The Brief Obsessive–Compulsive Scale (BOCS): A self-report scale for OCD and obsessive–compulsive related disorders

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Background: The Brief Obsessive Compulsive Scale (BOCS), derived from the Yale–Brown Obsessive–Compulsive Scale (Y-BOCS) and the children's version (CY-BOCS), is a short self-report tool used to aid in the assessment of obsessive–compulsive symptoms and diagnosis of obsessive–compulsive disorder (OCD). It is widely used throughout child, adolescent and adult psychiatry settings in Sweden but has not been validated up to date. *Aim*: The aim of the current study was to examine the psychometric properties of the BOCS amongst a psychiatric outpatient population. *Method*: The BOCS consists of a 15-item Symptom Checklist including three items (hoarding, dysmorphophobia and self-harm) related to the DSM-5 category "Obsessive–compulsive related disorders", accompanied by a single six-item Severity Scale for obsessions and compulsions combined. It encompasses the revisions made in the Y-BOCS-II severity scale by including obsessive–compulsive free intervals, extent of avoidance and excluding the resistance item. 402 adult psychiatric outpatients with OCD, attention-deficit/ hyperactivity disorder, autism spectrum disorder and other psychiatric disorders completed the BOCS. *Results*: Principal component factor analysis produced five subscales titled "Symmetry", "Forbidden thoughts", "Contamination", "Magical thoughts" and "Dysmorphic thoughts". The OCD group scored higher than the other diagnostic groups in all subscales ($P < 0.001$). Sensitivities, specificities and internal consistency for both the Symptom Checklist and the Severity Scale emerged high (Symptom Checklist: sensitivity = 85%, specificities = 62–70% Cronbach's $\alpha = 0.81$; Severity Scale: sensitivity = 72%, specificities = 75–84%, Cronbach's $\alpha = 0.94$). *Conclusions*: The BOCS has the ability to discriminate OCD from other non-OCD related psychiatric disorders. The current study provides strong support for the utility of the BOCS in the assessment of obsessive–compulsive symptoms in clinical psychiatry.
• *Attention deficit hyperactivity disorder, Autism, Assessment, Compulsive behaviour, Obsessions.*

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Obsessions and compulsions are considered the main features of obsessive–compulsive disorder (OCD); however in the DSM-5, body dysmorphic disorder, hair-pulling, hoarding and skin-picking are all included under the new chapter "Obsessive–compulsive related disorders", reflecting the association between one another and OCD. Moreover, obsessive–compulsive symptoms have a high frequency of comorbidity with a range of other psychiatric disorders (1–3).

Although the core symptoms of OCD are easily identified, most outpatients with OCD remain unrecognized by their psychiatrist (3). The use of rating scales, however, may improve and facilitate the assessment of OCD. The Yale–Brown Obsessive–Compulsive Scale (Y-BOCS) is regarded as the gold standard (4, 5). A very similar version for children (CY-BOCS) was introduced in 1997 (6). Both versions have been widely used in research and in clinical settings (7, 8). A second edition of the

Y-BOCS (Y-BOCS-II) differed from the original by including assessments of obsessive–compulsive free intervals and extent of avoidance (9). Both Y-BOCS versions, as well as CY-BOCS, consist of two parts: first part consisting of an extensive symptom checklist of 54 items in the Y-BOCS and more than 60 items in the CY-BOCS, followed by a second part made up of a separate clinician-rated scale measuring symptom severity. A self-rated version of Y-BOCS (10) has shown a good agreement with the Y-BOCS (11) however less for obsessions than for compulsions (12).

Today an array of self-reports for OCD are available but each one has limitations (13, 14). In short, either they are too extensive or repetitive, hampering their clinical use (10, 15, 16), lack discriminative power (17–19), have low convergence with Y-BOCS (20–23), include items that are not associated with OCD (24) or do not measure severity (25).

Succinct and psychometrically valid instruments for identifying obsessive–compulsive symptoms and assessing their severity, tested in large psychiatric populations, are still lacking. In view of this, a shortened self-rated version of Y-BOCS and CY-BOCS combined, developed 1997–2002 was the Brief Obsessive–Compulsive Scale (BOCS) (26). It consists of both a symptom checklist section illustrated with examples and a severity scale section. Today, the BOCS is in wide use throughout child, adolescent and adult psychiatry settings in Sweden. The aim of the present study was to evaluate psychometrically the BOCS—assessing its internal consistency, factor structure, sensitivity and specificity in OCD versus autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD) and a mixed non-OCD group of adult psychiatric patients.

Material and methods
Patient characteristics
The main sample consisted of 402 psychiatric outpatients (range 18–82 years) recruited through a number of different clinical and non-clinical services in Sweden. Sample characteristics are shown in Table 1. The patients were divided into four diagnostic groups: 1) OCD, consisting of patients with a diagnosis of OCD, with or without psychiatric comorbidity; 2) ASD without a diagnosis of OCD but possibly with other types of psychiatric comorbidity; 3) ADHD without a diagnosis of OCD or ASD but possibly with other types of psychiatric comorbidity, and 4) a mixed psychiatric group without a diagnosis of a comorbid OCD, ASD or ADHD.

