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The associations between childhood trauma, neuroticism and comorbid obsessive-compulsive symptoms in patients with psychotic disorders

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ABSTRACT

Various studies reported remarkably high prevalence rates of obsessive-compulsive symptoms (OCS) in patients with a psychotic disorder. Little is known about the pathogenesis of this co-occurrence. The current study aimed to investigate the contribution of shared underlying risk factors, such as childhood trauma and neuroticism, to the onset and course of OCS in patients with psychosis. Data were retrieved from 161 patients with psychosis included in the 'Genetic Risk and Outcome in Psychosis' project. Patients completed measures of OCS and psychotic symptoms at study entrance and three years later. Additionally, childhood maltreatment and neuroticism were assessed. Between-group comparisons revealed increased neuroticism and positive symptoms in patients who reported comorbid OCS compared to OCS-free patients. Subsequent mediation analyses suggested a small effect of childhood abuse on comorbid OCS severity at baseline, which was mediated by positive symptom severity. Additionally, results showed a mediating effect of neuroticism as well as a moderating effect of positive symptoms on the course of OCS severity over time. OCS severity in patients with psychosis might thus be associated with common vulnerability factors, such as childhood abuse and neuroticism. Furthermore, the severity of positive symptoms might be associated with more severe or persistent comorbid OCS.

1. Introduction

Since the early twentieth century, remarkably high prevalence rates of obsessive-compulsive symptoms (OCS) in individuals suffering from psychosis have been reported (de Haan et al., 2015). Recent meta-analyses revealed that approximately 30% of individuals diagnosed with a psychotic disorder suffer from OCS, while 12% fulfill the diagnostic criteria of obsessive-compulsive disorder [OCD, (Swets et al., 2014)]. The presence of comorbid OCS in psychotic patients has been related to several psychopathological characteristics, including neuropsychological impairments (Berman et al., 1998; Schirmbeck et al., 2013; Whitney et al., 2004), elevated risk for depression and greater suicidality (de Haan et al., 2013; Sevincok et al., 2007; Szmulewicz et al., 2015), reduced (premorbid) daily life functioning (Berman et al., 1998; de Haan et al., 2013; Tonna et al., 2015) and poor treatment outcome (Minichiello et al., 1987). Furthermore, a meta-analysis revealed positive associations between the severity of comorbid OCS and both positive (hallucinations and delusions) and negative symptoms [apathy, social/emotional withdrawal and reduced expressiveness, (Cunill et al., 2009)].

Previous studies provided diverse theoretical explanations for the marked comorbidity between OCS and psychotic symptoms (de Haan et al., 2015; Rosen, 1957). Initially, studies emphasized the role of ambiguous and partly overlapping diagnostic criteria and proposed that delusions might arise when obsessions no longer succeed as a dysfunctional attempt to cope with environmental stress (Rosen, 1957). In contrast, more recent studies suggest that obsessions and delusions represent distinct symptoms, which can be distinguished based on the individual's attribution, certainty and insight as well as on the content and course of the symptoms (de Haan et al., 2015). A possible account for the co-occurrence of psychotic disorders and OCS concerns the notion of shared intra-individual and environmental risk factors (de Haan et al., 2015; Kahn et al., 2005; Klein Hofmeijer-Sevink et al., 2013). For instance, increased neuroticism (reflected by high levels of irritability, anxiety and hostility; also referred to as negative affectivity) was consistently related to psychosis (Krabbendam et al., 2002; van Os

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and Jones, 2001), OCD (Askland et al., 2015; Bienvenu et al., 2004; Fullana et al., 2004; Wu et al., 2006) and the comorbidity of these disorders (Klein Hofmeijer-Sevink et al., 2013). In agreement, an earlier cross-sectional investigation of our group revealed increased neuroticism levels in patients with comorbid psychosis and OCS relative to patients without co-occurring OCS (Schirmbeck et al., 2015). Besides neuroticism, earlier studies implicated self-reported childhood maltreatment as a risk factor for both psychosis (Read et al., 2005) and OCD (Briggs and Price, 2009; De Silva and Marks, 1999; Mathews et al., 2008). The etiological role of childhood trauma in OCD and psychosis was supported by the finding that both OCS (De Silva and Marks, 1999) and hallucinations (Read et al., 2005) might be reminiscent of specific traumatic experiences. Hence, the comorbidity of OCS and psychosis might be partly attributable to individual differences in neuroticism and adverse childhood experiences.

