Dimensional structure of the Yale–Brown Obsessive-Compulsive Scale (Y-BOCS)

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Abstract

The Yale–Brown Obsessive-Compulsive Scale (Y-BOCS) is a widely used instrument to assess obsessive–compulsive symptomatology. The present study provides evidence that the Y-BOCS is best represented by a three-dimensional model comprising *severity of obsessions* (factor 1), *severity of compulsions* (factor 2) and *resistance to symptoms* (factor 3). On the basis of exploratory factor analysis, this structure was found for both baseline ($n = 109$) and discharge ratings ($n = 68$) following a multimodal cognitive–behavioral intervention. The factor solution remained essentially unchanged when two optional items (items 1b and 6b) were dropped from analysis. The three-factor structure was replicated with confirmatory factor analysis and showed better fit than previously proposed single- and two-factor models. For future research, we propose a new Y-BOCS scoring algorithm that takes this factor structure into account. A further result was that resistance significantly declined in response to cognitive–behavioral intervention, whereas drug treatment alone did not seem to moderate this variable according to previous research conducted by Kim et al. [*Psychiatry Research* 51 (1994) 203–211]. © 2002 Elsevier Science Ireland Ltd. All rights reserved.

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1. Introduction

Since its introduction in 1989, the Yale–Brown Obsessive-Compulsive Scale (Y-BOCS; Goodman et al., 1989a,b) has been increasingly utilised in both drug trials and cognitive–behavioral studies (e.g. Hohagen et al., 1998). The Y-BOCS is consensually acknowledged as being the gold standard for rating obsessive–compulsive symptomatology. It is a clinician-administered semi-structured interview that contains 16 core items scored on a five-step Likert scale (0–4, higher scores indicate greater disturbance). The total score is computed from the first 10 items (without items 1b and 6b). While items 1 to 5 represent obsession-related dysfunctions, items 6 to 10 measure disturbances associated with compulsions. The remaining items were originally introduced for exploratory purposes. These tap features that are

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not disease-specific but do give valuable information for both differential diagnosis (especially insight) and treatment (e.g. avoidance). In addition to its excellent psychometric properties (see Frost et al., 1995; Goodman et al., 1989a,b) other advantages of the Y-BOCS relative to other scales are that it quantifies the severity of obsessive–compulsive symptomatology and that it thoroughly taps major obsessions and compulsions on a checklist, thus providing further important qualitative information.

However, although its status in both clinical trials and research is undisputed, several issues have yet remained unresolved. First, the psychometric properties of two items later incorporated into the scale have not yet been thoroughly examined. These two items (items 1b and 6b) assess the longest number of consecutive hours per day that are completely free of obsessions and compulsions in the past week. Another major question concerns the factorial structure of the Y-BOCS. Despite its face-validity, the subscale composition proposed by Goodman et al. (1989a) (sumscore of items 1–5: severity of obsessions; sumscore of items 6–10: severity of compulsions) has not been consensually confirmed by subsequent research. A clarification of the factorial structure of the Y-BOCS is essential, however. If the subscore algorithm proposed by Goodman et al. does not reflect the structure of the Y-BOCS adequately, this may explain why correlations between variables reflecting the pathogenesis of obsessive–compulsive disorder (OCD) and Y-BOCS subscores have usually failed to achieve significance (see, for example, Moritz et al., 2001a,b). In particular, the allocation of items 4 and 9 (resistance to obsessions/compulsions) is subject to controversy.

Factor analyses of the Y-BOCS have shown inconsistent solutions with models ranging from one to three factors. In a first study by Fals-Stewart (1992) only one factor emerged with all 16 items loading at least 0.45 on this single dimension. However, this solution has been criticised because it included the six additional Y-BOCS items not considered for the total score. This may have obscured other solutions (Amir et al., 1997).