Ninety-four of these patients had a primary diagnosis of OCD. Information on patients' affiliation, diagnostic instrument used, year of enrolment and settings are shown in Table 2. All patients who completed the BOCS in a structured way were included.

Table 1. Patient characteristics.

Characteristic	OCD (n = 94)	ASD (n = 82)	ADHD (n = 157)	Mixed psychiatric group (n = 69)
Gender				
Men	39%	63%	52%	44%
Women	61%	37%	48%	57%
Age (years)				
Mean	35.1	30.2	32.2	34.3
Range	18–82	18–59	18–57	18–60
GAF				
Mean	52.2	46.5	53.1	49.9
Range	30–80	21–68	30–80	15–81

OCD, obsessive–compulsive disorder (with or without comorbidity); ASD, autism spectrum disorder without a diagnosis of OCD; ADHD, attention deficit/hyperactivity disorder without a diagnosis of OCD or ASD; GAF, Global Assessment of Functioning. The mixed psychiatric group has not been diagnosed with OCD, ASD or ADHD.

A subgroup consisting of 12 OCD outpatients was included from a cognitive behavioural therapy (CBT) treatment programme at a psychiatric outpatient unit in Stockholm. These patients were assessed with the NIMH-GOCS (National Institute of Mental Health Global Obsessive Compulsive Scale (27))—a single-item expert rating of the overall severity of obsessive–compulsive symptoms—in addition to self-assessment with BOCS prior to and post-treatment.

Patients with primary diagnoses of ADHD or ASD were recruited through consecutive referrals to St Göran hospital in Stockholm, or to the Gothenburg Neuropsychiatric Genetic Project. If the SCID I interview (28) implied the presence of any obsessions or compulsions the patient was further assessed with the BOCS.

The mixed psychiatric group consisted of patients with primary diagnoses of (non-OCD) anxiety disorders, tic disorders, depression, eating disorders and personality disorders. They were recruited through the specialized outpatient clinic at St Göran hospital, the Gothenburg Neuropsychiatric Genetic Project or through a research project on social anxiety disorder. The study was approved by the medical ethical review boards at each site.

All patients were interviewed face-to-face and diagnosed by a senior psychiatrist. Forty-two patients were diagnosed earlier, according to DSM-III-R (29), while the other patients were diagnosed according to DSM-IV (30), assessed through the Clinical Interview for DSM-IV—Axis I Disorders (SCID-I) (31) or a structured DSM-IV-based clinical interview. The gender ratio varied across the diagnostic groups, with a male predominance among patients with ASD, and more females in the OCD group (chi-square 11.96, df = 3, P = 0.008). Mean Global Assessment of Functioning (GAF) score (29, 30) was significantly lower in patients with ASD in

Table 2. Affiliation, recruitment, setting and diagnostic procedures in study participants.

Affiliation	n	With OCD	Recruitment	Year of BOCS assessment	Diagnostic procedure	Outpatient setting
Psychiatric clinic, Östermalm/Lidingö, Stockholm	12	12	Secondary referrals	1997–1999	Structured, DSM-III-R based clinical interview + clinical records	Regular outpatient unit for patients with non-psychotic psychiatric disorders
Anxiety disorder clinic, Danderyd Hospital, Stockholm	30	30	Secondary or tertiary referrals,	1997–1999	SCID-1 interview for DSM-III-R + clinical records	Specialized OCD outpatient centre
Psychiatric clinic, S:t Göran hospital, Stockholm	33	0	Advertisement in a local paper, self-referrals, secondary and tertiary referrals	2001	SCID-1 interview for DSM IV + clinical records	*Expert research setting for treatment of social phobia
Gothenburg neuropsychiatric genetic project	114	24	Self-referrals, secondary and tertiary referrals	2001–2003	SCID-1 interview for DSM IV	Expert diagnostic centre focused on neuropsychiatric assessments of childhood-onset disorders in adults
ASD/ADHD unit, St Göran hospital, Stockholm	196	11	Tertiary referrals	2001–2006	Structured, DSM-IV based clinical interview + DSM-IV symptom checklists + clinical records	Expert diagnostic and treatment outpatient centre for neuropsychiatric assessments of childhood-onset disorders in adults
Swedish OCD foundation members	17	17	Self-referrals from OCD summer camp	2010	Clinical assessment + clinical records	Psychiatric outpatient units

OCD, obsessive–compulsive disorder (with or without comorbidity); BOCS, Brief Obsessive–Compulsive Scale; SCID-I, Structured Clinical Interview for DSM IV—Axis I Disorders; ASD, autism spectrum disorders.
*Exclusively a research setting.

comparison with the other groups ($P \leq 0.05$ in a *post hoc* analysis).