The present study aimed to explore the relation between childhood maltreatment, negative affectivity and the course of comorbid obsessive-compulsive symptoms in individuals diagnosed with a psychotic disorder over a three year period. In line with the notion that common risk factors might account for the comorbidity observed among psychiatric disorders, we hypothesized positive associations between childhood trauma and neuroticism and the severity of obsessive-compulsive symptoms.

2. Methods

2.1. Study design and participants

Data were retrieved from the Dutch Genetic Risk and Outcome in Psychosis (GROUP) study, which prospectively investigated vulnerability and resilience factors involved in the course of psychosis in patients, their first-degree relatives and controls (Korver et al., 2012). For detailed information concerning study design, participants and assessments we refer to Korver et al. (Korver et al., 2012). Patients were recruited from mental health care institutions across the Netherlands and were included if they met the DSM-IV criteria for a non-affective psychotic disorder, which was assessed with the Comprehensive Assessment of Symptoms and History [CASH; (Andreasen and Flaum, 1992)] or the Schedules for Clinical Assessment of Neuropsychiatry version 2.1 [SCAN; (Wing et al., 1990)]. All participants were between 16 and 50 years old, were required to have a good command of the Dutch language and were willing to provide informed consent.

Upon inclusion, questionnaires were administrated in a semi-structured manner by trained investigators. In order to examine the course of comorbid OCS over time, measures of OCS severity and psychotic symptoms were repeatedly assessed at baseline (T1) and three years later (T2). In contrast, estimates of childhood trauma and neuroticism were assessed once per individual (childhood trauma: T1 or T2; neuroticism: T2). Similar to childhood trauma, which is intrinsically time-independent, neuroticism was assumed to reflect a relatively stable trait (Costa and McCrae, 1992b). The study was approved by the Medical Ethical Committee of the University Medical Center Utrecht, the Netherlands.

2.2. Clinical assessments

OCS were assessed with the Dutch version of the Yale-Brown Obsessive-Compulsive Scale [Y-BOCS; (Goodman et al., 1989)]. The Y-BOCS evaluates the time spent on, interference from, distress from, resistance against and control over OCS during the previous week, yielding a total score ranging from 0 to 40. Earlier studies demonstrated that the Y-BOCS provides reliable estimates of OCS in patients with psychotic disorders (Boyette et al., 2011; de Haan et al., 2006). Childhood trauma and neuroticism were measured by Dutch versions of the Childhood Trauma Questionnaire [CTQ; (Bernstein and Fink, 1998)] and the Neuroticism-Extraversion-Openness Five-Factor Inventory [NEO-FFI; (Costa and McCrae, 1992a)], respectively. The CTQ consists of two subscales, reflecting abuse (emotional, physical or sexual) and neglect (physical or emotional). The reliability of the CTQ has been confirmed in community samples (Scher et al., 2001) as well as patients diagnosed with schizophrenia (Kim et al., 2013). The neuroticism scale of the NEO-FFI was used as a measure of negative affectivity (Costa and McCrae, 1992b; Lahey, 2009). In the general population as well as in patients diagnosed with schizophrenia, the NEO-FFI has been shown to encompass good construct validity and reliability (Bagby et al., 1999; Robins et al., 2001). Finally, the positive and negative symptoms subscales of the Positive and Negative Syndrome Scale [PANSS; (Kay et al., 1987)] were used to assess the severity of symptoms of schizophrenia. Both positive and negative subscales contain 7 items which are scored on a 7-point Likert-scale, resulting in total scores ranging from 7 to 49 (Kay et al., 1987).

