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PREDICTING GENETIC LOADING FROM SYMPTOM PATTERNS IN OBSESSIVE- COMPULSIVE DISORDER: A LATENT VARIABLE ANALYSIS

Carmi Schooler, Ph.D.^{1,*}, Andrew J. Revell, Ph.D.^{1,2}, Kiara R. Timpano, M.S.³, Michael Wheaton, B.A.⁴, and Dennis L. Murphy, M.D., Ph.D.⁴

¹Section on Socio-Environmental Studies, Intramural Research Program, National Institute of Mental Health, Bethesda, Maryland ²Department of Psychology, University of Massachusetts Dartmouth, North Dartmouth, MA ³Department of Psychology, Florida State University, Tallahassee, FL ⁴Laboratory of Clinical Science, Intramural Research Program, National Institute of Mental Health, Bethesda, MD

Abstract

Background—Some symptom dimensions in obsessive-compulsive disorder (OCD) patients have a familial and putative genetic foundation, based on replicated findings in studies of sib-pairs with OCD. However, these symptom dimensions are all from exploratory factor analyses of Yale-Brown Obsessive-Compulsive Scale Symptom Checklist ratings based on non-empirically derived symptom categories, rather than individual symptoms.

Methods—In this study, we used a novel latent variable mixture model analysis to identify meaningful patient subgroupings. This was preceded by a confirmatory factor analysis of a 65-item OCD symptom inventory from 398 OCD probands, which yielded a five-factor solution. Data from all five symptom factors were used in a latent variable mixture model analysis, which identified two statistically separate OCD subpopulations.

Results—One group of probands had a significantly higher proportion of OCD-affected afflicted relatives (parents or close parental relatives), whereas the other group had a less prevalent familial OCD. The group with the more familial OCD was also found to have an earlier age of OCD onset, more severe OCD symptoms, and greater psychiatric comorbidity and impairment.

Conclusions—Especially if the results are verified in other samples, this research paradigm, which identified characteristics of individuals with familial OCD, should prove useful in carrying out genome-wide linkage and association studies of OCD and may provide a model for other symptom-based studies of additional medical disorders.

Keywords

OCD; confirmatory factor analysis; structural equation modeling; psychiatric comorbidity; familiarity

*Correspondence to: Carmi Schooler, Ph.D., Chief, Section on Socio-Environmental Studies, Intramural Research Program, National Institute of Mental Health, 6101 Executive Blvd., Suite 360, Room 362, MSC 8408, Bethesda, MD 20892–8408. E-mail: carmi.schooler@nih.gov.

INTRODUCTION

The Diagnostic and Statistical Manual of Mental Disorders [DSM-IV][¹] describes obsessive-compulsive disorder (OCD) as a single nosological entity that is characterized by intrusive and persistent thoughts (obsessions) that evoke anxiety, followed by urges or ritualized behaviors (compulsions) meant to neutralize and relieve the distress associated with obsessions. These symptoms are the hallmark features of this disorder and have been consistently identified across diverse cultures.[²⁻⁴] Nevertheless, further examination of the phenomenological, etiological, and treatment traits of OCD reveals a marked heterogeneity.[⁵] Although the cardinal features of OCD may be consistent, the scope of symptoms classified as obsessions and compulsions are diverse and include a wide range of intrusive thoughts and preoccupations, rituals, and compulsions. Other phenomenological aspects of the disorder also reflect heterogeneity, including differences in insight, gender, age of onset, and comorbidity patterns.[⁵⁻⁸]

