Research paper

Anxiety during the long-term course of obsessive-compulsive disorder

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ABSTRACT

Objective: The study aimed to investigate anxiety and its relation with obsessive-compulsive symptoms during the long-term course of obsessive-compulsive disorder (OCD).
Methods: We used data from the Netherlands OCD Association (NOCDA) study, which included 419 participants with OCD (aged 18–79 years). Severity of obsessive-compulsive symptoms and anxiety at baseline and after two, four, and six years were entered into three models, which were analyzed using structural equation modeling: 1) the cross-lagged model, which assumes that anxiety and obsessive-compulsive symptoms are two distinct groups of symptoms interacting directly on the long-term; 2) the stable traits model, which assumes that anxiety and obsessive-compulsive symptoms result from two distinct latent factors, which are stable over the time and interact with each other; and 3) the common factor model, which assumes that anxiety and obsessive-compulsive symptoms are presentations of the same latent factor.
Results: The cross-lagged model and the stable traits model both were valid models with a good model fit. The common factor model had a poor model fit and was rejected.
Limitations: The duration of OCD varied widely between the participants (0–64 years). The majority experienced obsessive-compulsive symptoms since several years, which may have affected results on the course of anxiety and the interaction between anxiety and obsessive-compulsive symptoms.
Conclusions: Anxiety and obsessive-compulsive symptoms in OCD patients do not result from a shared underlying factor but are distinct, interacting symptom groups, probably interacting by distinct latent factors.

1. Introduction

Obsessive-compulsive disorder (OCD) is defined by recurrent, intrusive thoughts, urges or images (obsessions) and repetitive and often ritualistic behaviors (compulsions) (DSM-5, APA, 2013). According to the learning theory obsessions provoke distress, which often presents as anxiety. Subsequently, compulsions are performed to diminish the distress or anxiety. Several studies and theories address the short-term relation between obsessions leading to anxiety leading to compulsions (e.g., Hartmann et al., 2019; Starcevic et al., 2011; Salkovskis, 1985; Rachman and Hodgson, 1980), but anxiety in OCD also occurs unrelated to the immediate distress response (Citkowska-Kisielewska et al., 2019;

van Schalkwyk et al., 2016).

In fact, anxiety has a significant role in the clinical picture of OCD (Citkowska-Kisielewska et al., 2019). More severe anxiety is related to chronicity (Nakajima et al., 2018; van Oudheusden et al., 2018; Ferrão et al., 2006), impaired quality of life (Remmerswaal et al., 2020; Velloso et al., 2018; Subramaniam et al., 2013) and more functional impairment (Velloso et al., 2018; Storch et al., 2009). It is also associated with more severe obsessive-compulsive symptoms cross-sectionally (Klein Breteler et al., 2021; Sulkowski et al., 2008). In treatment studies, no effect of anxiety on treatment outcome was observed (Kathmann et al., 2022; Knopp et al., 2013; Farrel and Boschen, 2011; Steketee et al., 2019), possibly because most therapeutic interventions for OCD, such as

cognitive behavioral therapy and serotonergic antidepressants, also effectively reduce anxiety (Anand et al., 2011; Blair Simpson et al., 2008). Therefore, natural follow-up studies may be preferred to study the long-term relation between anxiety and obsessive-compulsive symptoms.

Longitudinal natural studies may also address the question whether the role of anxiety decreases during the course of OCD. Studies on the neurobiology of OCD report, that brain structures associated anxiety-driven behavior have an important role in the earlier phases of OCD, while in chronic OCD, an increasing involvement of habit-related brain structures is observed (Shephard et al., 2021; Stein et al., 2019; van den Heuvel et al., 2016). This shift in the involvement of distinct brain circuits may clinically lead to a shift from anxiety-driven compulsive behavior during the earlier phases of OCD to an increasing role of habit with the duration of the obsessive-compulsive symptoms. Although they did not address anxiety, studies on checking behavior confirm that perseverating checking behavior is performed more habitually and with less conscience over the time (Dek et al., 2015).

To our knowledge, natural studies addressing the role of anxiety during the course of OCD are lacking and evidence is very limited. Insight on the long-term relation between anxiety and obsessive-compulsive symptoms may help to understand the nature of OCD and may clarify aspects of its heterogeneity between individuals as well as individual changes during the course of OCD.

Different models of the long-term relation between anxiety and obsessive-compulsive symptoms in OCD are plausible. The severity and course of the distinct symptoms may reflect a dynamic interaction and may result from a specific effect of one symptom towards the other (Klein Hofmeijer-Sevink et al., 2018; McGorry et al., 2018). In that case, anxiety and obsessions/compulsions may be regarded as co-occurring but distinct symptoms which affect each other directly during the course of OCD. The severity of anxiety may be positively associated with the severity of the obsessions and compulsions in the future, or the severity of the obsessive-compulsive symptoms may be related to anxiety in the future. However, a bi-directional interaction is also possible.

Another hypothesis is, that the reciprocal relation between obsessive-compulsive symptoms and anxiety results from distinct underlying latent factors, which interact. Obsessive-compulsive disorder often has a chronic course (Garnaat et al., 2015; Kempe et al., 2007; Skoog and Skoog, 1999) and thus the occurrence and severity of obsessions and compulsions may be associated with a latent underlying obsessive-compulsive factor, e.g., a chronic vulnerability, which is stable over the time and results in a specific expression of obsessive-compulsive symptoms at specific moments during the course of OCD. In the same way, anxiety may result from a latent underlying anxiety factor. The interaction between anxiety and obsessive-compulsive symptoms rather may be an interaction of the underlying stable latent factors, than a direct interaction at the specific moment.