Development of the symptom checklist
The symptom checklist of the self-report Y-BOCS and the CY-BOCS were combined into a 62-item checklist and divided into sections roughly in accordance with the 13 main pre-set symptom categories of the Y-BOCS (32). The order of the checklist items was rearranged so that an item related to a specific obsession was immediately followed by an item relating to the corresponding compulsion. For example, "I am concerned that I may contaminate others by spreading dirt or germs" was followed by "I wash my hands excessively or in a ritualized way in order to avoid contamination", with examples provided. Each checklist item was followed by a request to specify if each symptom was present "right now" (i.e. during the past week), "in the past" or "has never been present". Next, the given examples were rephrased into less personal, more casual formulations. To make the examples less personal "you" was replaced by "one". The type of obsession, e.g. whether it was the need for "the just right feeling" or a magical (i.e. superstitious) belief that preceded the ritual, was specifically

targeted in order to distinguish different justifications for the compulsion. This distinction is not accommodated by the Y-BOCS but is considered of great clinical relevance. This 62-item checklist was completed by 61 of the OCD patients.

The final symptom checklist items were selected to fulfil the following: if any of these 61 patients had endorsed only one item within a section, this item should be included. For those endorsing more than one item within a section, at least one of these items should be included. As within each section some items were much more often endorsed than others, it turned out that only one or two items per section were necessary in order to fulfil these requirements. Thus the remaining items were considered superfluous and excluded from the checklist. This "pruning" of the Y-BOCS/CY-BOCS symptom checklist resulted in 14 hierarchically superordinate and highly relevant items. In addition, one item reflecting self-harm (included in the Miscellaneous compulsions section of the Y-BOCS checklist) was added based on the clinical observation that patients with comorbid ASD, tic disorders and borderline personality disorder occasionally harm themselves in a compulsive or ritualized manner. This was considered clinically important to include.

In sum, 11 symptom areas—(A) contamination/cleanliness, (B) harming obsessions, (C) sexual obsessions, (D) checking, (E) religious/magical thoughts/superstition, (F) morality and justice, (G) symmetry/exactness/ordering, (H) just right/repeating rituals/counting, (I) hoarding and saving, (J) somatic obsessions and (K) self-harming behaviours—covered by 15 items, formed the BOCS symptom checklist. In addition, the respondent was invited to also add additional information if s/he had any other symptoms not included in the checklist as an addition to the list of the most troublesome symptoms.

The obsession and compulsion ratio and inter-rater reliability

The Y-BOCS provides sub-scores on obsessions and compulsions. In order to estimate the percentage of obsessive and compulsive symptoms respectively, the BOCS asks: "What is worse, your obsessions or your compulsions? If you separate your obsessions and your compulsions, what percent are the former and what the latter?" If this question was incomprehensible to the patient, an alternative version with a circle divided into eight sections was presented, followed by the question: "Obsessions and compulsions should together fill the circle. Please dash the sections that correspond to your compulsions/habits. The empty sections correspond to your obsessions/thoughts".

Sixty patients with OCD completed the BOCS and were interviewed with Y-BOCS in the same session. The aim was to investigate the inter-rater reliability between patient and expert ratings of the obsession and compulsion quotient. The order of the two scales was randomly administrated.

The severity scale

The BOCS severity scale includes six questions measuring the severity of the disorder. These questions are based on the Y-BOCS severity rating but have been reduced in number. While the Y-BOCS, CY-BOCS and the Y-BOCS-II have separate severity ratings for obsessions and compulsions, the BOCS severity rating refers to both obsessions and compulsions. Response options range from *none* to *extremely*, scored from 0 to 4, and thus identical to the original Y-BOCS and CY-BOCS scorings. The BOCS encompasses the revisions made in the Y-BOCS-II severity scale by including obsessive–compulsive free intervals, extent of avoidance and excluding the resistance items.

Scale scoring

For the purpose of psychometric testing, all scale scores were calculated as mean scores. The scores were first summed to a total score, and then divided by the number of items to which the patient had responded. If the patient had more than two missing responses, the mean score was set as a missing value.

Statistical analysis

Statistical calculations and analyses were performed with SPSS version 19. Data were summarized using standard descriptive methods, such as frequency, mean and standard deviation. The intercorrelation matrix was studied through principal component analysis (Oblimin rotation). Five factors were extracted (adjusted for low (< 0.35) communalities). For calculations of sensitivity and specificity, cross-tables and the receiver operating characteristics (ROC) curves between diagnosis and score were established. Scores were then dichotomized using values as close to the median as possible. Internal consistencies were expressed as Cronbach's alphas and mean inter-item correlation coefficients. Correlations between total BOCS scale scores and age, GAF and NIMH-GOCS were expressed as non-parametric Kendall's rank correlation coefficients (τ). The correlation between the obsessions and compulsions in Y-BOCS and BOCS was expressed as Pearsons' product-moment correlation coefficient. Differences between diagnostic groups in age and GAF scores were analysed with one-way analysis and *post hoc* tests with Tukey's HSD test. Differences between diagnostic groups in item scores were analysed with a non-parametric Kruskal–Wallis test also corrected for multiple testing. The significance level in all analyses was set at 5% (two-tailed). Since most of the analyses had an implicit directed hypothesis this is, in fact, mostly equivalent to a significance level of 2.5%.