The high degree of variability in the features and course of OCD has arguably confounded clinical, neurobiological, and genetic investigations. A number of approaches have been employed in an effort to identify more homogeneous subgroups, which may in turn increase the power of genetic and neurobiological investigations.[^{9, 10}] The most common method has been to classify patients based on a theoretically relevant phenomenological characteristic. For example, studies have clustered individuals into groups such as “washers,” “checkers,” and “hoarders”.[^{11,12}] Other grouping categories have been based on age of onset,[¹³] gender,[¹⁴] specific etiology [e.g., PANDAS],[¹⁵] and familiarity.[¹⁶] An increasingly more common approach has been to delineate OCD subgroups based on exploratory factor analyses (EFA) of symptom rating scales including the Yale-Brown Obsessive-Compulsive Scale Symptom Checklist [YBOCS-SC],[¹⁷] the Thoughts and Behavior Inventory [TBI],[¹⁸] the Padua Inventory,[^{19,20}] the Obsessive-Compulsive Inventory Revised,[²¹] and the Leyton Obsessional Inventory.[²²]

The first EFA conducted on the YBOCS-SC[²³] found support for three factors: *symmetry/hoarding*, *contamination/cleaning*, and *pure obsessions*. Since this initial report, over 14 additional EFA studies have been conducted on more than 2,000 patients, and as a recent review reveals, generally similar factor solutions have been consistently identified across investigations.[²⁴] The majority of EFA analyses have suggested the existence of either four or five dimensions, though a range of three- to seven-factor solutions have been found. Of note, emerging research indicates that these dimensions exhibit clinically meaningful differences with regard to etiology, neurobiology, comorbidity patterns, and treatment response.[⁵] For example, some of the EFA-derived dimensions have been used successfully in familial analyses,[^{9,25-27}] neuroimaging experiments,[²⁸⁻³⁰] treatment outcome trials,[³¹] and genetic studies.[^{18,32}]

Despite the recent popularity of using factor analysis of symptom inventories to identify patient subgroups, several issues remain unresolved with this methodology. One key limitation of these types of studies is their general use of symptom categories instead of individual items. [³³] conducted a factor analysis of the individual items on the YBOCS-SC and found that the rationally derived symptom categories did not properly group a number of items, especially in regard to contamination symptoms. In addition, the majority of EFA studies have also excluded items from the miscellaneous categories of the YBOCS-SC, which include several well-recognized OCD symptoms. The fact that as yet no consensus has been found with regard to a number of factors or categories suggests that these methods have not yet adequately reduced the heterogeneity of OCD and accounted for the variability of OCD symptoms. Some have even questioned the taxonomic value of groupings based on overt behavioral similarities.[³⁴] It has been argued that identifying groups based on a particularly prominent symptom

overlooks the possible tendency for patients to experience symptoms from a wide range of categories and the possibility for the patients' symptoms to change over time.

The general aim of this investigation is to identify and characterize subclasses of OCD that differ in symptomatology using a methodological approach that classifies patients according to the breadth of their symptoms rather than merely emphasizing the presence of certain a priori symptom categories. We then test whether the emergent subclasses differ in their levels of familiarity and heritability, nature of illness, and psychiatric comorbidity, as well as in depressive affect and global psychiatric health. Our approach uses two forms of statistical analyses with latent variables [Mplus].^[35] In the first step, we use confirmatory factor analysis [CFA]^[35,36] to determine the number and nature of the latent factors underlying the array of symptoms characterizing OCD. We do this by testing and comparing the four- and five-factor solutions that have tended to emerge across the extant EFA studies. In the second step, we use mixture modeling^[35,37] to estimate the number of statistically distinct subclasses into which those with OCD can be grouped, based on the OCD symptoms represented by the latent factors. In the third step, we test whether the OCD subclasses differ in the number of genetically close ancestors who also have OCD. Finally, in the fourth step, we examine whether the individuals in the emergent OCD subclasses show differences in the severity of their symptoms, comorbidity for other disorders, and clinical and sociodemographic status.