2.3. Statistical analyses

In order to explore the characteristics that distinguished subjects without comorbid obsessions or compulsions (Y-BOCS = 0) to those who demonstrated (sub)clinical comorbid OCS (Y-BOCS > 0), independent *t*-tests were conducted both at T1 and T2. Pearson bivariate correlations between childhood maltreatment, neuroticism, psychotic symptoms and OCS ratings were analyzed. Variables that appeared to be associated to OCS severity were further examined in serial mediation analyses. Specifically, we explored the associations between potential predictors and comorbid OCS severity at T1 and T2. These analyses were conducted using the Process macro offered by A.F. Hayes, which returns parameter estimates of direct and indirect effects based on bootstrapping (Hayes, 2013). The number of samples used for bootstrapping was set to 10,000. Notably, the Process macro automatically assessed whether the assumption of homogeneity of slopes was violated by testing the interaction effect of the predictor and the mediator on the outcome. In case this interaction proved statistically significant, the associated variable was considered a moderator rather than a mediator, which is in agreement with the recommendations of Hayes and Preacher (Hayes and Preacher, 2014). All statistical analyses were conducted using SPSS (version 19.0), with alpha set to 0.05.

3. Results

3.1. Sociodemographic and clinical sample characteristics

Removal of subjects with missing data resulted in a sample of 161 patients, who are described in Table 1.

3.2. Between-group comparisons

Independent *t*-tests were conducted to compare the severity of childhood maltreatment, neuroticism and symptoms of psychosis between patients who reported no OCS and patients who demonstrated obsessions or compulsions. The latter group suffered from relatively mild OCS, with mean Y-BOCS scores of 10.41 (T1, std. 5.52) and 9.67 (T2, std. 5.13), respectively. Correspondingly, only 7 (T1, 4.3%) and 5 (T2; 3.1%) patients reported Y-BOCS scores higher than 15, indicating that patients with comorbid OCS were unlikely to meet the criteria for a diagnosis of OCD (Swets et al., 2014).

Table 2 shows that individuals who experienced OCS at T1 additionally presented more positive symptoms ($t_{(159)} = 3.18$, $d = 0.58$) compared to individuals without OCS. In contrast, estimates of negative symptom severity, childhood trauma and neuroticism were similar between patients with and without comorbid OCS. Regarding sociodemographic and clinical measures, between-group comparisons indicated that the presence of comorbid OCS was unrelated to illness duration, age of onset, gender, age, ethnicity, diagnosis, history of cannabis abuse or dependence or medication status (clozapine/olanza-

Table 1
Sociodemographic and clinical characteristics of the sample ($n=161$).

Gender (%)	Male	133	(82.6)
	Female	28	(17.4)
Age in years (std.)		28.2	(7.8)
Ethnicity (%)	Caucasian	129	(84.8)
	Other[a]	28	(17.4)
	Unknown	4	(2.5)
Diagnosis (%)	Schizophrenia	105	(65.2)
	Schizoaffective disorder	21	(13.0)
	Psychotic disorder	23	(14.3)
	Schizophreniform disorder	5	(3.1)
	Other[b]	4	(2.5)
	Unknown	3	(1.9)
Age of onset in years (std.)		23.8	(7.0)
Illness duration in years (std.)		4.5	(4.9)
Medication status at T1; T2 (%)[c]	Olanzapine and/or clozapine	65; 61	(40.4; 37.9)
	Other second-generation antipsychotics	58; 50	(36.0; 31.1)
	First-generation antipsychotics	4; 12	(2.5; 7.5)
	No antipsychotics or unknown	30; 38	(21.1; 23.6)

Abbreviations: std.: standard deviation.
[a] Including Moroccan, Surinamese, Turkish, and mixed ethnicity.
[b] Including delusional disorder and polysubstance dependence.
[c] Patients who used more than one category of antipsychotics ($n=50$ and 53, respectively) were included in the category for which earlier studies (summarized in de Haan et al., 2015, pp. 147–167) provided most conclusive results concerning its relation with comorbid OCS (sequentially: olanzapine and/or clozapine; other second-generation antipsychotics, including aripiprazole, quetiapine, risperidone, sertindol; first-generation antipsychotics, including broomperidol, chloorproxiteen, pimozide, penfluridol, haloperidol, perfenazine, zuclopentixol; no antipsychotics or unknown).

pine vs. other second-generation antipsychotics vs. first-generation antipsychotics).

