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A critical appraisal of heterogeneity in Obsessive-Compulsive Disorder using symptom-based clustering analysis

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ABSTRACT

Obsessive-compulsive disorder (OCD) encompasses a broad range of symptoms and is commonly considered a heterogeneous condition. Attempts were made to define discrete OCD subtypes using a range of symptom-based methods including factor and cluster analyses. The present study aims to find the most appropriate clustering model based on Yale-Brown obsessive-compulsive scale (YBOCS) checklist explaining OCD heterogeneity.

Five different clustering algorithms (FCM, K-means, Ward, Ward + K-means and Complete) applied on YBOCS symptoms of 216 patients with OCD. Data studied as four different sets including item-level raw data, item-based factor scores, category-level raw data and category-based factor scores and clustering results for 2 to 6 cluster solutions evaluated by four clustering indices (Davies-Bouldin, Calinski-Harabasz, Silhouettes and Dunn indices).

Two-cluster solution was detected as the most appropriate model for item and category-based clustering analyses of YBOCS checklist symptoms. Patients in each cluster were characterized based on their clinical and demographic properties and results showed that they had similar patterns of symptoms but in different severities.

Heterogenity of OCD based on the YBOCS-symptoms has been challenged as OCD patients were classified based on their symptom severity not their symptom patterns. More investigations need to find appropriate measures explaining OCD heterogeneity with clinical importance.

1. Introduction

Obsessive-compulsive disorder (OCD) is a neuropsychiatric heterogeneous condition that affects 1–3% of the population worldwide (Hasler et al., 2005). OCD patients may display different symptom patterns and illness courses. This phenotypic variability has led to the hypothesis that OCD is a heterogeneous disorder (Lochner and Stein, 2003; Mataix-Cols et al., 2005). Various subtypes of OCD have been reported in the literature obtained from different analytic approaches (Bloch et al., 2008). Different OCD subtypes may have different etiologic pathways and justify variability in genetic, neural, and neuropsychological correlates. (McKay et al., 2004). A better understanding of OCD clinical subtypes may lead to advances in understanding the psychobiology of the disorder, and improved treatments.

Researchers have used several different measures for identifying OCD subtypes including obsessive and compulsive symptom patterns (Calamari et al., 1999; Lochner et al., 2008), age at onset of OCD (Noshirvani et al., 1991), differential treatment response, genetic backgrounds of individuals diagnosed with OCD (Katerberg et al., 2010) and the presence of comorbid conditions (Mataix-Cols et al., 2000).

The most frequently used strategy for identifying subtypes of OCD has involved the evaluation of obsessive and compulsive symptom commonalities in patients (Calamari et al., 1999). The most comprehensive and widely used inventory available and the source of data for investigation of OCD symptoms and severity is

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the Yale Brown Obsessive Compulsive Scale (YBOCS) (Goodman et al., 1989). YBOCS symptom checklist (YBOCS-CL) classifies the obsessions and compulsions in 13 specific categories and 2 miscellaneous groups. The item composition of each of the checklist categories was derived through clinical judgment to group the symptoms into clinically coherent categories, and to create a checklist that would facilitate data collection (Feinstein et al., 2003).

There are two common types of methods for analysis of OCD data: variable-centered factor analysis and person-centered clustering (Calamari et al., 2004; Delucchi et al., 2011; Katerberg et al., 2010). Factor analysis is used for investigating the relationships of variables for complex concepts that are not easily measured directly. This method reduces a large number of variables into a few interpretable underlying factors. Category and item based factor analyses of (YBOCS-CL) in different studies resulted into four or five factor models (Bloch et al., 2008).

Clustering strategies and latent class analysis (LCA) are person-centered methods that are used for identifying OCD symptom-specific subtypes (Calamari et al., 1999, 2004; Delucchi et al., 2011; Nestadt et al., 2003, 2009). In cluster analysis, subjects are grouped into several clusters by maximizing between group differences and minimizing within group variation on the chosen set of criteria while LCA assumes an underlying latent class membership among subjects that gives rise to the subject subgroups (Vermunt and Magidson, 2004). In factor analysis, subjects may have loadings on all the identified factors so it will be hard to relate each person to a specific dimension. Cluster and latent class analyses enables researchers to form relatively homogenous subject groups within complex data set (Calamari et al., 1999).