METHODS

PARTICIPANTS

The sample consisted of 398 consecutive admissions to the Adult OCD Clinic at the National Institute of Mental Health. These patients were part of a number of investigational and treatment protocols approved by the National Institute of Mental Health Intramural Research Program IRB and were recruited through physician/psychologist referrals and advertisements. Inclusion criteria for participation included being at least 18 years of age and having an OCD diagnosis based on the Structured Clinical Interview for DSM-IV.^[38] Exclusion criteria included active schizophrenia or psychosis, severe mental retardation that does not permit an evaluation to characterize OCD, and OCD symptoms that occur exclusively in the context of depression. All participants gave written informed consent to participate.

The mean age of the sample was 43 years ($SD = 12.69$; age range = 19–80 years) and the majority of the participants were female (59.8%) and Caucasian (95%, with 1.6% Hispanic, 1.1% African American, 1.1% Asian, and 1.1% other). The average symptom severity, as measured by the Yale-Brown Obsessive-Compulsive Scale [YBOCS],^[17] was 21.63 ($SD = 9.34$), and the mean age of OCD onset was 14.18 years ($SD = 8.67$; range 3–55 years). With regard to comorbidity features, 90% of the participants were diagnosed with at least one additional lifetime axis I psychological disorder. The number of comorbid axis I disorders ranged from zero to eight ($M = 2.46$, $SD = 1.79$), with the most frequently comorbid disorder being major depressive disorder (65%). The mean current Beck Depression Index (BDI) score was 14.85 ($SD = 1.79$; range 0–59).

PROCEDURE

Participants were diagnosed with OCD using the Structured Clinical Interview for DSM-IV-TR Axis I Disorders Patient Edition [SCID-P].^[38] Assessment of symptoms was carried out using two self-report symptom checklists. Primarily we used the TBI,^[39] but for a small subgroup of the sample the TBI was unavailable, so we used the YBOCS-SC^[17] as a proxy. Specifically, of the 398 patients in the total sample, 356 completed the TBI, the primary measure of interest in this investigation. For the 42 cases where the TBI was missing, we converted YBOCS-SC items into TBI items because the TBI and YBOCS-SC cover the same

set of symptoms. Previous research has established good concurrent validity between the Y-BOCS-SC and TBI.^[18,39] Analyses of both measures were based on the lifetime occurrence of individual symptoms. Symptoms present at the time of assessment or in the past were coded 1; symptoms that were never present were coded 0.

At the time of assessment, OCD symptom severity was measured by the YBOCS,^[40] depressive affect was measured by the BDI,^[41] and overall psychiatric health by the Global Assessment of Function [GAF; American Psychiatric Association].^[1] Comorbidity for major DSM axis I disorders was assessed using the SCID-P. Specifically, we created one variable that was the sum of all comorbid disorders including major depressive disorder, dysthymia, bipolar I, bipolar II, social anxiety disorder, panic disorder, agoraphobia, specific phobia, generalized anxiety disorder, substance use disorders, and eating disorders.

MEASURES

Structured Clinical Interview for DSM-IV-TR Axis I Disorders Patient Edition—

The SCID-P^[38] was used to diagnose DSM-IV Axis I disorders, including OCD. Interviews were conducted by clinically trained interviewers either on site or over the telephone. One hundred and thirty-eight participants were interviewed in person and 160 by telephone. To ensure reliability, a blind diagnostic procedure was used in which two independent reviewers evaluated each diagnosis. The SCID-P has been found to be a highly reliable measure for most axis I disorders.^[42]

Thoughts and Behaviors Inventory—The TBI^[39] is a 65-item self-report questionnaire for OCD that is a modified version of the YBOCS-SC. The TBI consists of 33 items on obsessional thoughts and 32 items on compulsive actions. For each item, responses are scaled on a three-point scale (yes, no, unsure), where participants are asked to report lifetime occurrence of symptoms. For this study, only the yes and no categories (i.e., 1 = ever present, 0 = never present, respectively) were included.