At T2, subjects with OCS again reported more positive symptoms ($t_{(159)}=4.55$, $d=0.78$) relative to subjects without OCS (Table 2). Furthermore, there were significant differences between both groups in neuroticism ($t_{(159)}=3.58$, $d=0.65$, Table 2). Other measures, including negative symptoms and estimates of childhood trauma, did not distinguish subjects with OCS from those without OCS. Additionally, the manifestation of comorbid OCS was unrelated to gender, age, ethnicity, diagnosis, age of onset, illness duration, history of cannabis abuse or dependence or medication status.

3.3. Bivariate correlations between measures related to the presence of comorbid OCS

Correlation analyses were performed to investigate the associations between comorbid OCS severity, symptoms of psychosis, neuroticism and childhood trauma (Table 3). Results indicated significant positive correlations between Y-BOCS scores and positive symptoms both at T1 ($P < 0.005$) and at T2 ($P < 0.001$, Table 3). Additionally, initial OCS measures were related to the severity of childhood abuse ($P < 0.005$) while OCS measures obtained at T2 correlated with neuroticism levels ($P < 0.01$). Negative symptoms and childhood neglect were not associated with comorbid OCS severity.

Table 3
Bivariate correlations between psychopathological variables.

	OCS (T1)	OCS (T2)
OCS (T2)	0.45***	
Neuroticism	0.15	0.21**
Childhood abuse	0.23**	0.14
Childhood neglect	−0.07	−0.05
Positive symptoms (T1)	0.25**	0.34***
Positive symptoms (T2)	0.14	0.34***
Negative symptoms (T1)	0.07	0.15
Negative symptoms (T2)	−0.04	0.04

Abbreviations: OCS: obsessive-compulsive symptoms.
** $P < 0.01$.
*** $P < 0.001$.

3.4. Mediation analyses

In order to further explore the reported associations between childhood trauma, neuroticism, and psychopathological symptoms, serial mediation analyses were conducted. Based on correlation analyses, we hypothesized that OCS severity at T1 might be predicted by both childhood abuse and positive symptoms. Given the marked association between these variables ($r=0.22$; $P < 0.01$), positive symptoms were hypothesized to mediate the relation between childhood abuse and comorbid OCS severity. With respect to OCS estimates at T2, individual differences in neuroticism and positive symptoms along with initial OCS ratings were selected as predictors. Specifically, neuroticism and positive symptoms were hypothesized to mediate the relation between OCS estimates at T1 and T2.

Primary mediation analyses concerned the effects of childhood abuse and positive symptom severity on comorbid OCS at T1. No significant interaction effect of childhood abuse and positive symptoms on OCS ratings ($F_{(1157)}=3.02$, $P=0.08$, partial $\eta^2=0.02$) were found. Consequentially, positive symptoms were regarded as a mediator in the association between childhood abuse and OCS severity. This was confirmed by subsequent analyses, which showed significant direct effects of both childhood abuse ($F_{(1158)}=5.30$, $P=0.02$, partial $\eta^2=0.03$) and positive symptoms ($F_{(1158)}=6.99$, $P < 0.01$, partial $\eta^2=0.04$) on OCS estimates (Fig. 1). Additionally, we found an indirect effect of childhood abuse on OCS ratings via positive symptoms that accounted for approximately 20% of the total effect (Fig. 1). Together,

Table 2
Comparison of psychopathological variables between patients with psychosis with and without comorbid OCS at T1 and T2.

	T1, mean (std.)					T2, mean (std.)				
	OCS ($n=44$)		No OCS ($n=117$)		Sig.[a]	OCS ($n=43$)		No OCS ($n=118$)		Sig.[a]
PANSS										
Positive	15.64	(5.12)	12.46	(5.83)	< 0.005	13.63	(4.46)	10.37	(3.84)	< 0.001
Negative	15.59	(4.97)	14.50	(5.98)	0.28	12.56	(4.41)	11.81	(5.42)	0.42
CTQ										
Abuse	4.50	(1.53)	4.14	(1.39)	0.16	4.45	(1.35)	4.16	(1.46)	0.27
Neglect	3.67	(1.19)	3.68	(1.04)	0.94	3.57	(0.92)	3.72	(1.13)	0.46
NEO-FFI										
Neuroticism	36.09	(7.48)	34.65	(9.09)	0.35	38.95	(7.94)	33.62	(8.53)	< 0.001

Abbreviations: CTQ: Childhood Trauma Questionnaire; NEO-FFI: Neuroticism-Extraversion-Openness Five-Factor Inventory; OCS: obsessive-compulsive symptoms; PANSS: Positive and Negative Syndrome Scale; std.: standard deviation.
[a] The P-value obtained from independent *t*-tests.

