/or task-oriented coping styles led to less SCC.

In the current study, OCI was not related to SCC. In aging and stroke populations, previous studies also did not find correlations between OCI and SCC consistently (Burmester et al., 2016; Johansson et al., 2015; M. W. van Rijsbergen et al., 2017; M. W. A. van Rijsbergen et al., 2020). In the current study with patients with SSRD, more OCI did not lead to more SCC. This result aligns with the Somatic Amplification Theory, which has been used previously to explain somatic complaints in patients with SSRD (Ak et al., 2004; Barsky et al., 1988; Kose-Ozlece et al., 2016; Köteles & Doering, 2016; Köteles & Witthöft, 2017; Perez et al., 2015). Subtle and benign cognitive failures, which do not represent cognitive impairment, could be experienced as intrusive and intense, which will lead to SCC which can be more distressing and alarming as they truly are, and this phenomenon can also be considered as the criterion B of SSRD (APA, 2013).

Contrary to our hypothesis, the findings did not show that coping styles strengthen or weaken the relationship between OCI and SCC. While coping styles and depression were found to be significantly related to SCC, they did not moderate the relationship between OCI and SCC. One reason for this could be that SCC are more directly influenced by psychological factors rather than actual cognitive impairments, which aligns with the results of the current study and previous research (Burmester et al., 2016; Johansson et al., 2015). This could explain why coping styles and depression were associated with SCC independently of OCI, indicating that subjective cognitive concerns are more reflective of an individual's emotional and coping state rather than their objective cognitive performance. However, we did find that symptoms of depression and coping styles are related to SCC in patients with SSRD. In line with other studies, the current study found that patients with higher depressive symptomatology and emotion-oriented coping styles reported more SCC (Roth et al., 2005; van der Hiele et al., 2012; M. W. van Rijsbergen et al., 2017).

The role of depressive symptoms in SCC requires deeper exploration and discussion. Depression is known to involve various cognitive symptoms and is often the strongest predictor of SCC, as evidenced in our sample. Depressed individuals frequently report subjective cognitive problems that are not necessarily related to OCI (Mouta et al., 2023). Depressive symptoms can lead to cognitive distortions and heightened self-focus on cognitive failures, which may amplify SCC (Rock et al., 2014). This suggests that the presence of depressive symptoms might skew the perception of cognitive impairments, making it crucial for clinicians to consider psychological factors when evaluating SCC in patients with SSRD.

The Self-Regulatory Executive Function model (S-REF) suggests that individuals with psychological disorders often engage in maladaptive coping strategies (Wells, 2019). Based on this model, emotion-oriented coping styles may contribute to SSRD symptomatology by activating and maintaining metacognitive processes implicated in this disorder. For example, the tendency to worry, catastrophize, and ruminate when coping with stress may reinforce SSRD declarative metacognitive beliefs such as "I am sick" or "Something is wrong in my head" and thus increase the subjective perception of cognitive impairments. On the other hand, a task-oriented coping style could help counteract these processes by promoting adaptive problem-solving strategies and focusing on practical solutions to stressors. Finally, the current study found that an avoidance-oriented coping style is related to lower SCC. This finding may initially seem counterintuitive, as avoidance-oriented coping is generally considered to be maladaptive. One possible explanation for this finding may be related to the short-term relief provided by avoidance-oriented coping strategies (Suls & Fletcher, 1985). In the context of SSRD, patients may experience fewer SCC when they momentarily divert their attention away from their

symptoms; however, this hypothesis needs further investigation.

One interesting finding of this study was the association between higher education and increased SCC. There are several potential explanations for this relationship. Individuals with higher education, in this population, may have greater cognitive expectations and be more attuned to cognitive changes or difficulties, leading to heightened awareness and reporting of cognitive concerns. This heightened awareness could result from the increased cognitive demands and complexities associated with higher educational and professional responsibilities. Furthermore, individuals with higher education levels might have more knowledge about cognitive health and thus be more likely to perceive and report even minor cognitive issues. However, it is important to note that exploring the relationship between education and SCC was not the primary objective of our study. Therefore, further research is needed to specifically investigate this association and to better understand the underlying mechanisms.