Kim et al. (1994) collected Y-BOCS scores from OCD patients who entered a multicenter drug treatment study. Exploratory factor analysis revealed a three-factor solution. Items 1–3 and 5 predominantly loaded on the first factor (severity of obsessions). Items 6–8 and 10 loaded on factor 2 (severity of compulsions). Items 4 and 9 (resistance of symptoms) strongly loaded on the third factor. However, items 5 and 10 (control over obsessions/compulsions) also loaded on factor 3. This finding might suggest that the ability to control symptoms is a joint function of the ability to resist the execution of compulsions/the emergence of obsessions and/or the extent to which obsessions and compulsions are present. The factor solution was similar for patients who were treated with either drug or placebo, regardless of whether baseline or end-point data were considered. Factor scores for the resistance factor did not decline in either the drug treatment or placebo group while factor scores from the obsessions and compulsions factors significantly decreased in at least the drug group. This highlights the need to consider resistance as a separate dimension. Subsequent factor-analytic studies using a confirmatory approach, however, have not taken into account the three-factor solution of Kim et al. (1994).

McKay et al. (1995) tested a single-factor model, a two-factor model (*obsessions* vs. *compulsions*) and the same two-factor model with a higher order factor in a sample of 83 OCD patients. The simple two-dimensional model showed the best fit in a confirmatory factor analysis. However, the authors acknowledge that resistance to obsessions did not significantly load on factor 1 (*obsessions*) and resistance to compulsions yielded the least loading of all compulsion items on factor 2 (*compulsions*).

Amir et al. (1997) tested the single-factor and two different two-factor models with a confirmatory factor analysis approach. They divided their initial sample of 404 OCD patients into two equal-sized samples for the purpose of validation. Although the authors interpret their findings in favour of a two-factor model comprising a *disturbance* (items 2, 3, 7 and 8) and a *symptom severity* factor (1, 4, 5, 6, 9 and 10), some items only showed poor to modest fit for this solution.

A further confirmatory factor-analytic study by McKay et al. (1998) on a sample of 146 OCD patients compared different factorial models of the Y-BOCS. Adequate fit indices were found for their initial model (McKay et al., 1995). The solution suggested by Amir et al. (1997) also showed reasonable fit. The authors emphasised that resistance to obsessions again loaded poorly in both models.

To summarise, previous studies on the factor structure of the Y-BOCS have produced inconsistent results: a single-factor solution (Fals-Stewart, 1992), a two-factor model with disturbance and symptom severity (Amir et al., 1997), a two-factor model with severity of obsessions vs. compulsions (McKay et al., 1995), and a three-factor model with an additional resistance factor (Kim et al., 1994).

The current study pursues four major aims. First, Y-BOCS items are factor-analysed using an exploratory approach. Factor models are determined for a group of OCD patients before and after therapy, thus allowing one to assess the generalisability of the solutions. Second, psychometric properties of two additional Y-BOCS items (1b and 6b) are presented for the first time. Third, sensitivity to change is tested for the exploratory factor structure. Finally, competing factorial models are tested using confirmatory factor analysis.

2. Methods

2.1. Subjects

One hundred and nine subjects fulfilling ICD-10 criteria for obsessive–compulsive disorder were interviewed with the Yale–Brown Obsessive-Compulsive Scale (Y-BOCS; authorised German version by Hand and Büttner-Westphal, 1991) and the Hamilton Depression Rating Scale (17 items) prior to undergoing multimodal cognitive–behavioral treatment (see Hand, 1998). All subjects were inpatients at the university hospital of Hamburg (Germany) and gave informed consent to participate. A diagnosis of OCD was determined by an experienced clinician. Medical records were screened for symptoms incompatible with a diagnosis of OCD. Sixty-eight of these patients were

available for a second interview prior to discharge. Thirty patients did not receive any medication in this time. Ratings were performed by experienced and trained psychologists who were not involved in patients' treatment. Patients main characteristics were as follows: 51 male (46.8%), 58 female (53.2%); age: 33.2 years (S.D.: 9.9); length of illness: 11.0 years (S.D.: 8.6); school: 11.4 years (S.D.: 2.7); psychiatric hospitalisations: 1.7 (S.D.: 1.5). The Hamilton Depression Rating Scale score was 10.7 (S.D.: 7.1). The Y-BOCS total score was 23.5 (S.D.: 6.4; items 1–10 without 1b and 6b).