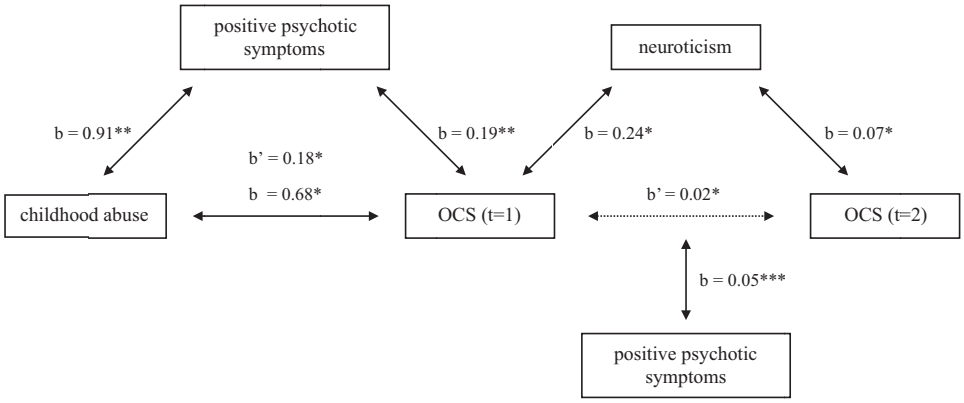

Fig. 1. Effects of childhood abuse, neuroticism and positive symptoms on comorbid obsessive-compulsive symptoms (OCS) at T1 and T2. Individual coefficients refer to the estimates of direct (b) and indirect (b′) effects derived from mediation analyses. The non-continuous arrow between OCS (T1) and OCS (T2) denotes that the direct effect of OCS at T1 on OCS at T2 was not statistically significant. All effects were small in size, with partial η^2 ranging from 0.02 to 0.09. *$P < 0.05$; **$P < 0.005$; ***$P < 0.001$.

childhood abuse and positive symptoms explained 9% of the variability in OCS estimates ($R^2 = 0.09$).

Secondary mediation analyses, which concerned the course of OCS over time, revealed a significant interaction effect between OCS ratings (T1) and positive symptoms ($F_{(1156)} = 15.14$, $P < 0.001$, partial $\eta^2 = 0.09$). In contrast, there was no interaction effect between OCS severity and neuroticism scores ($F_{(1156)} = 1.17$, $P = 0.28$, partial $\eta^2 = 0.01$). These findings were considered suggestive of moderating effects of positive symptoms together with mediating effects of neuroticism on the course of OCS. In accordance, subsequent mediation analyses showed a small but significant indirect effect of OCS estimates acquired at T1 on OCS estimates at T2 via neuroticism (Fig. 1). Further, we found a significant moderating effect of positive symptoms on the course of OCS (Fig. 1). The direct relation between OCS scores at both time points established earlier (Table 3) was not statistically significant after accounting for the mediating and moderating effects of neuroticism and positive symptoms ($b = -0.26$, $se_b = 0.17$, $F_{(1156)} = 3.32$, $P = 0.13$, partial $\eta^2 = 0.02$). Finally, initial OCS estimates, neuroticism and positive symptoms accounted for slightly more than a third of the variability in OCS severity assessed at T2 ($R^2 = 0.36$).

4. Discussion

This study investigated the effects of childhood maltreatment, neuroticism and psychotic symptoms on the severity of comorbid OCS in patients with psychotic disorder. Between-group comparisons indicated that the presence of comorbid OCS was related to increased positive symptom severity. Additionally, patients with comorbid OCS reported increased neuroticism levels compared to OCS-free patients at follow-up. Correlation analyses, in which continuous measures of OCS severity were analyzed, revealed significant positive associations between estimates of OCS severity, positive symptoms, neuroticism and childhood abuse. Serial mediation analyses elaborated these findings by indicating a mediating effect of positive symptoms in the association between childhood abuse and initial OCS severity. Moreover, individual differences in neuroticism partially accounted for the association between OCS at T1 and T2, which was particularly pronounced in patients with relatively severe positive symptoms. Taken together, the findings obtained by the present study confirm the hypothesis that risk factors commonly related to both OCD and psychotic disorders might be involved in the comorbidity of these disorders.