Results

The symptom checklist

ENDORSEMENT

Frequencies of endorsement of the BOCS symptom checklist items are presented in Table 3. Eight items (listed from highest to lowest endorsement: 6, 1, 2, 11, 12, 10, 3, 5) significantly distinguished the OCD patients from all the other diagnostic groups. However, for five items (4, 7, 14, 15, 16), no significant differences were found between the diagnostic groups.

FACTOR STRUCTURE

All the variables were entered in a principal component analysis. The first analysis of the symptom checklist items identified four components. The communalities and correlations of six items were however, very low. Therefore, a second analysis was performed with five extracted components with acceptable levels of the communalities (Table 4). The components were

Table 3. Frequency of endorsement of Brief Obsessive–Compulsive Scale (BOCS) Symptom Checklist items in psychiatric patients.

Item	OCD, $n = 94$	ASD, $n = 82$	ADHD, $n = 157$	Mixed psychiatric group, $n = 66$	P	*Post hoc* test
1. I am worried about dirt, germs, virus	52%	26%	17%	14%	<0.001	OCD> All
2. I wash my hands very often or in a special way to be sure I am not dirty or contaminated	47%	12%	10%	12%	<0.001	OCD> All
3. I fear that my actions might harm others	35%	13%	12%	8%	<0.001	OCD> All
4. I fear I will lose control and do something I don't want to do	26%	15%	18%	11%	0.083	N/A
5. I have unpleasant forbidden or perverse sexual thoughts, images or impulses that frighten me	18%	2%	11%	5%	0.002	OCD> ASD, Mixed
6. I must check the stove or other electrical appliances, that I have locked the door or make sure that things have not disappeared	62%	24%	24%	33%	<0.001	OCD> All
7. My dirty words, thoughts and curses directed towards God bothers me; I have a fear of offending God	16%	10%	8%	11%	0.224	N/A
8. In order to prevent something terrible to happen I must have special thoughts or acts done in a special way	22%	7%	10%	9%	0.006	OCD> All
9. I am occupied with morality issues, justice or what is right or wrong	32%	17%	18%	15%	0.019	OCD> Mixed
10. How things are placed or how they are positioned is important to me. It needs to feel 'just right' (but isn't associated with magical thinking)	40%	22%	16%	21%	<0.001	OCD> All
11. I get a compelling urge to put my things in a special order	46%	20%	11%	26%	<0.001	OCD> All
12. I have a compelling urge to repeat certain actions until it feels just right	46%	18%	11%	15%	<0.001	OCD> All
14. I must follow strong impulses to collect and hoard things	28%	21%	18%	15%	0.186	N/A
15. I have worries that I look peculiar; I am concerned that something is wrong with my looks	23%	13%	23%	20%	0.309	N/A
16. I do things that injure my body	14%	10%	15%	9%	0.558	N/A

N/A, no significant difference, *post hoc*-test not conducted; OCD, obsessive–compulsive disorder; ASD, autism spectrum disorder; ADHD, attention deficit/hyperactivity disorder.

denoted: (I) "Symmetry", (II) "Forbidden thoughts", (III) "Contamination", (IV) "Magical thoughts" and (V) "Dysmorphic thoughts". Based on the factor structure subscales were established. In Fig. 1, the mean scores of the subscales are presented for the four diagnostic groups. The OCD group had the highest score on all subscales compared with all other groups. The largest difference was found for the Contamination subscale [$F(3,398) = 26,25$, $P < 0.001$]. A Tukey test revealed significant differences between the OCD population in comparison with the other diagnostic groups on most subscales. The exception was the Magical thoughts subscale, where the OCD group did not differ significantly from the mixed psychiatric group.

INTERNAL CONSISTENCY

The internal consistency of the total symptom checklist (Table 4) was good (>0.80); however, this was lower for the subscales. Three of the subscales had Cronbach's alphas close to 0.70 and mean inter-item correlations ranging from 0.31 to 0.52. The mean inter-item correlation for the total symptom checklist was 0.22.

SENSITIVITY AND SPECIFICITY

Sensitivity and specificity for OCD diagnosis for the symptom checklist was calculated. The cut-off score was set to 0.15 representing a mean endorsement of 15% of the items; this divided the total sample into two equally sized groups (55% below and 45% above the cut-off). The sensitivity was very high with 85% of the OCD patients being correctly identified. The specificity was somewhat lower; 62% of the patients with ASD, 69% of the ADHD patients, and 70% of the patients with other various diagnoses were correctly identified as not having an OCD diagnosis. A ROC curve of the BOCS checklist yielded an area under the curve (AUC) of 0.79 and 0.80 for the BOCS severity scale (Fig. 2).