3. Results

3.1. Exploratory factor analysis

Factor analyses were performed for baseline and discharge assessment separately. Since items 1b and 6b have rarely been used in previous research, these two items were skipped in a second step to explore if a different loading pattern emerged. Four different factor analyses were conducted: baseline and discharge scores each with the simple and the extended item set (i.e. with/without 1b and 6b). Y-BOCS scores 1 to 10 were entered in a principal component analysis with varimax rotation. Factor extraction was terminated if a factor did not exhibit eigenvalues >1 (Kaiser–Guttman criterion). Factor scores were saved and later correlated with socio-demographic and psycho-pathological indices. The Keyser–Meyer–Olkin measure of sampling adequacy revealed a score of at least 0.72 for each solution, which indicates that the variables entered were adequate for factor analysis (Kaiser, 1974). Bartlett's test of non-sphericity was highly significant for all four analyses ($\chi^2 \geq 370$; $P < 0.001$).

The factor structures are presented in Table 1. Three factors with eigenvalues >1 emerged in all analyses. Loading patterns for baseline and discharge scores were almost identical. Whereas the three-factor model extracted for the baseline assessment explained 66% of the total variance (factor 1: 25.5%; factor 2: 25.3%, factor 3: 15.1%), 71% of the total variance was explained for the discharge assessment (factor 1: 32.2%, factor 2: 25.2%, factor 3: 13.7%). Items 1, 1b, 2,

Table 1
Item loadings on the three varimax-rotated dimensions (loadings ≥ 0.5 are set in bold type)

Item #	Baseline 12 items Factor			Discharge 12 items Factor			Baseline 10 items Factor			Discharge 10 items Factor		
	1	2	3	1	2	3	1	2	3	1	2	3
1 Time on obsessions	**0.83**	0.10	−0.06	**0.85**	0.15	0.08	**0.81**	0.10	−0.05	**0.85**	0.14	0.07
1b Obsession-free interval	**0.77**	0.08	0.10	**0.81**	0.16	−0.03	–	–	–	–	–	–
2 Interference from obsessions	**0.76**	0.24	−0.05	**0.76**	0.29	0.11	**0.81**	0.21	−0.02	**0.81**	0.24	0.08
3 Distress from obsessions	**0.80**	0.17	0.00	**0.81**	0.31	0.08	**0.84**	0.12	0.03	**0.84**	0.29	0.04
4 Resistance to obsessions	0.26	0.00	**0.84**	0.31	0.06	**0.83**	0.25	−0.02	**0.86**	0.33	0.04	**0.82**
5 Control over obsessions	**0.54**	0.30	0.40	**0.71**	0.31	0.27	**0.56**	0.30	0.41	**0.77**	0.32	0.21
6 Time on compulsions	0.18	**0.83**	0.01	0.39	**0.64**	0.28	0.21	**0.80**	0.01	0.41	**0.60**	0.30
6b Compulsion-free interval	0.21	**0.75**	0.12	**0.50**	**0.55**	0.07	–	–	–	–	–	–
7 Interference from compulsions	0.21	**0.79**	0.08	0.38	**0.78**	0.05	0.27	**0.79**	0.09	0.41	**0.76**	0.06
8 Distress from compulsions	0.14	**0.74**	0.13	0.31	**0.77**	0.05	0.14	**0.76**	0.11	0.33	**0.79**	0.04
9 Resistance to compulsions	−0.22	0.23	**0.79**	−0.08	0.26	**0.84**	−0.26	0.24	**0.78**	−0.08	0.27	**0.85**
10 Control over compulsions	−0.10	**0.62**	**0.52**	0.01	**0.85**	0.27	−0.07	**0.67**	**0.50**	0.06	**0.86**	0.25

3 and 5 most strongly loaded on factor 1 (*severity of obsessions*) and items 6, 6b, 7, 8 and 10 heavily loaded on factor 2 (*severity of compulsions*). Items 4 and 9 strongly loaded on factor 3 (*resistance to symptoms*). Commonalities were at least 0.53. When items 1b and 6b were dropped from analyses, the factor structure remained almost unchanged (see Table 1; baseline: 68.9% of total variance explained; discharge: 74.8% of total variance explained).