A third hypothesis is the presence of a common latent factor of obsessive-compulsive symptoms and anxiety, which determines the course of both. This is in line with studies suggesting a "higher-order factor" which is shared by different mental disorders including OCD (Caspi et al., 2014; Barlow, 2000). In that case, anxiety and obsessions/compulsions are presentations of a common latent factor, i.e., they may form distinct symptoms of shared underlying mechanisms or vulnerabilities. Changes in the common latent factor may subsequently lead to changes in its presentation with anxiety and obsessions/compulsions over time.

The aim of the present study was to investigate the role of anxiety during the long-term course of OCD, and specifically the relation between anxiety and obsessive-compulsive symptoms. We tested three different models to describe this relation. We hypothesized that anxiety and obsessions/compulsions are distinct but related aspects of OCD which affect each other longitudinally. We also expected that the role of anxiety diminishes over time and that the strength of the association between anxiety and obsessive-compulsive symptoms decreases during

the long-term course of OCD.

2. Methods

2.1. Participants

The present study used data from the Netherlands Obsessive Compulsive Disorder Association (NOCDA) study, a longitudinal naturalistic cohort study which followed 419 adult OCD patients for six years. The study design and characteristics of the baseline assessment are described in detail elsewhere (Schuurmans et al., 2012). Participants were included at one of the seven participating mental health care centers in the Netherlands. Inclusion criteria were a lifetime diagnosis of OCD, irrespective of the state of the disease, and age of 18 years or older. Any type of comorbidity was allowed. Comorbidity in the NOCDA sample is previously described and investigated by Klein Hofmeijer-Sevink and colleagues (Klein Hofmeijer-Sevink et al., 2013). Insufficient understanding of the Dutch language to complete the interviews and questionnaires was the only exclusion criterion. All participants gave written informed consent. The protocol was approved by the Medical Ethical Committee VU University Medical Center Amsterdam and the local Medical Ethical Committees of all participating centers.

2.2. Measures

The present study analyzed information from interviews and questionnaires of the baseline assessment and follow-up after two, four, and six years.

At baseline, current and lifetime diagnoses of OCD were ascertained according to the criteria of the DSM-IV-TR (APA, 2000) using the Structured Clinical Interview for the DSM-IV-TR (SCID-I/P) (First et al., 1999).

At baseline and each follow-up after two, four, and six years, the severity of the obsessive-compulsive symptoms was assessed by the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) (Goodman et al., 1989a; Goodman et al., 1989b). The severity of anxiety symptoms was measured by the Beck Anxiety Inventory (BAI) at baseline and at each follow-up after two, four, and six years (Beck et al., 1988).

2.3. Descriptive and cross-sectional statistical analyses

Differences at baseline between participants who completed all assessments and drop-outs were analyzed by Pearson's chi square tests (sex and current symptom dimensions), and independent samples *t*-test (age, number of symptom dimensions, Y-BOCS and BAI scores at baseline).

To investigate if the strength of the correlation between anxiety and obsessive-compulsive symptoms decreases during the follow-up, we tested: *H0*: $\rho T = 0$ cross-sectionally at baseline and each follow-up, where ρT denotes the correlation between anxiety and obsessive-compulsive symptoms at baseline ($t = 0$) and at the 2, 4, and 6-year follow-ups ($t = 2, 4, 6$, respectively).

2.4. Structured equation modeling

To investigate the longitudinal relationship between anxiety and obsessive-compulsive symptoms, the BAI and the Y-BOCS were analyzed using three different models: 1) a cross-lagged model, 2) a stable traits model, and 3) a common factor model. The models are illustrated in Fig. 1.