OBSESSION AND COMPULSION RATIO AND INTER-RATER RELIABILITY

The distribution of self-rated obsessions vs. compulsions did not differ significantly between the OCD group and the other diagnostic group combined ($P = 0.27$). Among the OCD group, obsessions and compulsions were equally common (50%:50%), whereas in the other diagnostic groups, obsessions were slightly more common than compulsions (56%:44%). The distribution between obsessions and compulsions in the Y-BOCS subscales was highly correlated with the distribution between self-rated obsessions and compulsions in the BOCS ($r = 0.67$, $P < 0.001$). The administration order of the two measures had no significant effect on the results.

Table 4. Factor loadings of BOCS Symptom Checklist items.

Item no.	Item	Component					
		Symmetry I	Forbidden thoughts II	Contamination III	Magical thoughts IV	Dysmorphic thoughts V	h^2
10	How things are placed or how they are positioned is important to me. It needs to feel "just right" (but isn't associated with magical thinking).	**0.84**	0.23	0.20	0.22	0.13	0.71
11	I get a compelling urge to put my things in a special order.	**0.84**	0.11	0.27	0.29	0.12	0.74
12	I have a compelling urge to repeat certain actions until it feels just right.	**0.54**	0.23	0.37	0.47	− 0.20	0.47
14	I must follow strong impulses to collect and hoard things.	**0.51**	0.34	− 0.05	0.09	0.04	0.38
9	I am occupied with morality issues, justice or what is right or wrong.	**0.51**	*0.42*	0.15	*0.36*	0.04	0.29
4	I fear I will lose control and do something I don't want to do.	0.31	**0.82**	0.17	0.21	0.11	0.71
3	I fear that my actions might harm others.	0.24	**0.70**	0.28	0.15	0.18	0.56
5	I have unpleasant forbidden or perverse sexual thoughts, images or impulses that frighten me.	0.29	**0.62**	0.07	*0.38*	− 0.40	0.59
16	I do things that injure my body.	0.14	**0.55**	0.17	0.15	0.17	0.75
2	I wash my hands very often or in a special way to be sure I am not dirty or contaminated.	0.20	0.20	**0.86**	0.17	0.11	0.72
1	I am worried about dirt, germs and virus.	0.19	0.28	**0.83**	0.26	− 0.01	0.65
7	My dirty words, thoughts and curses directed towards God bothers me; I have a fear of offending God.	0.20	0.23	0.19	**0.81**	0.20	0.68
8	In order to prevent something terrible to happen I must have special thoughts or acts done in a special way.	0.24	0.15	0.19	**0.80**	− 0.05	0.71
15	I have worries that I look peculiar; I am concerned that something is wrong with my looks.	0.26	*0.36*	0.06	*0.35*	**0.73**	0.49
6	I must check the stove or other electrical appliances, that I have locked the door or make sure that things have not disappeared.	*0.46*	*0.37*	0.31	0.20	**0.50**	0.34
	Proportion of explained variance	0.26	0.10	0.09	0.08	0.07	0.60*
	Cronbach's alpha	0.70	0.65	0.69	0.57	0.42	0.81†

Highest factor loadings are in bold and all secondary factor loadings 0.35 or above in italics.
h^2, communality, i.e. the proportion of variance of a single item that is explained by the factor solution. Cronbach's alpha is presented for the subscales based on the items with the highest loading for each factor.
*Total proportion of explained variance; †Cronbach's alpha of total scale.

The BOCS severity scale
Means and standard deviations for the six items measuring severity are presented in Table 5. Patients were asked to complete these items only if s/he endorsed any of the symptom checklist items. If they had not, the score of these items were set to zero ("0"). Also, some patients refrained from completing this section even though they had scored on the symptom checklist items. For those reasons, the total number of people in this analysis was different from that in Table 3. As can be seen in Table 5, the OCD patients scored significantly higher on each item in the severity scale. The factor analysis performed yielded a single factor. The internal consistency of the severity scale was, thus, very high (Cronbach's alpha = 0.94 and the mean inter-item correlation was 0.73). The mean cut-off score was 1.50, and divided the sample into two groups of severity (low = 65% vs. high = 35%, $n = 354$). Seventy-two per cent of the OCD patients were correctly identified, as were 75% of the ASD patients, 76% of the ADHD patients and 84% of the patients with mixed psychiatric disorders.

Correlations between the BOCS and the global assessment of functioning
There were modest negative correlations between the mean number of endorsed items in the symptom checklist and the mean of the severity scale, and GAF ($r_{xy} = − 0.17$, $P = 0.004$ and $r_{xy} = − 0.28$, $P < 0.001$, respectively) indicating that higher scores on the symptom checklist and severity scale were associated with lower level of global functioning.