The first reported OCD cluster analysis OCD personality data were clustered by Ward's method and were verified by K-means clustering algorithm. Four clusters that were different with each other in response to behavioral therapy were identified (Fals-Stewart and Lucente, 1993). Calamari et al. used Ward's hierarchical agglomerative cluster analysis followed by K-means clustering of YBOCS-CL scores and identified five groups that were characterized by dominant symptom patterns (Calamari et al., 1999). Further validation of results by subgroup characteristics related to treatment response or the etiology of OCD showed greater support for a seven subgroup taxonomy (Calamari et al., 2004). Another study clustered OCD patients into 3 clusters based on their comorbidity of obsessive-compulsive spectrum disorders (OSCDs) using Ward's method (Lochner et al., 2005). Cluster analysis of 45 items of YBOCS-CL reported by this sample identified six-cluster solution (Lochner et al., 2008).

Attempts for classifying OCD symptoms using LCA resulted in different models based on the symptoms types. LCA analysis of neurologic signs, electroencephalographic abnormalities, attention deficit, and developmental disorder to investigate birth complications and neurologic abnormalities in individuals with OCD identified a two class model, organic and nonorganic class suggesting that OCD belongs to nonorganic class and is not the result of organic brain disease (Thomsen and Jensen, 1991). LCA analysis of OCD using patterns of comorbidity detected 4 latent classes: a minimal disorders class; a recurrent major depression and generalized anxiety class; a highly comorbid class, consisting of individuals with multiple comorbid psychiatric disorders; and a tic disorder, panic, and agoraphobia class (Nestadt et al., 2003). The subsequent study using comorbidity and clinical characteristics such as sex, age at onset, and OCD symptom type resulted in a 2-class solution was characterized by lesser and greater comorbidity classes and a 3-class solution that consisted of an OCD-only class (±major depression), an OCD + tics class, and an OCD + affective disorders (highly comorbid) class (Nestadt et al., 2009). Latent class analysis of the 8-item obsessive-compulsive scale of the Child Behavior Checklist suggested a 4-class model, including a "no symptoms" class, a "worries and has to be perfect" class, a "thought problems" class,

and an "obsessive-compulsive scale items" class (Althoff et al., 2009). In another study analysis of YBOCS symptoms to detect latent classes yielded 3 classes differed only in frequency of symptom endorsement (Delucchi et al., 2011).

Different OCD symptom subtypes may have different psychopathological mechanisms requiring specific treatment strategies. The present study aims to shed more light on OCD symptom subtypes and suggest the best model for clustering OCD patients. We have used several clustering strategies to for categorizing OCD patients based on their YBOCS symptoms and compared the results with those of LCA.

2. Method

2.1. Participants and clinical assessment

Two hundred and sixteen patients with OCD (n = 216, 146 female and 70 male), were included in the study (mean age at assessment, 33.7 ± 10.2) (Table 1).

Subjects were interviewed by an experienced clinician, and met the Diagnostic and Statistical Manual of Mental Disorders (DSM IV-TR) (Association, 1994) criteria for OCD on the Structured Clinical Interview for Axis I Disorders. The exclusion criteria were having a history of psychotic disorders or mental retardation, reporting severe neurological pathology and history of substance use, diagnosis with other DSM-lV-TR Axis l disorders except depression, anxiety or tic disorder. The socio-demographic data was applied through a questionnaire. The Persian version of YBOCS severity scale and checklist (Rajezi Esfahani et al., 2012) was used to assess the severity and types of current obsession and compulsion symptoms. The study was approved by the Research Ethics Committee of Neuroscience Research Center, Shahid Beheshti University of Medical Sciences (Project No. 492.1).

2.2. Data analysis

Scores on the YBOCS – CL were analyzed in two levels: item and category levels. In item-level analyses the 5 point Likert scale data without any conversion was used as raw data. For category-level analyses each category was scored 0, 1 or 2 in the same manner as

Table 1
Demographic and clinical characteristics of OCD patients (N = 216).

		Number	*%*
Gender	Male	70	32
	Female	146	68
Marital status	Single	70	32
	Married	145	68
Educational level	School dropout	69	33
	Diploma	93	43
	Under graduate	44	20
	Graduate	9	4
Occupation	Unemployed	118	55
	Employed	97	45
Familial history of psychiatric disorders	OCD	101	47
	Other Axis l disorders	59	27
	No history	54	26

	Mean	SD
Age at assessment	33.7	10.2
Age of onset	23.7	10.7
Obsession Severity	10.3	4.7
Compulsion Severity	8.9	5.9
Total Severity	18.6	8.8