The cross-lagged model (Fig. 1a) hypothesized that anxiety measured by the BAI and obsessive-compulsive symptoms measured by the Y-BOCS are distinct symptoms, and that anxiety and obsessive-compulsive symptoms are directly related. We analyzed the cross-lagged regression paths to examine the reciprocal relation between each Y-BOCS and the BAI two years later and vice versa. The auto-
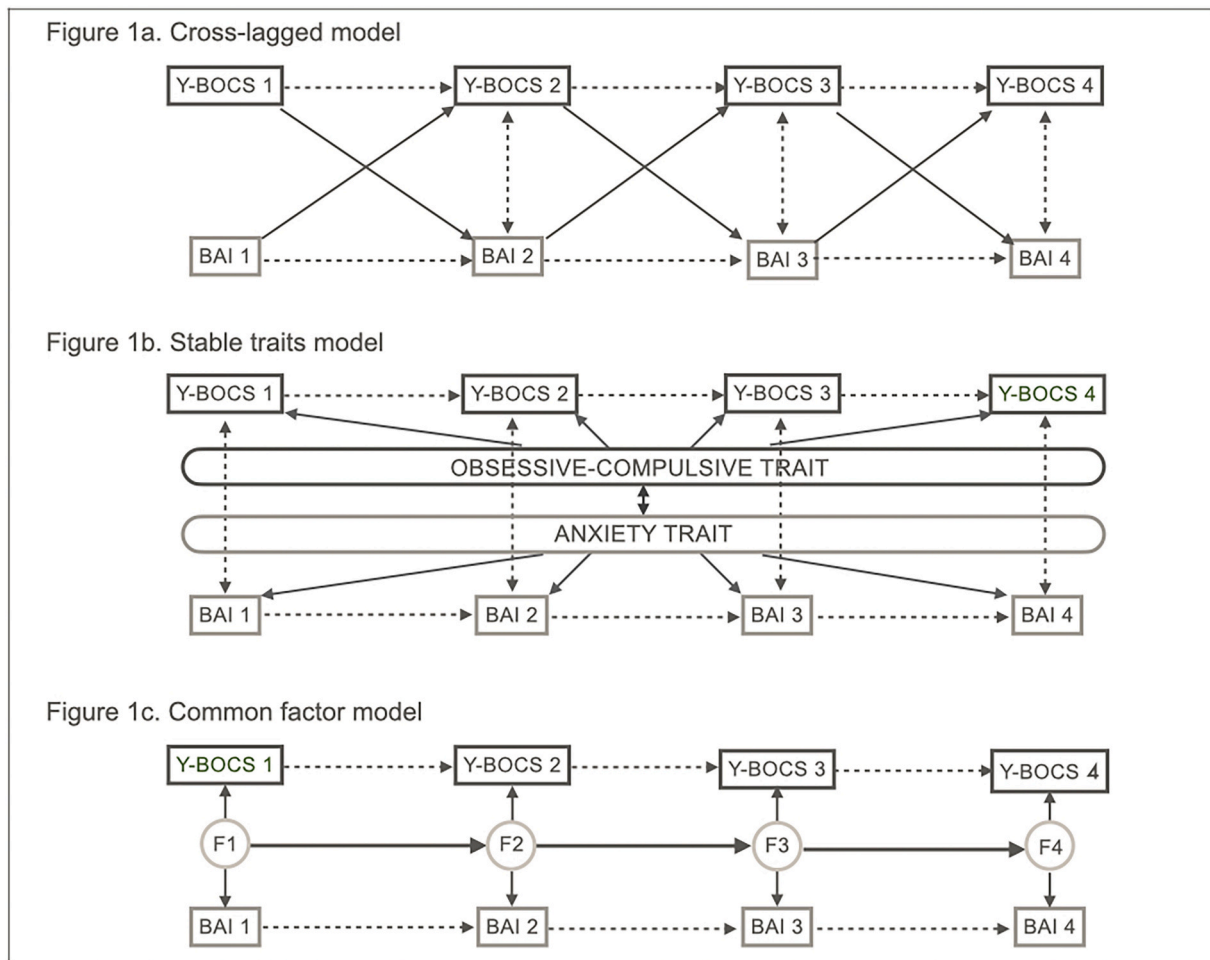
Fig. 1. Models of the longitudinal relationships between the Y-BOCS and BAI scores.
Regression paths and loadings (continued arrows), auto-regressions and covariances (dotted arrows), observed variables (squares) and latent variables (circles).

correlations for the longitudinal effects of the Y-BOCS on the following Y-BOCS and the BAI on the following BAI were included, as well as the cross-sectional covariances between the BAI and Y-BOCS scores. The strength of the respective cross-lagged regression paths subsequently were compared against each other: the path baseline Y-BOCS to 2-years BAI versus the path baseline BAI to 2-years Y-BOCS, the path 2-years Y-BOCS to 4-years BAI versus the path 2-years BAI to 4-years Y-BOCS, and the path 4-years Y-BOCS to 6-years BAI versus the path 4-years BAI to 6-years Y-BOCS.

The stable traits model (Fig. 1b) hypothesized that anxiety measured by the BAI and obsessive-compulsive symptoms measured by the Y-BOCS are distinct symptoms, which do not interact directly but by latent traits. The latent trait reflects an underlying unobserved construct, which is stable over time. For the stable traits model, we used a confirmatory factor analysis with 2 latent factors (the obsessive-compulsive trait and the anxiety trait), which were allowed to correlate. The observed measures of the Y-BOCS and BAI at baseline, and the 2-, 4-, and 6-years follow-up were the respective indicators of the latent traits. The auto-correlations for the Y-BOCS and the BAI were included into the model, as well as the cross-sectional co-variance between the BAI and the Y-BOCS.

The common factor model (Fig. 1c) hypothesized that the symptoms measured by the Y-BOCS and the symptoms measured by the BAI originate from a common latent factor. In this model, the baseline Y-BOCS and the baseline BAI were indicators of a latent baseline factor, and each follow-up measure of the Y-BOCS and BAI were the indicators of the respective latent factor during follow-up. Auto-correlations for the Y-

BOCS and BAI were included in this model.

To analyze these three models, structural equation modeling was used, including the Y-BOCS and BAI total scores of the baseline and each follow-up assessment after two, four, and six years. Subsequently, analyses were repeated using the Y-BOCS compulsion sub-scale (Y-COM) and the BAI total score, because hypotheses over anxiety-driven behavior in OCD often focus on the relation between anxiety and compulsive behavior (Stein et al., 2019; Gillan et al., 2016).

Y-BOCS and BAI scores were rescaled to equal both measures before entering the scores into the structured equation modeling analyses. To account for missing data (that were assumed to be missing at random), the models were fitted using the full information maximum likelihood (FIML) estimation.

