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Etiology of obsessions and compulsions: General and specific genetic and environmental factors

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ABSTRACT

Evidence suggests that a general etiologic factor plays a role in many forms of psychopathology, possibly including obsessive–compulsive (OC) symptoms. A twin study ($N=307$ twin pairs) of OC symptoms and their endophenotypes was conducted to investigate the role of general and symptom-specific etiologic factors. OC symptoms and endophenotypes were found to have complex etiologies, being shaped by OC-specific genetic and environmental factors, and by genetic and environmental factors that shape psychopathology in general. Understanding the general and specific etiologies underlying OC symptoms has implications for improving treatments outcomes through the development of therapies that target general and/or specific factors.

1. Introduction

Obsessive–compulsive disorder (OCD) is a common, chronic, and often debilitating psychiatric condition that is characterized by obsessions and compulsions. Obsessions are persistent and unwanted thoughts, images, or urges, whereas compulsions are repetitive behaviors or mental acts that the person feels compelled to perform, typically with a desire to resist (American Psychiatric Association, 2013). Obsessive–compulsive (OC) symptoms likely arise from a complex interplay of biopsychosocial factors. Twin studies suggest that these symptoms arise from additive genetic and environmental factors, which exert their effects by shaping OC-related endophenotypes (Taylor, 2011, 2012). To attain a comprehensive understanding of OC symptoms it is important to examine the etiologic factors shaping endophenotypes, such as OC-related dysfunctional beliefs.[1]

Evidence suggests that a general psychopathology factor (GPF) plays a role in many psychiatric conditions, possibly including OC symptoms and their endophenotypes (Caspi et al., 2014). The GPF is thought to be dimensional in nature, where the severity of psychopathology is linked to the degree to which brain integrity is compromised (Caspi et al., 2014). If the GPF plays a role in OC symptoms and endophenotypes, then this suggests an etiologic architecture involving OC-specific genetic and environmental factors, along with genetic and environmental factors that are general in nature, influencing many forms of psychopathology. The present study investigated this possibility, based on a reanalysis of previously collected data (Taylor and Jang, 2011; Taylor et al., 2010). The previous study reported results on the heritability of OC symptoms and beliefs but did not address the aims of the present study.

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[1] As originally applied to psychiatric disorders, an endophenotype was conceived as a measurable intermediary variable lying somewhere in a causal chain linking genes to a given disorder (Gottesman and Shields, 1972). The concept has since been expanded to include endophenotypes that are intermediary between environmental etiologic factors and symptoms or disorders (Kendler and Neale, 2010). An endophenotype need not be a causal variable; it can be a marker (correlate) of some causal mechanism (Walters and Owen, 2007). An endophenotype may be a variable from any of a number of levels of organization, including neurophysiological, neuroanatomical, cognitive, or other variables, including those obtained from self-report measures (Gottesman and Gould, 2003; Cannon and Keller, 2006). A growing body of evidence suggest that three types of OC-related dysfunctional beliefs are OCD endophenotypes (Taylor, 2012): beliefs about the importance and control of thoughts (ICT), perfectionism and intolerance of uncertainty (PC), and inflated personal responsibility and the overestimation of threat (RT), as assessed by the Obsessive Belief Questionnaire (OBQ: Obsessive Compulsive Cognitions Working Group, 2005). These beliefs, especially when strongly (rigidly) held, are said to give rise to OCD, according to contemporary cognitive-behavioral models (Frost and Steketee, 2002). Several lines of evidence show that these beliefs are OCD endophenotypes, including correlational studies, longitudinal studies, family studies, twin studies, and treatment studies (Rector et al., 2009; Taylor and Jang, 2011; Woody et al., 2011; Taylor et al., 2012; Abramowitz et al., 2014). This includes evidence supporting the view that such beliefs are causally related to OC symptoms. Twin research, for example, has found support for a model in which OC-related dysfunctional beliefs mediate the relationship between genetic factors and OC symptoms (Taylor and Jang, 2011). Such a model provided a better fit to the data than a model in which beliefs played no mediational role (Taylor and Jang, 2011).

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2. Methods

2.1. Participants

A community sample of 167 monozygotic (MZ) and 140 dizygotic (DZ) twin pairs was recruited across Canada. The sample consisted of 33 MZ male–male pairs, 134 MZ female–female pairs, 14 DZ male–male pairs, 86 DZ female–female pairs, and 40 DZ male–female pairs. Most were White, 78% were women, and the mean age was 40 years ($SD=15$ years, range=17–81 years). Most (68%) were employed full- or part-time, with the remainder being full-time students (7%), full-time homemakers (7%), retirees (7%), or people subsisting on disability or unemployment benefits (10%).

A community sample was appropriate for this study because (a) OC symptoms are common in nonclinical samples, (b) symptoms in such samples have similar form and content to symptoms in OC disorder, and (c) clinical and nonclinical samples have similar patterns of heritability (Abramowitz et al., 2014). Previous twin studies, including studies conducted by our research group, have shown that twins recruited in the manner as in this study are no different from people in the general population in terms of demographics, personality traits, and clinical variables (Barnes and Boutwell, 2013; Jang et al., 2000, 2006; Johnson et al., 2002; Taylor et al., 2008). Previous research has identified no evidence of self-selection biases that might significantly impact behavioral-genetic psychopathology research (Johnson et al., 2002; Neale and Maes, 2004; Jang, 2005). Research from community-based samples, as in the present study, has produced the same pattern of heritabilities of OC symptoms as in studies using clinical samples (Taylor, 2011). The overrepresentation of MZ twins, as compared to DZ twins, is consistent with previous twin studies, and has not been found to impact the pattern of twin results (Jang, 2005). Previous research from our twin registry indicates that the assumption of equal environments was met for our MZ and DZ twins (Taylor et al., 2008).