Sensitivity to change
The self-rated BOCS severity rating before and after CBT treatment, strongly and positively correlated with
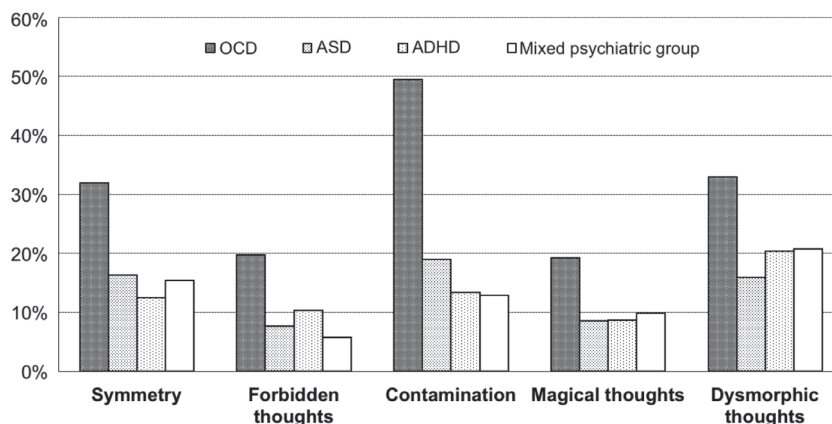
Fig. 1. Proportion of endorsed items in four samples of patients with psychiatric diagnoses. BOCS, The Brief Obsessive–Compulsive Scale; OCD, obsessive–compulsive disorder; ASD, autism spectrum disorder; ADHD, attention deficit/hyperactivity disorder.

clinician NIMH-GOCS ratings before and after treatment ($\tau = 0.93$, $P < 0.001$, $n = 12$).

Discussion

This paper has presented the BOCS, a shortened and modified self-administered version of the Y-BOCS and CY-BOCS, consisting of a 15-item checklist and a six-item severity scale (Please find this material with the following direct link to the article: http://informa healthcare.com/doi/abs/10.3109/08039488.2014.884631) Since its introduction in Sweden more than a decade ago, it has been widely used in assessment of OCD, which illustrate its face validity. The current study provides strong support for the utility of the BOCS in the assessment of OCD in adults.

Psychometric properties

The BOCS symptom checklist showed good to excellent psychometric properties, with a high sensitivity (85%) and specificity (67%), especially considering that the comparison group consisted of cohorts of psychiatric patients and not of healthy controls. The mean inter-item correlations describe how different items are related to one another. Ideally, they should fall between 0.15 and 0.50. A mean inter-item correlation of 0.22 was obtained for the total BOCS symptom checklist, and fell between 0.31 and 0.52 for the separate subscales. This is a strong indication that the BOCS subscales indeed measure different properties, related to but nevertheless different from one another. Also, sensitivity and specificity of the six items in the BOCS severity scale, performed well in discriminating OCD from other psychiatric diagnoses.

Clinical usefulness

Together, the findings indicate that BOCS can successfully identify individuals who are likely to match the diagnostic criteria for OCD. As expected, some psychiatric patients without an OCD diagnosis have obsessions and/or compulsions. This was especially common among patients with ASD, in which ritualistic behaviours and hoarding is often part of the clinical profile (33). However, the OCD patients showed BOCS scores almost twice as high as that of the ASD patients (Table 5). In addition, the obsessive–compulsive characteristics that are typically to be expected in patients with ASD were most frequent in component I denoted "Symmetry". In the study, we chose to categorize ASD patients with a comorbid OCD as "OCD", and this may have attenuated loading on component I (Fig. 1).