Fit indices of the three models were compared using the following indicators for a good fit: a chi-square test p-value > 0.05, a comparative fit index (CFI) value > 0.95, a Tucker Lewis index (TLI) value > 0.90, a root mean square error of approximation (RMSEA) value < 0.08, and a standardized root mean square residual (SRMR) value < 0.05.

Data were analyzed with SPSS (version 23) and R (version 3.6.0) using the lavaan package for the structured equation modeling (Rosseel, 2012).

3. Results

3.1. Clinical characteristics

At baseline, 419 participants completed the interviews and

questionnaires. Due to drop-out, at follow-up after two years 311 patients (74.2 %) still participated, at follow-up after four years 295 patients (70.4 %), and at follow-up after six years 268 patients (64 %). Complete questionnaires of the baseline and all follow-up assessments of the Y-BOCS and BAI were available for 187 participants (44.6 %). At baseline, the group of completers did not differ significantly from the group with missing data regarding age, sex, current diagnosis of OCD, current OCD symptom dimensions, Y-BOCS and BAI scores. Characteristics of all participants at baseline are summarized in Table 1.

The mean Y-BOCS and BAI scores per assessment are shown in Table 2. Mean Y-BOCS and BAI scores both were highest at baseline, declined towards the 2-year follow-up, and remained stable towards the 4-year and 6-year follow-up.

Cross-sectional correlation analyses at baseline and all follow-ups showed a significant correlation between BAI and Y-BOCS total scores, between the BAI and the Y-BOCS obsession subscale, and between the BAI and the Y-BOCS compulsion subscale, as shown in Table 2.

3.2. Long-term relation between anxiety and obsessive-compulsive symptoms

Model fit indices of the models based on the BAI and Y-BOCS total scores (resp. the Y-BOCS compulsion subscale) are shown in Table 3. The cross-lagged model and the stable traits model both had a good model fit and similar fit indices, and thus both are valid models. The common factor model had poor model fit and therefore was rejected as a plausible model.

When the analyses were repeated with the BAI and the Y-BOCS compulsion subscale, the pattern of results did not change.

3.2.1. The cross-lagged model

The standardized regression coefficients and auto-correlations of the cross-lagged model are illustrated in Fig. 2.

The regression paths from the baseline BAI to the 2-years follow-up Y-BOCS and the cross-lagged path from the baseline Y-BOCS to the 2-years BAI showed a significant positive relation ($\beta = 0.108$, $p = 0.042$ and $\beta = 0.103$, $p = 0.20$, respectively), while the path from the 4-years Y-BOCS to the 6-years BAI showed a significant negative relation ($\beta = -0.224$, $p = 0.001$). All other regression paths were not statistically significant. When the strengths of the cross-lagged paths were compared against each other, no significant differences emerged (baseline to 2-years follow-up $p = 0.643$, 2-years follow-up to 4-years follow-up $p = $

Table 1
Characteristics of all participants ($n = 419$) at baseline.

	n = 419
Age	36.6 yrs (18–79 yrs)
Male/female	$n = 185$ male (44.2 %), $n = 234$ female (55.8 %)
OCD current	$n = 382$ (91.2 %)
OCD lifetime	n = 419 (100 %)
Duration OCD	17.9 years (SD 12.2, range 0–64 yrs)
Y-BOCS	
Total score	19.8 (SD 8.1, range 0–40)
Obsessions	9.9 (SD 4.3, range 0–20)
Compulsions	10.0 (SD 4.8, range 0–20)
BAI	17.3 (SD 12.0, range 1–60)
Symptom dimensions	
Aggressive obsessions/checking	$n = 370$ (90.7 %)
Symmetry/ordering	$n = 282$ (62.1 %)
Contamination/washing	$n = 251$ (61.5 %)
Hoarding	$n = 68$ (16.7 %)
Number of current OCD symptom	
dimensions	n = 18 (4.3 %)
$n = 0$	$n = 76$ (18.1 %)
n = 1	$n = 123$ (29.4 %)
n = 2	$n = 145$ (34.6 %)
n = 3	$n = 46$ (11 %)
n = 4	

Table 2
Severity of obsessive-compulsive symptoms and anxiety as well as the correlation between obsessive-compulsive symptoms and anxiety in all participants.

	Baseline Mean (SD, range)	2-Yrs FU Mean (SD, range)	4-Yrs FU Mean (SD, range)	6-Yrs FU Mean (SD, range)
Y-BOCS	20.0 (SD 8.1, 0–40)	15.1 (SD 9.0, 0–40)	15.4 (SD 9.2, 0–40)	15.6 (SD 9.4, 0–40)
Y-OBS	9.9 (SD 4.3, 0–20)	7.4 (SD 4.8, 0–20)	7.5 (SD 4.7, 0–20)	7.5 (SD 4.8, 0–20)
Y-COM	10.0 (SD 4.8, 0–20)	7.7 (SD 5.0, 0–20)	7.9 (SD 5.2, 0–20)	8.1 (SD 5.1, 0–20)
BAI	17.3 (SD 12.0, 0–60)	13.4 (SD 11.2, 0–52)	13.6 (SD 10.9, 0–55)	13.6 (SD 10.7, 0–54)

	Baseline Correlation	2-Yrs FU Correlation	4-Yrs FU Correlation	6-Yrs FU Correlation
Y-BOCS - BAI	$r = 0.41$, $p < 0.001$	$r = 0.50$, $p < 0.001$	$r = 0.46$, $p < 0.001$	$r = 0.49$, $p < 0.001$
Y-OBS - BAI	$r = 0.38$, $p < 0.001$	$r = 0.51$, $p < 0.001$	$r = 0.43$, $p < 0.001$	$r = 0.49$, $p < 0.001$
Y-COM - BAI	$r = 0.34$, $p < 0.001$	$r = 0.42$, $p < 0.001$	$r = 0.42$, $p < 0.001$	$r = 0.44$, $p < 0.001$

Y-BOCS Y-BOCS total score, Y-OBS Y-BOCS obsession subscale score, Y-COM Y-BOCS compulsions subscale score, BAI BAI total score, SD standard deviation.

