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Review

Neuropsychological differences between obsessive-compulsive washers and checkers: A systematic review and meta-analysis

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ABSTRACT

Inconsistent results in neuropsychological research of obsessive-compulsive disorder (OCD) may be the result of the heterogeneous nature of OCD symptoms. The most frequently investigated symptoms are contamination/cleaning and doubt/checking. The aim of this review was to determine whether OCD washers and checkers differ in their neuropsychological performance. We conducted a meta-analysis of 13 studies (including 535 patients) comprising tests in 10 different neuropsychological domains. Washers showed significant better task performance than checkers in 8 of 10 cognitive domains. Large effect sizes were found in planning/problem solving and response inhibition. Effect size in set shifting was medium, whereas effect sizes in attention, processing speed, encoding, verbal memory and nonverbal memory were small. Limitations consisted in a relatively small number of primary studies. In line with current neurobiological findings, the results provide further evidence for the validity of different symptom dimensions in OCD. Clinical and theoretical implications are discussed.

Contents

1. Introduction

Obsessive-compulsive disorder is increasingly considered as a heterogeneous mental disorder (Mataix-Cols, do Rosario-Campos, & Leckman, 2005) comprising, as cited in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), specific symptom

Abbreviation: PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-analyses Statement.

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dimensions that differ from each other in numerous ways. The most widely investigated OCD symptom dimensions are the contamination/washing dimension, and the doubt/checking dimension (Fontenelle, Mendlowicz, Marques, & Versiani, 2004; Rasmussen & Eisen, 1989). The washing dimension contains intrusive thoughts of contamination, emotions of fear and disgust, and ritualized washing and cleaning behavior. The checking dimension includes thoughts of harm avoidance, pathological doubt, and repeated checking of, for example, locked doors and turned-off stoves or irons. In both symptom dimensions, the obsessive thoughts cause marked distress, and the time-consuming compulsive behaviors lead to significant impairment in daily life.

An OCD patient can suffer either from washing or checking symptoms or from both. Thus, for instance, an OCD patient may score higher on the washing dimension and lower on the checking dimension (or vice versa or even on both dimensions to a similar degree). As obsessive-compulsive disorder symptoms vary on a continuum of severity, categorical attempts to classify OCD patients according to distinct subgroups of non-overlapping symptoms have been criticized (Leckman, Mataix-Cols, & do Rosario-Campos, 2005). Nevertheless, in several studies OCD researchers compared washers with checkers (Horesh, Dolberg, Kirschenbaum-Aviner, & Kotler, 1997; Khanna & Mukherjee, 1992 Rasmussen & Eisen, 1989). In our review, we will use 'symptom dimensions' as a superordinate term referring to 'checkers' as OCD patients either with exclusive checking symptoms or with predominant checking symptoms amongst multiple OCD symptoms, whereas we regard 'washers' as OCD patients either with exclusive washing symptoms or with predominant washing symptoms amongst multiple OCD symptoms.

Studies in various fields of research such as genetic, neuroimaging and treatment studies provided evidence of the washing and the checking symptom dimension in OCD symptomatology. Factor analyses of symptom scales such as the symptom checklist of the Yale-Brown Obsessive Compulsive Scale (Y-BOCS; Goodman, Price, Rasmussen, & Mazure, 1989) and self-report measures such as the Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002) consistently generated both the washing and checking dimensions (Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008; Foa et al., 2002; Pinto et al., 2007). The symptom dimensions are stable over the time (Mataix-Cols, Rauch et al., 2002) and across different cultures as the two dimensions have been found in Western (Leckman, Grice, Boardman, & Zhang, 1997; Mataix-Cols et al., 2005) and Asian OCD patient samples (Kim, Lee, & Kim, 2005; Matsunaga et al., 2008).

Explorative studies found specific genetic influences with regard to the contamination/washing dimension in contrast to the doubt dimension (Katerberg et al., 2010). Likewise, molecular genetic associations of the contamination/washing dimension with the serotonin transporter polymorphism have been found (Kim et al., 2005). In a large twin study, van Grootheest, Boomsma, Hettema, and Kendler (2008) reported that the contamination dimension was influenced by specific genetic and environmental factors. With respect to the checking dimension, particular genetic findings are still missing. Neuroimaging studies showed that the washing and the checking dimension differ in structural brain features as reported by van den Heuvel et al. (2009). The authors found that the washing dimension correlated negatively with gray matter volume in the bilateral dorsal nucleus caudatus, while the checking dimension correlated negatively with gray matter and white matter volumes of both temporal lobes.