The subscale structure of the BOCS

The five components that were extracted by the factor analysis of the symptom checklist bear clinical relevance for OCD and cover some of the symptomatology described as the broader OCD phenotype. Component I includes items that regard symmetry, ordering and "just right" (items 10–12) that are common in tic disorders and ASD (34, 35). Preoccupation with morality and justice (item 9), and collecting and hoarding (item 14) characterize both obsessive–compulsive personality disorder and ASD but could also be expected to be rather common in the general population. We expect, this is the reason those items showed a low communality. Aggressive and sexual obsessions (i.e. items 3, 4, 5) and self-harm (item 16) showed a high loading (> 0.5) in component II. Both skin-picking and hair-pulling, included in the new category of obsessive–compulsive related disorders in DSM-5, could be endorsed as self-harming behaviours. As expected, washing and fear of germs (items 1 and 2 in component III) most convincingly discriminated the OCD group from other psychiatric patients, mainly because these symptoms are highly specific for OCD. Magical and religious obsessions constitute component IV, the singular component that did not discriminate OCD from other psychiatric disorders. Although magical thinking is very common among
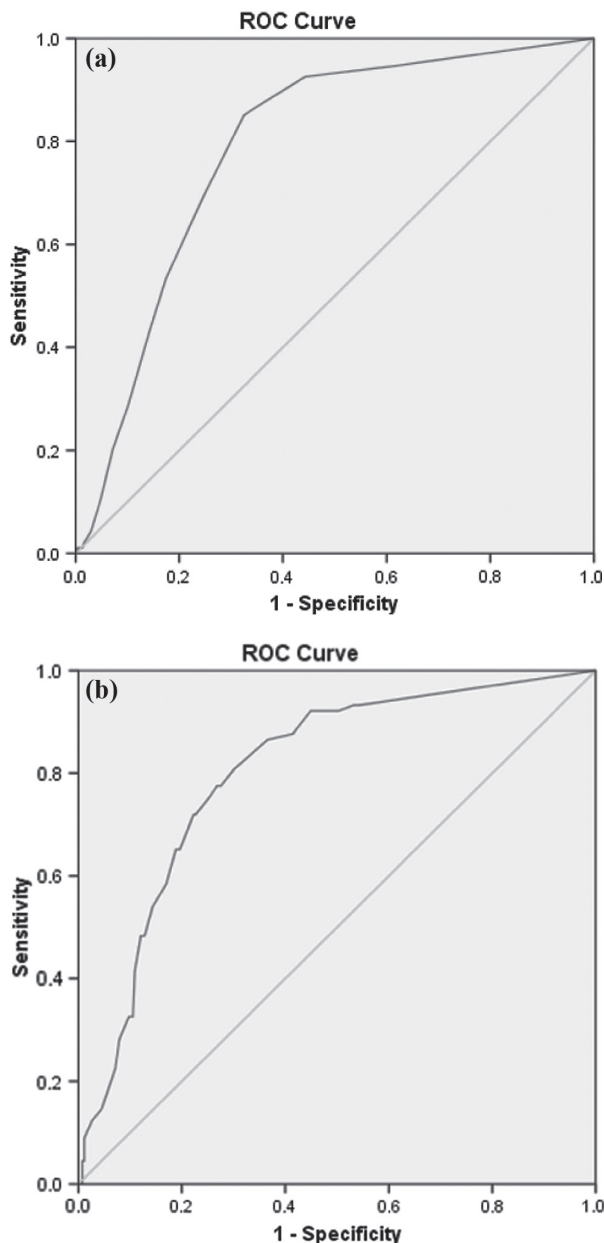
ROC Curve

(a)

ROC Curve

(b)

Fig. 2. (a) Receiver operating characteristics (ROC) curve for the Brief Obsessive–Compulsive Scale (BOCS) symptom checklist; (b) ROC curves for the BOCS severity scale.

people in general, it rarely becomes problematic. However, because people with OCD often are unable to trust their own senses, they are susceptible to superstitious beliefs and magical rituals for reassurance. For this reason item 13, the unlucky number, is absent in the BOCS checklist.

The two items in component V, checking electrical appliances (item 6) and worries about one's appearance (item 15), showed a lower internal consistency than the other factors. This could be attributed to the unspecific nature of these symptoms; apparently, they are very common in the general population (36).

Similarities and differences in the factor analysis of Y-BOCS, CY-BOCS and BOCS

A large meta-analysis published by Bloch and co-workers on the Y-BOCS and CY-BOCS symptom checklists based on the 13 main pre-set symptom categories resulted in a four-factor solution (32). The four symptom dimensions identified were (1) Symmetry: obsessions and repeating, ordering and counting compulsions; (2) Forbidden thoughts: aggression, sexual and religious obsessions and checking compulsions; (3) Cleaning: cleaning and contamination, and (4) Hoarding: hoarding obsessions and compulsions. Our findings were slightly different, presumably because we included patients with ASD, ADHD and other psychiatric disorders, whereas Bloch restricted his selection to studies on OCD patients only. Nevertheless, the BOCS is constructed of five factors recognised as representing discrete variants of OCD. Specifically: the BOCS-component I "Symmetry" corresponds to the collapsed dimensions "Symmetry" and "Hoarding" in Y-BOCS and CY-BOCS. Noteworthy, a forced three-factor solution of CY-BOCS and Y-BOCS lumped hoarding and symmetry/ordering together, indicating that these are closely linked. Similarly, when the Y-BOCS checklist symptoms were classified into categories as either being "absent", "present" or "prominent", hoarding and symmetry/ordering loaded into a common factor (32). The component II "Forbidden thoughts" corresponded roughly to the second factor in the Y-BOCS, although the BOCS, in contrast to the Y-BOCS and CY-BOCS, categorize religious and somatic obsessions into other components. However, the relationship between aggressive, sexual, religious and somatic obsessive–compulsive symptom dimensions in the Y-BOCS and CY-BOCS is unclear and further investigation on singular item level has been recommended (32). While the BOCS component III "Contamination" is identical to the Y-BOCS and CY-BOCS contamination dimension, the fourth component (IV) "Magical thoughts" constitutes a major difference. This component consists of a superstitious and a religious item both showing a high loading on the factor. Presumably, the emergence of this "new factor" is attributed to the fact that the BOCS specifically distinguishes between compulsions performed due to the need for "the just right feeling" or those performed due to magical thinking. Finally component V "Dysmorphic thoughts", includes items regarding worry about own appearance and checking compulsions. The corresponding items (somatic obsession and checking) were problematic in the meta-analysis of the Y-BOCS and the CY-BOCS by showing divergent loading patterns between the two instruments; moreover, the checking compulsion items were associated with almost all factors in the Y-BOCS and the CY-BOCS (32). In addition, when a five-factor solution was forced, checking and somatic obsessions were separated out as a fifth