Table 3
Model fit indices of the cross-lagged model, stable traits model and common factor model using the BAI and the Y-BOCS total scale and compulsion subscale, respectively.

	CLM Y-BOCS	CLM Y-COM	STM Y-BOCS	STM Y-COM	CFM Y-BOCS	CFM Y-COM
Chi-square	$p = 0.117$	$p = 0.056$	$p = 0.095$	$p = 0.042$	$p < 0.001$	$p < 0.001$
CFI	0.995	0.994	0.995	0.993	0.872	0.831
TLI	0.985	0.978	0.984	0.977	0.674	0.569
RMSEA	0.038	0.046	0.039	0.047	0.178	0.206
SRMR	0.022	0.022	0.026	0.029	0.096	0.124

CLM cross-lagged model, STM stable traits model, CFM common factor model, Y-BOCS Y-BOCS total scores, Y-COM Y-BOCS compulsion subscale.

0.115, 4-years follow-up to 6-years follow-up $p = 0.146$).

When the cross-lagged analyses were repeated using the BAI scores and the Y-BOCS compulsion (Y-COM) scores, a significant positive relation was found between the baseline Y-COM and the 2-years BAI ($\beta = 0.095$, $p = 0.028$) and a significant negative relation between the 4-years Y-COM and the 6-years BAI ($\beta = -0.195$, $p = 0.001$). All other regression paths were not significant. When the strengths of the respective cross-lagged paths were compared directly, no significant results were found (baseline to 2-years follow-up $p = 0.781$, 2-years follow-up to 4-years follow-up $p = 0.143$, 4-years follow-up to 6-years follow-up $p = 0.193$).

3.2.2. The stable traits model

The regression paths and auto-correlations of the stable traits model are illustrated in Fig. 3.

The observed measures of the Y-BOCS significantly loaded on the obsessive-compulsive trait, and the observed measures of the BAI on the anxiety trait. The obsessive-compulsive trait and the anxiety trait correlated strongly ($r = 0.573$, $p < 0.001$). Covariances at each follow-up were moderate and significant, suggesting that at each distinct follow-up additional factors outside the modeled correlation of both latent traits were related to the Y-BOCS and BAI scores.

When analyses were repeated using the BAI scores and the Y-BOCS compulsion scale scores, the Y-BOCS compulsion subscale at baseline
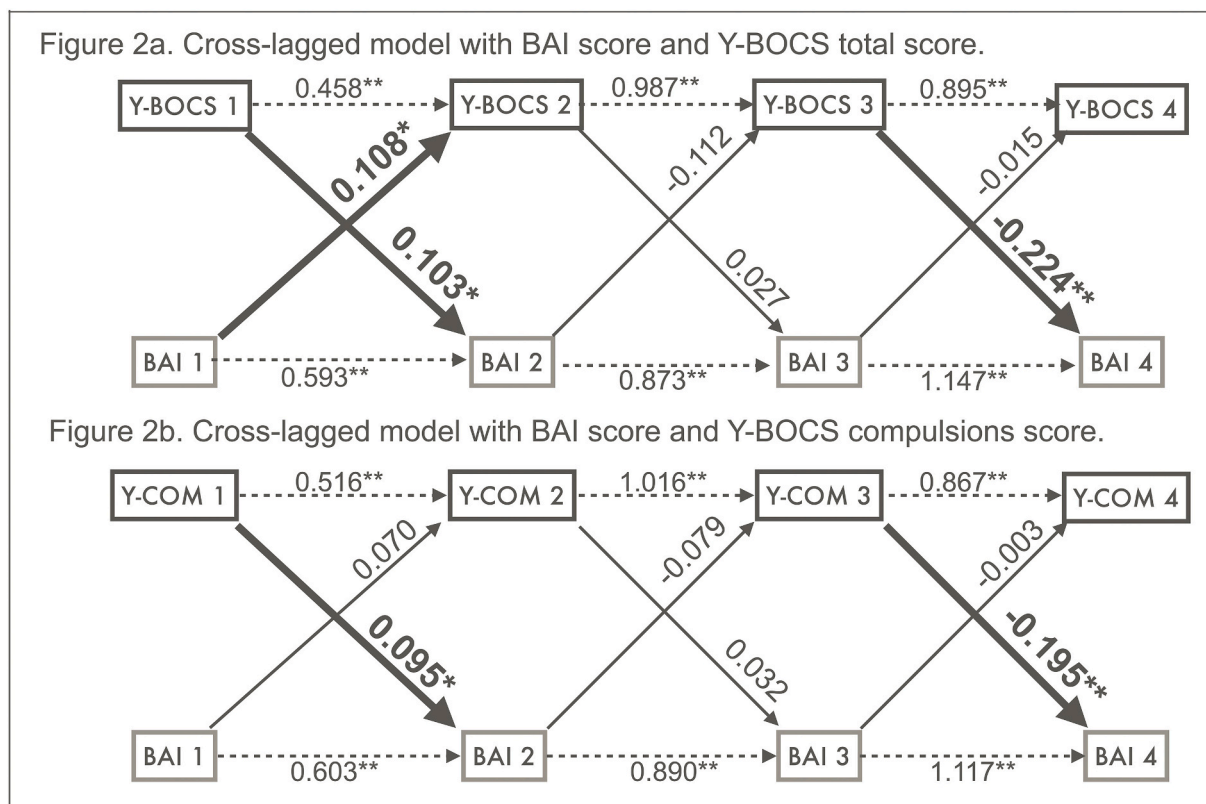
Fig. 2. Cross-lagged model.
Y-BOCS Y-BOCS total score, Y-COM Y-BOCS compulsion subscale score. Standardized regression coefficients per path (continued single-arrowed line) and auto-correlations (dotted single-arrowed line). $*p < 0.05$, $**p < 0.01$.