While the association between neuroticism and comorbid OCS was revealed by both between-group comparisons and correlation analyses, the effect of childhood abuse was limited to continuous (as opposed to categorical) measures of OCS. Similar findings were reported by Cunill et al., who demonstrated an association between symptoms of psychosis and comorbid OCS severity for continuous, but not categorical, OCS ratings (Cunill et al., 2009). These authors concluded that a dimensional conceptualization of the obsessive-compulsive schizophrenia spectrum might be preferable to the categorical definition. Irrespective of phenomenological perspective, results yielded no associations between negative symptoms and childhood neglect and comorbid OCS severity. This finding might imply distinct effects of specific psychotic symptom dimensions and childhood trauma on OCS severity. Alternatively, the relation between comorbid OCS and psychopathological characteristics might be affected by the nature or severity of obsessions, patient characteristics or medication status (Cunill et al., 2009; de Haan et al., 2015; Guillem et al., 2009). For instance, Lysaker *et al.* suggested that individuals with co-occurring psychosis and OCS might be categorized in two distinct subgroups based on negative symptom severity and social functioning (Lysaker et al., 2006). Further studies might investigate whether such subgroups are present and whether they vary with respect to the relation between symptoms of psychosis and OCS.

In summary, the current study revealed modest yet significant associations between childhood abuse and neuroticism and comorbid OCS severity in patients with psychosis, which appeared to be influenced by the severity of positive symptoms. It is noteworthy that childhood trauma and neuroticism have been implicated as risk factors in a variety of psychiatric disorders and deleterious outcomes, suggesting that their effects are far from specific (Kessler et al., 2010; Lahey, 2009; McMahon et al., 2003). Rather, childhood abuse and negative affectivity might constitute characteristics that reflect vulnerability to psychopathological symptoms in general. Thus, childhood abuse and neuroticism might predispose individuals to more severe psychopathology, corroborated by increased comorbid OCS severity as well as elevated positive symptoms.

4.1. Pathways by which childhood trauma and neuroticism might affect comorbid OCS

The mechanisms by which patients' vulnerability to comorbid OCS is affected by childhood maltreatment, remain speculative. Earlier studies proposed an avoidant attachment style, distorted emotional processing (Carpenter and Chung, 2011), the presence of recurrent intrusive thoughts or flashbacks, dissociative symptoms (De Silva and Marks, 1999; Read et al., 2005), maladaptive cognitive schemas (Briggs and Price, 2009; Read et al., 2005) and dysfunctional coping strategies (Briggs and Price, 2009; Mathews et al., 2008) as potential mediators in the association between adverse childhood experiences and OCS and psychosis.

For instance, traumatic experiences during childhood might trigger feelings of anxiety and hopelessness along with cognitive schemas that emphasize the unpredictability of the environment, one's vulnerability to danger and the concurrent desire for control (Briggs and Price, 2009; Lysaker et al., 2007; Read et al., 2005). Additionally, childhood trauma might reinforce passive coping styles, characterized by ignoring problems or resigning in one's faith (Lysaker et al., 2007). Collectively, these traits might increase one's vulnerability for symptoms of psychosis as well as OCS.

Notably, cognitive models describing the etiological role of neuroticism in psychopathology proposed similar mediators, including uncertainty intolerance, anxiety sensitivity (Sexton et al., 2003), fear of losing control (Barlow et al., 2014; Krabbendam et al., 2002; Pfaltz et al., 2015), thought suppression, tendency to worry and brooding (Barlow et al., 2014; Pfaltz et al., 2015) and inefficient coping (Lahey, 2009; Lysaker et al., 2003; van Os and Jones, 2001). In short, high levels of neuroticism appear to negatively affect the ability to adapt and respond to everyday challenges. A predisposition to experience anxiety along with avoidant responses in face of stress might cause emotional discomfort and global malfunctioning. These features might precipitate both psychosis and OCS. Intriguingly, the latter might initially serve to compensate for the adverse psychological consequences of symptoms of psychosis. In agreement, several studies showed beneficial effects of mild comorbid OCS on global functioning in patients with psychosis (Tonna et al., 2015, 2016; Üçok et al., 2011). As the severity of OCS increases, however, its co-occurrence with symptoms of psychosis implies a negative prognosis (de Haan et al., 2013; Üçok et al., 2011).