2.2. Measures

Zygosity was determined by means of a highly accurate questionnaire (Nichols and Bilbro, 1966; Kasriel and Eaves, 1976), along with an examination of recent color photographs. The questionnaire has an accuracy of 93–95% in establishing zygosity, compared with DNA testing (Kasriel and Eaves, 1976; Reed et al., 2005).

OC symptoms were measured by the Obsessive Compulsive Inventory-Revised (OCI-R; Foa et al., 2002), which assesses major types of OC symptoms (see Table 1). For each item, respondents rate on a 5-point scale how much they had been distressed or bothered by each symptom in the past month. The rating scale ranges from 0 (*not at all*) to 4 (*extremely*). Scores on the OCI-R have been shown to have acceptable performance on various indices reliability and validity in clinical and nonclinical samples (Foa et al., 2002; Huppert et al., 2007).

Cutoff scores derived by Foa et al. (2002), based on the obsessing subscale, were used to determine the proportion of participants who met criteria for "caseness" that is, individuals with sufficiently elevated scores to suggest clinically significant symptoms (full or subclinical OCD).

OC-related dysfunctional beliefs were assessed by the Obsessive Beliefs Questionnaire (OBQ; Obsessive Compulsive Cognitions Working Group, 2005). The OBQ is a comprehensive measure of dysfunctional beliefs that have been theoretically and empirically linked to OC symptoms (Obsessive Compulsive Cognitions Working Group, 2005). To date, the OBQ is the best available measure of dysfunctional beliefs linked to OCD, in terms of reliability, validity, and content coverage. The 44-item OBQ consists of three subscales: PC (perfectionism and intolerance of uncertainty, 16 items; e.g., "In order to be a worthwhile person, I must be perfect at everything I do"), ICT (importance and overcontrol of thoughts, 12 items; e.g., "Having violent thoughts means I will lose control and become violent"), and RT (inflated responsibility and overestimation of threat, 16 items; e.g., "When I see any opportunity to do so, I must act to prevent bad things from happening"). Respondents are asked to indicate their general level of agreement with each of the 44 statements ("What you are like most of the time") on a 7-point scale ranging from 0 (*disagree very much*) to 7 (*agree very much*).

Table 1
Phenotypic correlations among variables.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. GPF	–									
2. Checking	0.39	–								
3. Hoarding	0.38	0.56	–							
4. Neutralizing	0.40	0.76	0.57	–						
5. Obsessing	0.60	0.58	0.51	0.63	–					
6. Ordering	0.42	0.68	0.49	0.64	0.46	–				
7. Washing	0.44	0.79	0.47	0.71	0.56	0.66	–			
8. PC	0.65	0.40	0.30	0.41	0.47	0.50	0.41			
9. ICT	0.67	0.37	0.32	0.38	0.54	0.33	0.39	0.67	–	
10. RT	0.71	0.43	0.34	0.41	0.54	0.37	0.42	0.77	0.77	–

GPF=general psychopathology factor; PC=perfectionism and intolerance of uncertainty; ICT=importance and overcontrol of thoughts; RT=inflated responsibility and overestimation of threat.

GPF was measured by the higher-order factor on the Dimensional Assessment of Personality Pathology (DAPP; Livesley and Jackson, 2009). The latter is a broad measure of psychopathology but does not measure OC symptoms. Scores on the DAPP have been shown to have good reliability and validity in clinical and nonclinical samples (Livesley and Jackson, 2009).

2.3. Procedure

Twins were recruited though newspaper advertisements, print and radio media stories, and twin club registries. Inclusion criteria consisted of fluency in written and spoken English and provision of informed consent.

2.4. Statistical procedures

Statistical analyses proceeded in three steps. First, the heritability was computed for each variable, based on ACE modeling (see below). Second, if a variable was heritable, we then computed its genetic and environmental correlations with other heritable variables. Third, we assembled two matrices—a matrix of genetic correlations and a matrix of environmental correlations—and analyzed each matrix by means of exploratory factor analyses to determine whether the variables have genetic or environmental factors in common. Details of the data analytic methods are as follows.

Each variable (i.e., the 10 variables listed in Table 1) was defined, by means of structural equation modeling, as a standardized latent variable (i.e., with $M=0$, $SD=1$) in which its respective items served as indicators. For each variable the item loadings for MZ twins were equated with those of DZ twins, so that the latent variables for MZ twins represented the same constructs as those of DZ twins. Latent variables were computed by means of *Mplus*, version 5 (Muthén and Muthén, 2007), in which covariance matrices were analyzed by means of robust Maximum Likelihood estimation. Although data were skewed, it was not necessary to transform item scores because the statistical methods that were used (i.e., polychoric correlations and robust Maximum