and each follow-up significantly loaded on the compulsivity trait, as did the BAI scores on the anxiety trait. The anxiety and compulsivity trait strongly correlated ($r = 0.496$, $p < 0.001$). Cross-sectional error correlations were moderate except that at the follow-up after 2 years it was not significant.

4. Discussion

In the present study we investigated the long-term relation between anxiety and obsessive-compulsive symptoms during the course of OCD in three different models.

The cross-lagged model as well as the stable traits model showed good model fit and therefore both are valid descriptions of the long-term relation of anxiety and obsessive-compulsive symptoms. The common factor model fitted poorly and was rejected. Based on these results, we concluded that anxiety and obsessive-compulsive symptoms in OCD patients do not result from a shared underlying factor. Instead, anxiety and obsessive-compulsive symptoms are distinct groups of symptoms, which interact on the long-term, probably resulting from two distinct interacting latent traits.

Our results demonstrate that anxiety is not part of the obsessive-compulsive symptoms itself. Although anxiety often occurs in OCD and is a core characteristic according to the learning theory (Salkovskis, 1985), it is not specific to OCD. In addition, a high proportion of compulsions is performed for other reasons than to reduce anxiety (Starcevic et al., 2011), and the experience of anxiety varies between OCD patients. Previous studies in OCD report a general obsessive-compulsive factor, which is shared between OCD patients and represents general characteristics of OCD, and in addition several specific factors, which differ between OCD patients and cause the heterogeneity of the presentation of obsessive-compulsive symptoms (Olatunji et al., 2017; Delucchi et al., 2011). Obsessions and compulsions (measured by the Y-BOCS severity

scale) may represent the general obsessive-compulsive factor, while anxiety may be one of the specific factors which vary between OCD patients.

According to the cross-lagged model, obsessive-compulsive symptoms are related to previous anxiety symptoms, while anxiety symptoms are related to previous obsessive-compulsive symptoms. However, in the present study, the reciprocal relation between anxiety and obsessive-compulsive symptoms was only significant in the first two years of follow-up. When the relation between solely compulsions and anxiety was analyzed, compulsions at baseline correlated with anxiety two years later, but anxiety at baseline did not correlate with compulsions two years later. Although the cross-lagged model was valid according to the measures of model fit, the strengths of the regression paths were rather weak and did not differ when the respective cross-lagged paths were compared directly. Thus, the results of the path analyses should be interpreted with caution. However, results may point towards a reciprocal relation between anxiety and obsessive-compulsive symptoms especially in the earlier phases during the course of OCD. Anxiety may maintain or lead to obsessive-compulsive symptoms by an increase of negative affect or stress which may lead to more obsessive-compulsive behavior as a coping strategy. On the other hand, obsessive-compulsive symptoms may maintain or lead to anxiety, because the relief experienced after the performance of compulsions is short-lasting. The repetitive performance of compulsions to achieve relief may lead to the experience that the performance of compulsions is necessary to reduce anxiety, which may in turn lead to an increase in anticipatory anxiety.