It is noteworthy that these accounts conceptualize neuroticism and related cognitive schemas as relatively stable traits. In contrast, pathoplastic or scar models of personality and psychopathologies propose a bidirectional relation between neuroticism and psychopathological symptoms. Such models implicate that OCS at study entrance might catalyze neurotic tendencies, which in turn exacerbate OCS estimates acquired at follow-up (Barlow et al., 2014; Bienvenu et al., 2004; Schirmbeck et al., 2015). In order to verify such models, studies with longitudinal personality and psychopathology assessments are required.

4.2. Clinical implications

The possible role of childhood abuse and neuroticism in the manifestation of OCS in patients suffering from psychosis established in the present study conveys several clinical implications. First, the presence of childhood trauma and high levels of neuroticism should be acknowledged as non-specific risk factors which might be predictive of more severe or persistent psychopathological symptoms (Barlow et al., 2014; Kessler et al., 2010; Lahey, 2009; Read et al., 2005). Additionally, patients with psychosis and comorbid OCS may benefit from treatment that targets the attributes hypothesized to be involved in the associations between childhood abuse, neuroticism and OCS severity, such as maladaptive coping strategies.

4.3. Limitations and future directions

The most prominent limitation of the current study concerns the rather long assessment interval of three years, which challenged the longitudinal interpretation of our findings. By exploring the course of psychopathological symptoms on a more detailed time scale, future studies might provide insight in the role of childhood trauma and personality characteristics in transient alterations in psychopathological symptom severity. Such insight might be valuable both from scientific and clinical perspectives. A second limitation involves the relatively low estimated prevalence of clinical diagnoses of OCD (3–4%), which compromised the generalizability of the current findings and might have resulted in underestimated associations between childhood trauma, neuroticism and comorbid OCS. A third limitation is the cross-sectional structure of neuroticism assessments, which impeded validation of the hypothesized stability of this construct. The notion that neuroticism levels (assessed at T2) might fluctuate implies that our results might have been biased towards stronger associations between neuroticism and psychopathological symptoms at T2 compared to T1. However, Boyette et al. denoted a marked long-term stability of neuroticism estimates in patients with psychosis, which argues against a biasing effect of assessment time (Boyette et al., 2015). Future studies with longitudinal personality assessments might enhance our understanding of the relation between neuroticism levels and comorbid OCS severity. Additionally, these studies might further explore the interplay between positive symptoms and comorbid OCS. The present study revealed both mediating and moderating effects of positive symptoms on comorbid OCS severity, yet the implication of these findings remains inconclusive and warrants further investigation.

Given the variety of variables that have been associated with the severity or presence of OCS in psychotic individuals (Berman et al., 1998; de Haan et al., 2013; Minichiello et al., 1987; Schirmbeck et al., 2013; Sevincok et al., 2007; Szmulewicz et al., 2015; Tonna et al., 2015; Whitney et al., 2004) along with the correlations among risk factors (Lahey, 2009; Read et al., 2005), assessing the unique effects of individual variables on comorbid OCS severity remains challenging yet potentially inspiring from both scientific and clinical viewpoints. In order to elucidate whether the associations demonstrated in the present study result from specific pathways or general dysfunction, further research is necessary. Such research might focus on the mechanisms involved in the associations between the proposed risk factors and psychopathological symptoms by analyzing mediating factors, such as cognitive schema and coping strategies. Additionally, network analyses could reveal which symptoms or characteristics act as hubs, thereby exposing the aspects that might be central to the manifestation of OCS in patients suffering from psychosis (Borsboom and Cramer, 2013). Ultimately, insight in the factors that precipitate and exacerbate OCS in the face of psychosis might enhance our understanding in the etiology of comorbid OCS and facilitate the identification and treatment of patients who are at risk for comorbid OCS.

Declaration of interest

Authors are not aware of any conflict of interest. F. Schirmbeck was supported by a fellowship within the Postdoc Program of the German Academic Exchange Service (DAAD).

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