Yale-Brown Obsessive-Compulsive Scale—The magnitude of obsessions and compulsions was measured with the YBOCS,^[17] a frequently used assessment tool for the severity of obsessive-compulsive symptoms. The YBOCS is a 10-item index of severity that assesses the degree of control that the patient has over his obsessions and compulsions as well as the interference and distress caused by them. The YBOCS can either be completed by the clinician or as a self-report questionnaire, though for this specific investigation only the self-report form was used. The clinician-rated version has been found to have high interrater reliability and internal consistency [$\alpha = .89$].^[17,43] have demonstrated that the self-rated instrument compared well to the interview measure. The self-report form showed excellent internal consistency ($\alpha = .8-.9$) and good test-retest reliability.^[43]

Specific symptoms were assessed using the YBOCS-SC, a symptom inventory of 71 items assessing present and lifetime obsessions and compulsions divided into 15 a priori categories of OCD symptoms.^[17] As with the YBOCS, the YBOCS-SC exists in both a clinical interview and self-report form. Only the self-report form was used in this study. Good agreement has been found between the self-report version of the checklist and the clinician-administered form.^[43,44]

Familiarity—Probands were evaluated in terms of whether they had a possible familial loading for OCD. This was done by differentiating those with affected close ancestors with whom they shared 25% or more genes (i.e., parents, grandparents, parents' siblings) from those who had no affected close ancestors. The class of affected close ancestors ($n = 127$, 31.9% of total sample) consisted of those probands who had at least one close ancestor who was

interviewed and diagnosed with OCD, and/or who was reported by the proband as likely having OCD.

Beck Depression Inventory—Depressive symptomatology was assessed with the BDI, a 21-item self-report measure of current mood. Questions are answered using a four-point scale. The BDI has been shown to have high concurrent validity and strong convergent validity.^[41]

Global Assessment of Function—The GAF, also known as Axis V in the DSM-IV, is used to report the clinician's judgment of the individual's overall functioning [American Psychiatric Association].^[1] It assesses general psychological, occupational, and social functioning on a 100-point scale and has been shown to be a valid and reliable measure of psychiatric health and disturbance.^[45,46]

DATA ANALYSIS

A series of analyses were used to address our study objectives: (1) structural equation modeling-based CFA^[35] to determine whether various subsets of OCD symptoms occur together as factors, (2) mixture modeling^[35] to test whether differences in the pattern of symptom factors indicate that there are different OCD subtypes, (3) χ^2 to test for genetic load differences among the subtypes that emerge, and (4) χ^2 and *t* tests of group differences, to assess psychiatric and background variables between the emerging subtypes. A fuller description of each of these analyses follows.

1. We chose CFA, rather than traditional EFA, because CFA allows the investigator to 1. estimate and statistically evaluate a priori hypotheses about factor structure, which will allow us to simultaneously compare two different models, 2. test the significance of factor loadings, 3. model correlations of measurement error, and 4. correct for measurement error.^[47,48] For our purposes, CFA in Mplus has the additional advantage of allowing analysis of categorical variables (such as in the case of present versus absent symptom variables) in its modeling.
2. Mixture modeling^[35,37,49] is a statistically appropriate method for determining whether the population from which we are sampling is composed of several statistically distinct subpopulations (i.e., classes). As currently developed, mixture model programs [e.g., Mplus, Mx^[50]] make it possible to estimate how many statistically distinct classes are likely to exist in a given sample and to categorize each individual in terms of the class to which he or she is most likely to belong.
3. χ^2 tests of differences in genetic load based on differences in the proportion of affected close ancestors.
4. A comparison between the classes on several sociodemographic variables and critical clinical variables, including OCD severity (as measured by total obsessions and compulsions) and the total number of disorders in addition to OCD. This comparison was made by calculating the Pearson χ^2 statistic for dichotomous variables and independent *t* tests for continuous variables.