After four years, this relation changed to the opposite and more severe obsessive-compulsive symptoms, as well as solely compulsions, were subsequently associated with less anxiety. Probably, after years of obsessive-compulsive symptoms, patients may already perform compulsions in anticipation of anxiety prior to the experience of it, and thus
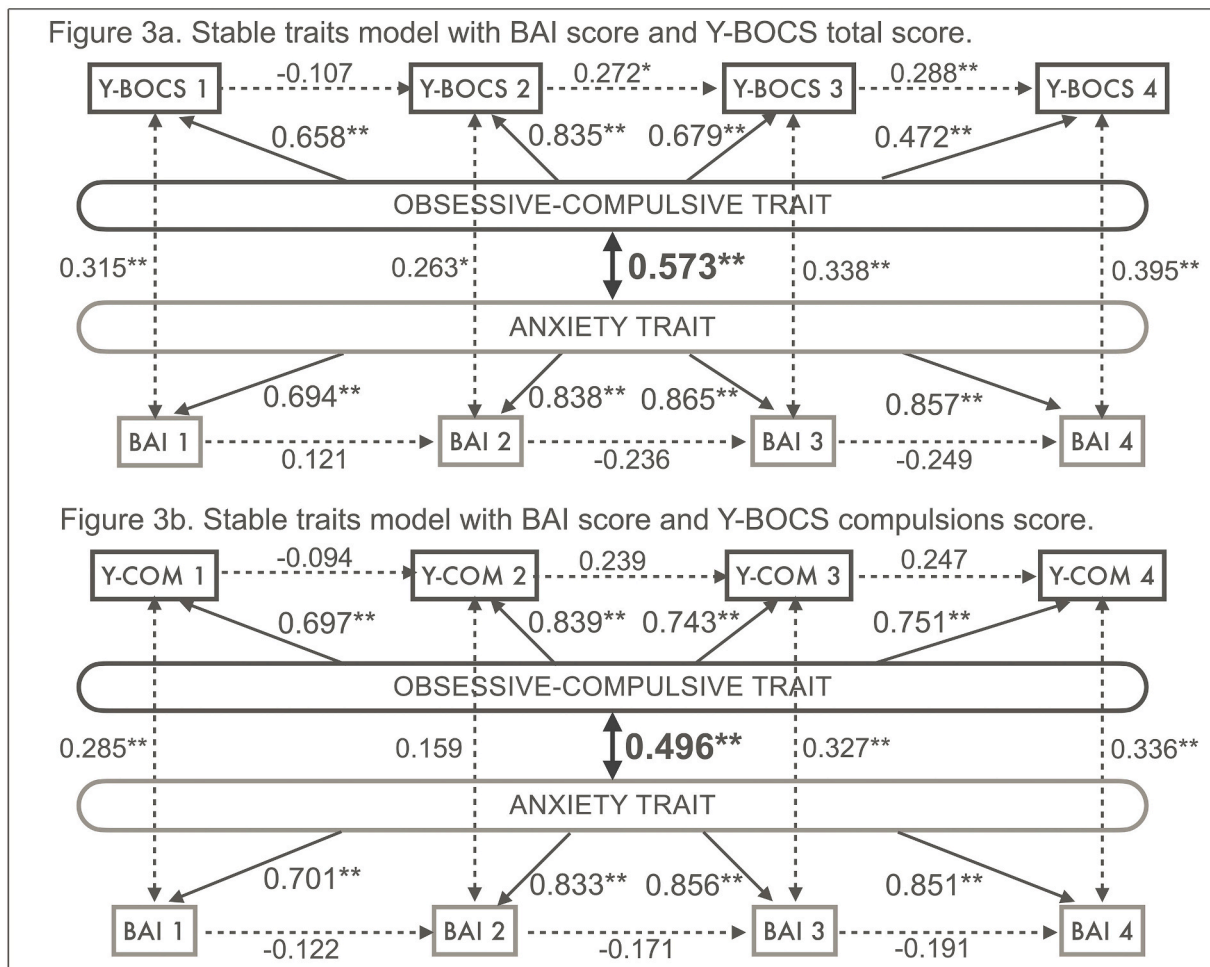
Fig. 3. The stable traits model.

Y-BOCS Y-BOCS total score, Y-COM Y-BOCS compulsion subscale score. Partial regression coefficients (continued single-arrowed line), auto-correlations (dotted single-arrowed line), error correlations between the Y-BOCS total score and BAI score (double-arrow dotted line) and correlation between the stable traits (double-arrowed continued line). $*p < 0.05$, $**p < 0.01$.

prevent its occurrence. In addition, the compulsions may be performed more habitual over time. During the earlier phases of OCD, brain circuits related to goal-directed behavior are involved, which leads to anxiety-driven obsessive-compulsive symptoms. When obsessive-compulsive symptoms persist and become chronic, the involved brain circuits change to brain regions which are involved in habitual behavior. (Shephard et al., 2021; Stein et al., 2019; van den Heuvel et al., 2016) Thus, over time compulsions become less anxiety-driven and are performed more habitually instead. This shift from anxiety-driven to habitual behavior may reflect the decrease of anxiety during the long-term course of OCD.

In the cross-lagged model more severe obsessive-compulsive symptoms were strongly associated with more severe previous obsessive-compulsive symptoms, and more anxiety was strongly associated with more previous anxiety. In other words, the severity of obsessive-compulsive symptoms and anxiety was carried forward during the follow-up, and thus may rather result from an underlying latent factor for obsessions/compulsions and respectively anxiety, which is stable over the time and determines the severity of obsessions/compulsions and anxiety during the course of OCD, as e.g., a chronic vulnerability. These considerations were modeled in the stable traits model, which included two latent factors, the obsessive-compulsive trait and the anxiety trait. The severity of the obsessive-compulsive symptoms at each assessment was strongly associated with an underlying latent factor, the obsessive-compulsive trait, while the severity of anxiety at each measure

was strongly associated with another underlying latent factor, the anxiety trait. Both traits correlated strongly, and the relation between anxiety and obsessive-compulsive symptoms during the follow-up period was primarily defined by the interaction between both traits. Thus, the relation between anxiety and obsessive-compulsive symptoms on the long-term rather results from the interaction of stable underlying factors than from an immediate interaction at each follow-up. However, at each follow-up moment, a residual variance remained, which was not explained by the respective underlying traits or previous anxiety and obsessive-compulsive symptoms. This may point towards other traits or factors not included into this model, which also affect anxiety and obsessive-compulsive symptoms in OCD, e.g. habit (Gillan et al., 2016). Anxiety-driven and habitual behavior both have a role in compulsive behavior (Gillan et al., 2017). They can be present at the same time (Starcevic et al., 2011) and may even interact with each other.