Table 5. Mean and standard deviation of Severity Scale items and total score for psychiatric patients diagnosed with obsessive–compulsive disorder (OCD), autism spectrum disorders (ASD), attention deficit/hyperactivity disorder (ADHD) and the mixed psychiatric group.

The patient is asked to respond according to the situation during the last seven days Item/Scale	OCD, $n = 89$		ASD, $n = 76$		ADHD, $n = 133$		Mixed psychiatric group, $n = 57$		P	Post hoc
	Mean	s	Mean	s	Mean	s	Mean	s		
1. Approximately, how much of your time is occupied by obsessive–compulsive problems	2.5	2.45	1.1	1.35	1.2	3.92	0.8	1.03	< 0.001	OCD > All
2. On the average, what is the longest amount of consecutive waking hours per day that you are completely free of obsessive–compulsive problems?	2.5	1.30	1.1	1.24	0.8	1.22	0.8	1.13	< 0.001	OCD > All
3. How much do your obsessive–compulsive problems interfere with your everyday life, work or school, or social functioning?	1.8	1.12	0.7	1.08	0.6	1.03	0.6	1.05	< 0.001	OCD > All
4. How much distress do your obsessive–compulsive problems cause you?	2.2	1.13	1.0	1.13	0.9	1.21	0.9	1.06	< 0.001	OCD > All
5. How much control do you have over your obsessive–compulsive problems? How successful are you in stopping or diverting them? If you rarely try to resist, please think about those rare occasions on which you did try.	2.1	1.12	1.2	1.35	0.9	1.18	0.9	1.05	< 0.001	OCD > All
6. Have you been avoiding doing anything, going anyplace or being with anyone in order to avoid your obsessive–compulsive problems?	1.6	1.28	0.7	1.18	0.5	0.94	0.5	1.03	< 0.001	OCD > All
BOCS total score	2.1	1.00	0.9	1.08	0.8	1.02	0.8	0.98	< 0.001	OCD > All

s, standard deviation; BOCS, The Brief Obsessive–Compulsive Scale.

factor (32) identical to the BOCS component Dysmorphic thoughts.

Limitations

This study has limitations that should be addressed. Firstly, the patients were assessed with different DSM criteria because some patients were diagnosed before 1994 and not re-diagnosed at the introduction of the DSM-IV. However, the diagnostic criteria for OCD are almost identical in the DSM-III-R compared with the DSM-IV, thus they are widely viewed as interchangeable (37), which also applies to the corresponding DSM-5 criteria. However, hoarding is now categorized as a separate diagnosis, similar to dysmorphic obsessions in body dysmorphic disorder. The two corresponding BOCS items, in addition to the self-harm item, can be helpful in identifying disorders within the new category of obsessive–compulsive related disorders in the DSM-5, thus suggesting an extended utility for the BOCS.

Although each patient was diagnosed through a structured interview lasting for several hours, the SCID-I Interview was not completed for all patients. However, the gestalt of OCD is remarkably consistent, irrespective of diagnostic instrument. Almost all OCD patients have a history of typical washing, checking and/or repeating compulsions. Accordingly, it seems reasonable to combine patients from various clinical settings.

Data on the number of OCD patients that had received successful treatment was unfortunately not available in this study. Some of the patients in the OCD group were treated and therefore may score lower on the BOCS than prior to treatment. Thus, the sensitivity of the BOCS in treatment-naïve OCD patients is presumably higher than reported here.

Unfortunately, only a small sample of 12 OCD patients was followed while receiving CBT treatment. Nevertheless, the trial illustrated that the expert assessment and the patient rated BOCS reached high agreement, indicating that BOCS was indeed sensitive to change.

Conclusions

In clinical practice, time for assessing OCD symptoms in detail is rarely available, and co-existence of signs and symptoms from different diagnostic categories is extensive among psychiatric patients. Self-rating scales must be brief but still provide comprehensive information, be valid and user-friendly, reliable, flexible and free of charge (38). Hopefully, future studies will confirm that the BOCS encompasses all these qualities and affirm its validity amongst other populations.

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