RESULTS

The Mplus structural equation modeling CFA program^[35] was used to test both a four- and five-factor model of OCD symptoms based on theoretical expectations, literature reviews,^[24] and earlier exploratory^[18] and confirmatory^[51] factor analyses. The five latent factors that we modeled are (1) *Fear of Hurting Self/Others*, (2) *Repetition/Symmetry*, (3) *Contamination*, (4) *Checking/Counting*, and (5) *Hoarding* (see Table 1 for symptom items and their factor loadings). As there were no a priori reasons for why these factors should not be

correlated, the model was not specified to be orthogonal. The Mplus program also provides regression-based factor scores. The hypothesized model fits the data very well ($\chi^2(199, N = 398) = 468.13, P < .001$;^[47] CFI = .911,^[52] RMSEA = .058).^[53] As a further check, we replicated the model separately on the TBI and YBOCS-SC data and ascertained that it fit both data sets well (fit statistics for TBI ($\chi^2(195, N = 356) = 466.33, P < .001$, CFI = .900, RMSEA = .063; fit statistics for YBOCS ($\chi^2(136, N = 257) = 254.85, P < .001$, CFI = .954, RMSEA = .058). We also tested the four-factor model that has frequently been reported in the extant EFA studies. Statistically, the χ^2 test for difference ($\Delta\chi^2$) in fit between nested models indicated that our five-factor model fit the data significantly better than the four-factor model ($\Delta\chi^2(df = 5) = 48.81, P < .001$).

Next, we carried out a series of mixture model analyses^[35] based on the probands' factor scores on each of the five factors. The^[54] adjusted likelihood ratio test and the parametric bootstrapped likelihood ratio test^[49] indicated that our sample was best described as being composed of two classes. Both tests indicated that two classes were better than one class ($P < .01$ and $P < .0001$, respectively), but that three classes are not significantly better than two classes ($P = .58$ and $P = .33$, respectively). Class 2 showed statistically higher levels of each of the five symptom factors than did Class 1 (see Table 2). This pattern of findings strongly suggests that there are two distinct subtypes of OCD, primarily distinguished from each other by their levels of symptomatology on all of the five symptom factors.

The examination of differences for genetic load indicated that, compared to Class 1 probands, Class 2 probands were more likely to have close ancestors affected by OCD (see Table 3; $\chi^2(1, N = 398) = 5.085, P = .024$). This pattern of findings indicates that among those with OCD, those in the more symptomatic class are more likely to have genetically related relatives with OCD than are those in the less symptomatic class.

To further elucidate our findings, we compared individuals from the two classes on a number of selected sociodemographic and clinically relevant variables (see Table 4). Probands in Class 2 had an earlier mean age of OCD onset and experienced greater interference and distress from their OCD symptoms, as assessed by the YBOCS. Class 2 probands also showed greater dysphoria as measured by the BDI as well as greater functional impairment as measured by the GAF. They had significantly more comorbid disorders on average (2.95 disorders) compared to Class 1 probands (2.54 disorders), although they did not show a statistically significant greater likelihood of being diagnosed with any particular disorder. Taken together, our results indicate that Class 2 probands experience more impairment in terms of OCD symptoms, dysphoria, and psychiatric comorbidity.

DISCUSSION

Substantively, our findings establish the presence of a statistically reliable factorial structure for OCD symptoms, the five factors being (1) Fear of Hurting Self/Others, (2) Repetition/Symmetry, (3) Contamination, (4) Checking/Counting, and (5) Hoarding. Further examination using latent variable analysis of these five factors provided evidence of two statistically distinct and approximately equally sized subclasses of OCD, distinguished by their level of severity of each of the five symptom factors. The more severely affected class shows a higher genetic loading, as well as higher overall levels of psychiatric comorbidity and impairment.