3.2. Correlations with socio-demographic and psychopathological variables

Pre-morbid intelligence, sex (treated as a continuous variable), age and education did not correlate significantly with any of the three-factor scores at baseline. However, length of illness and number of psychiatric admissions correlated significantly with factor 2 (*severity of compulsions*; $r=0.19$, $r=0.21$; $P \leq 0.05$ for both correlations) but not with factor 1 (*severity of obsessions*) or 3 (*resistance to symptoms*). Factor 1 was correlated with Hamilton Depression Rating Scale scores ($r=0.49$, $P \leq 0.001$).

3.3. Psychometric analyses

The Y-BOCS showed good internal consistency both with (Cronbach's alpha, baseline: 0.83, dis-

charge: 0.90) and without items 1b and 6b (baseline: 0.79, discharge: 0.88). As expected, item 1b correlated highest with item 1 (baseline: $r=0.62$, discharge: $r=0.67$) and item 6b with item 6 (baseline: $r=0.66$, discharge: $r=0.62$). However, both items still provided substantial non-redundant information (less than 45% of total variance explained). Item 1b (baseline: $r=0.46$, discharge: $r=0.56$) and item 6b (baseline: $r=0.39$, discharge: $r=0.64$) modestly correlated with the total score.

Cronbach's alpha for the obsessions and compulsions subscores based on the initial algorithm by Goodman et al. (1989a) were both 0.76 and rose to 0.80 when items 4 and 9 were deleted in each subscale. On the other hand, the deletion of any other items was accompanied by a large decrease of homogeneity (below 0.72).

3.4. Baseline vs. discharge scores

On the basis of the factor-analytic results, new syndrome algorithms were composed (*severity of obsessions*: items 1, 1b, 2, 3; *severity of compulsions*: items 6, 6b, 7, 8; *resistance*: items 4, 9). Items 5 and 10 were excluded from subscale composition because their loading patterns were less consistent. Significant decreases (i.e. symptomatic improvement) were evident for all dimensions: *severity of obsessions*, mean baseline =

Table 2
Summary of Y-BOCS confirmatory factor analyses

Model	χ^2	d.f.	P	GFI	AGFI	NFI	CFI	RMSEA
Single-factor	173.14	30	<0.001	0.72	0.48	0.60	0.63	0.21
Two-factor (Amir et al.)	172.74	29	<0.001	0.72	0.47	0.60	0.63	0.21
Two-factor (McKay et al.)	67.96	29	<0.001	0.89	0.79	0.84	0.90	0.11
Three-factor (Kim et al.)	36.40	25	0.07	0.94	0.87	0.92	0.97	0.06

Abbreviations: GFI, goodness of fit; AGFI, adjusted goodness of fit; NFI, Normed Fit Index; CFI, Comparative Fit Index; RMSEA, root mean square error of approximation.

10.30 (S.D. = 3.66), mean discharge = 7.85 (S.D. = 3.75); $t(66) = 6.95$; $P < 0.001$; *severity of compulsions*, mean baseline = 10.01 (S.D. = 3.39), mean discharge = 7.34 (S.D. = 3.42); $t(67) = 7.99$; $P < 0.001$; *resistance*, mean baseline = 3.87 (S.D. = 1.88), mean discharge = 2.19 (S.D. = 1.73); $t(67) = 7.42$; $P < 0.001$. For 30 unmedicated patients, similar results emerged ($P < 0.001$ for all analyses).