The interpretation of our study findings needs to be considered in the context of some limitations. First, we used a cross-sectional design, which prohibits causal inferences of the effects found in the study. Second, the use of self-report questionnaires is not ideal for patients with SSRD. Studies indicated that this patient group had impairments in mentalization and introspection (Zunhammer et al., 2015). Therefore, the use self-report questionnaires may not represent optimal insights for this type of patients. However, the self-report questionnaires we used are widely used instruments in several patient groups, with good validity and reliability (Endler & Parker, 1990; Kroenke et al., 2001; Ponds et al., 2006). Furthermore, we also used a screening instrument to assess symptoms of depression, which should also be considered a limitation. Moreover, one of the questions regarding the screening instrument of symptoms of depression consisted an item that conflated the relationship between depressive symptomatology and SCC (e.g., "Trouble concentrating on things, such as reading the newspaper or watching television"). Third, the study sample was obtained through convenience hence we were unable to fully control for exclusion criteria. For instance, with regard to use of drugs within the past six months (related to use of drugs such as cannabis or other (hard) drugs). Fourth, our neuropsychological measurements may not be sensitive enough to subtle, yet bothersome cognitive symptoms that patients experience. Therefore, the term cognitive impairment can be a bit misleading in a sense that is distorted at the level of neuropsychological testing (i.e., 1.5 or 2 standard deviations from the mean). As a result, discrepancies between OCI and SCC may have resulted from sensitivity issues rather than performance measures. One of the limitations of this study is the absence of specific symptom validity testing for cognitive concerns. While we excluded participants with invalid test performance to ensure the reliability of our neuropsychological assessments, we did not apply similar validity testing to cognitive symptom reports. This decision was made to include a broader range of SSRD patients, acknowledging that even invalid cognitive concerns can reflect significant clinical distress and are relevant for understanding SSRD. Future studies should consider incorporating symptom validity measures to better discern the extent of exaggerated cognitive concerns within this population.

Finally, the assessment of SCC using the CFQ, which has no empirically established and clinically meaningful cutoffs should be mentioned. Discussed more broadly, SCC are inconsistent and show less associations with OCI throughout a range of disorders (Groenman et al., 2022) but are associated with decreased activities of daily life (Cordier et al., 2019; Montejo et al., 2012) and poorer quality of life (Montejo et al., 2012; Rotenberg Shpigleman et al., 2019). However, most psychiatric classifications (i.e., DSM-5 classifications) are characterized by SCC and SCC are part of core symptomatology in many psychiatric problems (i.e., attentional problems). However, associations between SCC and OCI vary considerably (see for instance Van der Werf-Eldering et al. (2011) or Arntsberg Grane et al. (2014)). A review that explored the use of instruments exploring SCC concluded that SCC are significantly related to experienced distress and disability in daily life (Groenman et al., 2022). In this light, and because of the lack of instrument with good psychometric qualities, the assessment of SCC (with, i.e.,, the CFQ, as used in the current study) can contribute to acknowledgment of concerns in daily life. In case SCC and OCI do not overlap, this may be discussed during treatment in order to explore the amount of distress and disability that occurs with this sense of cognitive nuisance (i.e., individuals are bothered (a lot) by SCC in daily life).

The strengths of the study are the large sample size and therefore its representativeness for other patients with SSRD. Furthermore, it should be noted that this study, is to our knowledge, the first to investigate the relationship between OCI, coping styles and SCC, in patients with SSRD. Therefore, it adds knowledge to the already existing literature about these patients. It serves as a first indication for the fact that OCI is not

a predictive value for SCC, and there are other important predictors of SCC, such as depressive symptomatology and coping styles. It is important to investigate this further in the future research because this can lead to better adjusted treatment programs. To achieve a better understanding of the type of coping styles used by patients with SSRD, future research should investigate if certain coping styles are more apparent in this patient group and how they develop over time. In addition, future research could also explore if there are other predictors involved in the relationship between coping styles and SCC.

In conclusion, the study aimed at investigating the relationship between OCI and SCC, and if this relationship changed depending on coping styles. We concluded that OCI did not have a predictive effect on SCC in patients with SSRD, and that this relation does not change depending on coping styles. However, certain coping styles, i.e., emotion-oriented coping, were associated with more SCC. Conversely, other coping styles, i.e., avoidance-and/or task-oriented coping, were associated with less SCC. Finally, depressive symptomatology was the main predictor of more SCC. Future research should focus on explanatory modelsfor instance, the Somatic Amplification Theory or the Self-Regulatory Executive Function, for SCC in patients with SSRD in order to create and offer a patient-centered treatment options.

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