From a methodological perspective, our mixture model analysis was able to reduce the great variability in OCD symptom presentation to two classes of OCD individuals. Placement of individuals in classes was based on their factor scores on the five factors of a CFA model demonstrated to provide a better fit to the data than models with fewer factors. As this grouping was based on the five CFA symptom factors, it was not dependent on a priori non-empirically

evaluated symptom categories. Rather, the grouping was made based on distinct patterns of symptom occurrence as reflected by the individuals' scores on the five hypothesized and empirically confirmed CFA factors—the overall number and relative distribution of symptoms distinguishing the two groups. Our further analyses demonstrate that those individuals in Class 2 who reported more total obsessions and compulsions as well as a greater variety of symptoms had greater familial OCD than those in Group 1. In addition, Group 2 members had a more severe illness course. The use of data from all resultant symptom factors when making this grouping emphasizes the fact that many patients experience symptoms across symptom categories. Our method provides a more sophisticated way to measure symptom patterns and intraindividual symptom diversity than simply summing the total number of symptoms endorsed for each of the clinically hypothesized symptom groups. In addition, our approach avoids the complications that would arise by grouping patients by number of symptoms using an artificially decided upon cut point. Our method provides an elegant way of letting the data determine group membership without the need for cut points or a priori group categories.

The CFA we conducted sets our study apart from many earlier ones and deserves discussion. First of all, as we have noted, our study proceeded from item-level analysis, which allows us to avoid the pitfalls of using the rationally derived symptom categories of the YBOCS-SC. Despite the fact that^[51] have previously suggested that the current categories of the YBOCS-SC, which are based on a priori deductions from theoretical assumptions, may be inadequate, the majority of EFA analyses have used these a priori symptom categories rather than specific items. It is also worth noting that our CFA analysis included evaluations of miscellaneous obsessions and compulsions, which have been excluded in the majority of previous studies using factor analysis of the YBOCS-SC.^[8,18,23] Several studies have suggested that the miscellaneous items on the YBOCS have important associations with the defined symptom categories.^[8,34,55] In light of our inclusion of the miscellaneous items, it is remarkable that the factors in our model are quite similar to those found by^[18] in a previous smaller sample using EFA. The only substantive difference is that the first factor found by Hasler et al. (Aggressive, Sexual, Religious, and Somatic Obsessions and Checking Compulsions) includes both our first (i.e., Fear of Hurting Self/Others) and fourth (i.e., Checking/Counting) factors. In terms of content, our two factors, as opposed to Hasler et al's single first factor, represent quite different sorts of symptoms. Furthermore, in our five-factor model, we find a correlation of .69 between the two factors; this correlation indicates that the two factors share only 48% common variance indicating that the two factors, although sharing some variance, represent differentiable phenomena.

The fact that the mixture model analyses consistently indicate that our sample of OCD-affected participants contains two statistically distinct subgroups provides new evidence that there are two distinct types of OCD essentially distinguished by the severity of their symptomatology. The difference between the two subgroups in the prevalence of genetically related relatives strongly suggests that the two types of OCD are also differentiated by the degree of familial and possibly genetic contribution to the disease process. Thus, this study clarifies the factorial structure of OCD symptomatology and uses this clarified structure to distinguish different subgroups of OCD sufferers differentiated by both symptom severity and familial/genetic involvement.

The ability to segregate patients into more homogenous groups is becoming increasingly important with the growing body of evidence pointing to a heritable component for OCD. Family studies have consistently found that first degree relatives of individuals with OCD have significantly elevated morbidity rates, such that the aggregate risk for OCD is almost five times greater in relatives compared to controls.^[56-59] Twin studies have further corroborated the notion that OCD has a hereditary element.^[60] Genetic and familial studies have also begun to investigate the familiarity of OCD symptom dimensions. Results indicated that there were some

within-family associations for the *obsessions/checking* factor and the *symmetry/ordering* factor.^[25,61] A handful of association studies have also examined the OCD symptom dimensions in light of a candidate gene variant. For example,^[32] found an association between the serotonin transporter gene 5HTTLPR polymorphism and a *symmetry/repeating* factor in a subgroup of OCD patients with comorbid tic disorder. A partial replication of this association between the 5HTTLPR gene polymorphism and a YBOCS-SC based *symmetry/repeating* symptom factor was recently reported.^[6] However, to date, most genetic studies of OCD symptom dimensions have been based on exploratory factor analysis using the same method as.^[8] We believe that our novel grouping method could help enhance the power of genetic studies because of the way in which our latent variable analysis incorporates data from all five symptom dimensions in revealing two distinct classes of OCD patients, differentiated by both higher levels of symptomatology and a higher proportion of OCD-affected relatives. We hope that our results will replicate in other samples and that the methodological approach we have used will facilitate future genetic studies in OCD.