3.5. Confirmatory factor analysis

Despite the relatively small sample size ($n = 109$), we used confirmatory factor analysis to test the three-factor model against competing models. The analyses were computed with LISREL 8 (Joereskog and Soerbom, 1996). Four models were specified: (a) a single-factor model; (b) a two-factor model representing disturbance vs. symptom severity (Amir et al., 1997); (c) a two-factor model representing obsessions vs. compulsions (McKay et al., 1995, 1998); (d) the three-factor model emerging from exploratory analysis representing obsessions (items 1, 2, 3 and 5), compulsions (items 6, 7, 8, 10) and resistance against symptoms (items 4 and 9). Because our exploratory analyses as well as previous research (Kim et al., 1994) suggest that items 5 and 10 are related to resistance, these items were allocated to the resistance factor as well. In accordance with previous confirmatory factor analyses, only items 1 to 10 (without 1b and 6b) were used. Following McKay et al. (1995) the residuals of question pairs (i.e. time, interference, distress, resistance, control) were correlated for the single and the two-factor

models. For the three-factor model the residuals of the resistance and control items were correlated as well.

Standardized factor loadings for factor 1 were 0.75, 0.78, 0.78 and 0.46 for items 1, 2, 3 and 5, respectively. Loadings for factor 2 were 0.78, 0.78, 0.67 and 0.21 for items 5, 6, 7 and 10, respectively. Loadings for factor 3 were 0.30, 0.41, 0.54 and 0.75 for items 4, 5, 9 and 10, respectively. A summary of the fit indices of all models is presented in Table 2. The single factor model and the two-factor solution proposed by Amir et al. (1997) had an inadequate fit. Indices for GFI, AGFI, NFI and CFI were below 0.90, which is usually used as a cut-off for accepting a model. RMSEA, which is relatively robust to sample size, was above 0.08 indicating a poor fit. In addition, the χ^2-test was highly significant. While the two-factor model proposed by McKay et al. (1995) had a slightly better fit, only the three-factor model fit the data adequately well (see Table 2).

4. Discussion

The present factor analysis of the Y-BOCS yields a three-factor solution, thus replicating previous results from Kim et al. (1994). While our solution could clearly distinguish obsessions from compulsions in line with earlier studies (e.g. McKay et al., 1995), a third factor comprising resistance to obsessions/compulsions emerged. An important argument for the validity of this solution is that baseline and discharge assessments yielded a similar loading pattern. Furthermore, a subsequent confirmatory analysis showed that the three-

factor model fit the data better than a two- or single-factor model. Goodness-of-fit parameters indicated an adequate fit. It has to be emphasised, however, that our sample size was small and that the present study needs replication.

For subsequent studies using the Y-BOCS we suggest using the following alternative to the subscore algorithm initially proposed by Goodman et al. (1989a). We propose summing up items 1–3 to measure *severity of obsessions* and items 6–8 to measure *severity of compulsions*. Items 4 and 9 should form a third subscale (*resistance to symptoms*). Items 5 and 10 showed mixed loadings on the corresponding severity factor and the common resistance factor. From our data, it appears that symptom control reflects a joint function of symptom severity and symptom resistance, thus decreasing the homogeneity of the subscales when being incorporated.

Psychometric analyses show that items 1b and 6b fit well in the three-factor model and provide non-redundant information. We are currently running a study in which the interrater reliability of items 1b and 6b is assessed. Preliminary data indicate that both items show a good interrater reliability that is comparable to other Y-BOCS items.

In addition, we found that all subscores derived from the factor analyses significantly declined following cognitive–behavioral intervention. Kim et al. (1994) did not observe a significant decrease in the resistance factor following placebo and drug administration. This is an interesting result that deserves further investigation, since it confirms that cognitive–behavioral and drug therapy have different sites of action for symptom reduction. In this context, however, it is important to note that the *resistance to obsessions* item is problematic, since greater resistance to obsessions (represented by a lower score) has been reported to predict an increased rate of obsessions. The ambiguity of item 4 may also explain why most previous confirmatory analyses encounter problems representing this item.

Correlational analyses confirm previous research (Moritz et al., 2001a; Schmidtke et al., 1998) showing that depression as measured with the Hamilton Depression Rating Scale is associated with obsessions and that length of illness and number of previous hospitalisations are modestly correlated with greater extent of compulsions. Our results suggest that previous data may be reanalysed using the new algorithm. Meaningful associations between obsessive–compulsive symptoms and dependent variables might have been obscured by the conventional subscale algorithm which taps heterogeneous contents.

Acknowledgments

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