Results from a functional magnetic resonance imaging (fMRI) study using a symptom provocation paradigm revealed that the contamination/washing dimension was related to increased cerebral activation in prefrontal brain regions and the right nucleus caudatus, whereas the checking dimension was related to increased activation in the putamen and thalamus (Mataix-Cols et al., 2004). In a recent fMRI study also applying a symptom provocation paradigm, Murayama et al. (2013) reported that checking rituals were associated with subcortical brain regions such as the nucleus caudatus and anterior cingulate cortex, whereas washing rituals were associated with large cortical brain regions including the cerebellum.

The OCD symptom dimensions also vary with regard to comorbidity and treatment response. Patients with predominant washing symptoms seem to be at increased risk of eating disorders whereas patients with predominant checking behavior and aggressive obsessions are at higher risk for comorbid major depression and generalized anxiety disorder (Hasler et al., 2005). The OCD symptom dimensions are regarded as predictors of treatment response to serotonin reuptake inhibitors (Mataix-Cols, Rauch, Manzo, Jenike, & Baer, 1999) and cognitive behavioral therapy (Mataix-Cols, Marks, Greist, Kobak, & Baer, 2002), since patients with predominant washing symptoms need more therapy sessions when they primarily feel disgust compared to checkers as stated in the review by Williams, Mugno, Franklin, and Faber (2013). Although these prior studies provide evidence that OCD patients with either predominant washing or checking symptoms differ from each other in genetic, structural and functional neurobiological features as well as in comorbidity and treatment response, it remains unclear whether they also differ in their neuropsychological functioning.

Neuropsychological research of OCD in general draws a heterogeneous picture. Two recent meta-analyses reported that OCD patients exhibited significant but moderate deficits in the domains of attention (Abramovitch, Abramowitz, & Mittelman, 2013), executive functions, verbal and nonverbal memory, visuospatial abilities, processing speed, and working memory compared to healthy controls (Abramovitch et al., 2013; Shin, Lee, Kim, & Kwon, 2014). In a critical review, Kuelz, Hohagen, and Voderholzer (2004) reported visuospatial memory deficits and using more complex tasks, also verbal memory deficits in OCD, both presumably due to underlying encoding deficits. Findings regarding attention and executive functions were somewhat contradictory across the included studies: Kuelz et al. (2004) reported that sustained attention seemed to be unaffected. Moreover, some studies found impaired set shifting abilities in the WCST, whereas other studies did not (Kuelz et al., 2004). However, a substantial part of research did not find significant differences in neuropsychological performance between OCD patients and healthy participants in response inhibition (Moritz et al., 2008), set shifting (Abbruzzese, Ferri, & Scarone, 1995; Simpson et al., 2006), verbal memory (Moritz, Kloss, von Eckstaedt, & Jelinek, 2009) and nonverbal memory (Moritz, Kloss et al., 2009; Simpson et al., 2006). In summary, the presented outcomes regarding possible neuropsychological deficits in OCD patients are inconsistent.

A different conceptualization of OCD symptomatology may bring light into the divergent findings in neuropsychological research. Based on the outcome of their meta-analysis, Abramovitch et al. (2013) suggested considering the symptomatic heterogeneity of OCD in order to find out whether differences in subsamples moderate cognitive performance and whether symptom heterogeneity in the OCD samples accounts for the underestimation of cognitive deficits in OCD patients in general. While none of the aforementioned reviews considered any of the OCD symptom dimensions, two systematic reviews took at least the checking dimension into account. First, Woods, Vevea, Chambless, and Bayen (2002) found significant medium effect sizes for visual free recall, verbal cued recall and recall of actions, and significant small effect sizes for verbal free recall, visual recognition and working memory, indicating moderate memory impairment of checkers compared to non-checkers. Second, as a result of their