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TABLE 1
Factors, items, and factor loadings for five-factor model ($N = 398$)

Standardized β values	Factors and question items
Fear of hurting self/others (Factor I)	
0.659	Worry that you might hurt yourself even though you are not sad or depressed
0.726	Worry that you might hurt someone else even though you are not angry with anyone
0.216	Worries that others might be harmed somehow (possibly because of something you did or did not do)
0.675	Intrusive violent or horrible pictures in your mind (e.g., nightmares while you are awake)
0.778	A fear that you will blurt out obscenities or insults
0.767	A fear that you will do something else embarrassing
0.703	A fear that you will act on an unwanted impulse (e.g., to stab a family member)
0.494	A fear you will steal things
0.710	Repetitive forbidden or perverse sexual thoughts, images, or impulses that are disturbing to you
0.693	Excessive fears that you may have sinned or offended God somehow
0.751	Excessive worries about things you believe are right or wrong
0.469	Fears that you might have an illness or disease (e.g., cancer)
0.205	Excessive worries about how a part of your body looks or about some aspect of your appearance (e.g., believing your nose is "too big")
0.203	A feeling that certain numbers, colors, words, or other things are lucky or unlucky
0.828	A fear of saying certain things
0.712	A fear of not saying just the right thing
0.366	Intrusive sounds, words, music, or numbers that you cannot get "out of your mind" or ignore
0.697	Excessive checking because of concerns about an illness or disease (e.g., repeated tests for cancer)
0.296	A feeling that you must know/remember certain things
0.142	Ritualized eating behaviors (e.g., chewing food 100 times before swallowing it)
0.323	A fear you will be responsible for something terrible happening (e.g., fire, burglary, flood)
0.121	A fear that you will get sick because of contaminants
0.224	A fear that you will make others sick by spreading a contaminant
Repetition/symmetry (Factor II)	
0.625	A feeling that things need to be symmetric or even
0.787	A feeling that things need to be "just right" or "exactly right"
0.603	A feeling that certain numbers, colors, words, or other things are lucky or unlucky
0.488	A feeling that you must know/remember certain things
0.391	Excessive worries about how a part of your body looks or about some aspect of your appearance (e.g., believing your nose is "too big")
0.605	Excessive rereading, rewriting, erasing
0.703	Need to repeat routine activities until they are done a certain number of times
0.701	Need to repeat routine activities for other reasons
0.743	Need to count objects, certain numbers, or words
0.667	Need to make things symmetric or even (e.g., lining items up in a certain way or arranging them in specific patterns on your desk)
0.541	Mental rituals (e.g., other than checking/counting)
0.620	Need to repeatedly touch, tap, or rub things
0.533	Ritualized eating behaviors (e.g., chewing food 100 times before swallowing it)
0.413	Intrusive sounds, words, music, or numbers that you cannot get "out of your mind" or ignore