In the present study, anxiety and obsessive-compulsive symptoms correlated strongly at baseline and each follow-up, and the strength of the cross-sectional correlation did not change over time. In addition, the duration of OCD at baseline varied widely between the participants of the study, which limited the possibility to study the change of symptoms in relation to the illness duration. Thus, we could not confirm our hypothesis, that the role of anxiety diminishes during the course of OCD. However, we can conclude that anxiety in general remains an important symptom during the course of OCD.

The results of the present study provide novel insights into the long-

term relation between obsessive-compulsive symptoms and anxiety in OCD patients. Although the present study included only patients with a lifetime diagnosis of OCD, our results are in line with current trans-diagnostic theories, which state that the predominant symptoms of OCD result from a complex interaction of different independent trans-diagnostic dimensions, as e.g., anxiety and compulsivity (Gillan et al., 2017). According to the results of the stable traits model, the correlation between anxiety and obsessive-compulsive symptoms did not explain all of the variance of the respective symptoms, and thus additional factors may play a role. Besides anxiety and compulsivity, various trans-diagnostic symptoms and concepts relevant to OCD have been proposed, such as negative affectivity (Barlow, 2000), depressive symptoms (Chavez-Baldini et al., 2021), obsessive beliefs (Anholt and Kalanthroff, 2014), intolerance of uncertainty (Carelton et al., 2012), or not-just-right experiences (Fergus, 2014). However, not all of these aspects may be equally relevant in all OCD patients. Thus, the co-occurrence of distinct transdiagnostic symptoms and their reciprocal interactions may vary between individuals with OCD and may contribute to the heterogeneous presentation of OCD.

4.1. Limitations

Some limitations of the present study have to be addressed. Only 60 to 75 % of the participants enrolled at baseline participated in the follow-ups, and less than half of the participants completed all assessments during the 6-year follow-up. However, drop-out is not uncommon for longitudinal studies with such a long duration, and the study design and power calculation took this into consideration (Schuurmans et al., 2012). To deal with the missing data, we used full information maximum likelihood estimation (FIML) under the assumption that missing data were missing at random. Given that participants who completed all assessments and participants with missing data did not differ in their demographic or clinical characteristics at baseline, we were willing to tentatively make this assumption.

Another limitation is the heterogeneity of the group of OCD patients regarding the duration of the disease ranging from 0 to 64 years at baseline. OCD patients were included during various stages and the majority experienced OCD symptoms for several years. In this subgroup of chronic OCD, the relation between anxiety and obsessive-compulsive symptoms probably was already diminished, which may have affected the cross-lagged path analyses and the cross-sectional analysis during follow-up due to a floor effect.

The present study used the BAI, which is a valid and widely used measure of anxiety in primary as well as specialized mental health care settings (Muntingh et al., 2011; Leyfer et al., 2006; Beck et al., 1988). However, critics remark that it is rather a measure of panic than of anxiety in general (Cox et al., 1996). Although other studies partially contradicted this remark (Muntingh et al., 2011; Leyfer et al., 2006), the BAI emphasizes the somatic experience of anxiety, while aspects as anticipatory anxiety, avoidance behavior, worry, or cognitive appraisals are not included.

To our knowledge, the present study is the first one, which investigated anxiety during the long-term course of OCD, using a large naturalistic study, which followed participants for several years. We explicitly aimed to investigate the long-term relation between anxiety and obsessive-compulsive symptoms and thus do not pretend to make assumptions about the short-term interactions or the possible functional role of anxiety as a driver of compulsions. This may be subject to further research. Due to methodological limitations, we could not answer the question whether the role anxiety changes in relation to the duration of OCD. More evidence on the hypothesized switch from anxiety-driven to habit-driven behavior (Shephard et al., 2021; Stein et al., 2019; van den Heuvel et al., 2016) is warranting and may be addressed in future studies, as well as the longitudinal relation between anxiety, habit and obsessive-compulsive symptoms.

4.2. Conclusion

In conclusion, the present study contributes to the discussion on the role of anxiety during the long-term course of OCD. We demonstrated that anxiety and obsessive-compulsive symptoms are distinct but interacting concepts. Symptoms of anxiety are common and relevant during the course of OCD, also after years of disease, but their role differs between groups of OCD patients. Besides anxiety, other factors, such as habit-driven behavior or not-just-rights experiences, may have a role in OCD. Future research should address these factors and their interaction with obsessive-compulsive symptoms within OCD and transdiagnostically.

Disclosure

OvdH received consultation fee from Lundbeck.

CRediT authorship contribution statement

All authors (Judith Rickelt, Wolfgang Viechtbauer, Machteld Marcelis, Odile van den Heuvel, Patricia van Oppen, Merijn Eikelenboom, and Koen Schruers) have made a significant contribution to the conduction of the study and the writing of the manuscript.

OvdH, PvO, ME and KS contributed to the design of the NOCDA-study. JR, MM, OA and KS developed the hypotheses and selected the relevant data of the present study. JR, MV and KS chose the appropriate statistical approach. JR and MV conducted the statistical analyses. JR wrote the first draft of the manuscript, which was revised by MV, MM, OvdH, PvO, ME and KS.

All authors revised and approved the final manuscript, and agree on its submission to the Journal of Affective Disorders.

Declaration of competing interest

None.

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