Standardized β values	Factors and question items
Contamination (Factor III)	
0.752	A worry about urine, stools, or spit
0.847	A worry about dirt, germs, or an illness like AIDS
0.799	A fear or worry about environment contaminants (e.g., asbestos, radiation, toxic waste)
0.847	A fear or worry about household items (e.g., cleaners, solvents)
0.777	Being bothered by sticky substances or residues
0.760	A fear that you will get sick because of contaminants
0.672	A fear that you will make others sick by spreading a contaminant
0.274	Fears that you might have an illness or disease (e.g., cancer)
0.708	Excessive or ritualized washing of your hands
0.783	Excessive or ritualized showering, bathing, tooth brushing, grooming, or toilet routine
0.760	Excessive or involved cleaning of household items or other inanimate objects
0.834	Repeatedly doing things a special way to prevent or remove contact with contaminating substances
Checking/counting (Factor IV)	
0.893	Excessive checking that nothing terrible has happened or will happen
0.574	Worries that others might be harmed somehow (possibly because of something you did or did not do)
0.518	A fear you will be responsible for something terrible happening (e.g., fire, burglary, flood)
0.745	Excessive checking that you did not/will not harm others (e.g., that you did not accidentally run over something while driving)
0.823	Excessive checking that you did not/will not harm yourself
0.718	Excessive checking that you did not make an error or mistake
0.802	Doing things (other than checking) to prevent harm to yourself or others, or to prevent some terrible event from happening
0.619	Excessively superstitious behaviors
0.129	Excessive rereading, rewriting, erasing
0.195	Mental rituals (other than checking/counting)
Hoarding (Factor V)	
0.696	Need to collect things that some people might consider silly (e.g., bottle caps, old razor blades)
0.775	Fear will lose or throw out something important or needed later

TABLE 2
Factor loadings in two-class mixture model (*N* = 398)

Class	Factor I	Factor II	Factor III	Factor IV	Factor V	% of total sample
1	-.24***	-.35***	-.82***	-.50***	-.30***	45
2	.21***	.31***	.70***	.47***	.27***	54

Factor I, fear of hurting self/others; Factor II, repetition and symmetry; Factor III, contamination; Factor IV, checking and counting; Factor V, hoarding.
*** $P \leq .001$.

TABLE 3

Class differences in genetic load

	Classes from two-class mixture model		
	Class 1	Class 2	Row total
No direct genes shared	133	138	271
Direct genes shared	47	80	127
Column total	180	218	398

Direct genes shared combines all probands' family members interviewed as having diagnosed OCD, plus probands' family members interviewed with suspected OCD, plus probands who self-reported that their family members had OCD.

OCD, obsessive-compulsive disorder.

TABLE 4

Comparison of sociodemographic and clinical characteristics of Class 1 and 2

Variables	Class 1	Class 2	Test value	(df)
Sex (% female)	57.8	61.5	.56	(1)
Age at study, in years (<i>SD</i>)	43.15 (13.44)	42.82 (12.07)	.26	(395)
Education, % $\geq$ college degree	65.9%	61.0%	1.00	(1)
Marital status			4.41	(5)
Single	50.0%	51.2%		
Married	38.5%	39.3%		
Divorced	8.0%	8.1%		
Separated	0	.5%		
Widowed	2.3%	.9%		
Age at OCD onset, in years (<i>SD</i>)	15.33 (9.58)	12.38 (8.39)	3.25***	(388)
YBT (<i>SD</i>)	20.46 (8.29)	24.32 (7.67)	-4.69***	(375)
BDI (<i>SD</i>)	14.66 (11.40)	19.05 (12.94)	-3.16**	(310)
Comorbid disorders (<i>SD</i>)	2.54 (1.84)	2.95 (1.95)	-2.18*	(394)
GAF intake (<i>SD</i>)	66.66 (15.40)	62.61 (16.21)	2.13*	(277)

Pearson χ^2 calculated for dichotomous variables and independent *t* test for continuous variables. All *t* tests met Levene's assumption of equal variances. Only *t* tests that were statistically significant are listed above.

⁵YBT, Obsessions plus compulsions total as measured by YBOCS severity; BDI, Beck Depression Inventory. Comorbid disorders is the number of other disorders in addition to OCD. GAF, Global Assessment of Function at intake; YBOCS, Yale-Brown Obsessive-Compulsive Scale; OCD, obsessive-compulsive disorder.

* $P < .05$.

** $P < .01$.

*** $P < .001$.