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4.2

ABSTRACT

Background

The high rate of obsessive-compulsive symptoms (OCS) in schizophrenia requires a pathogenic explanation. Personality traits may represent risk and resiliency factors for the development of mental disorders and their comorbidities. The aim of the present study was to explore the associations between Five-Factor Model (FFM) personality traits and the liability for OCS in patients with psychotic disorders and in their unaffected siblings, while accounting for levels of (subclinical) psychotic symptoms.

Methods

FFM personality traits, occurrence and severity of OCS and levels of (subclinical) psychotic symptoms were assessed in 208 patients with psychotic disorders and in 281 siblings. Differences in FFM personality traits between participants with vs. without comorbid OCS were examined and the predictive value of FFM traits on group categorization was evaluated, for both patients and siblings. Furthermore, associations between FFM traits and OCS severity were investigated in a dimensional approach.

Results

Patients and siblings with OCS showed significantly higher Neuroticism compared to their counterparts without OCS. Additionally, Neuroticism was positively associated with higher OCS severity and significantly predicted group assignment in both patients and in siblings. Patients with comorbid OCS also presented with lower scores on Extraversion and Conscientiousness, compared to patients without OCS.

Conclusion

Our findings suggest that especially higher Neuroticism, and to a lesser degree lower Extraversion and lower Conscientiousness might increase the risk of patients with a psychotic disorder to develop co-occurring OCS. Future prospective studies are needed to elucidate proposed personality-psychopathology interrelations and possible mediating factors.

1. INTRODUCTION

Compared to individuals from the general population, patients with schizophrenia have an enhanced lifetime risk of about 12% to also fulfil the criteria for obsessive-compulsive disorder (OCD) (Achim et al., 2011) and almost one of three patients experiences comorbid obsessive-compulsive symptoms (OCS) (Swets et al., 2014). The co-occurrence of OCS in patients with schizophrenia is associated with pronounced impairments and results in a higher burden of disease, poorer social and vocational functioning, longer hospitalization and a less favourable overall prognosis (Berman et al., 1995, de Haan et al., 2013, Fenton and McGlashan, 1986, Lysaker et al., 2004, Schirmbeck and Zink, 2013b).

The clinical presentation of comorbid OCS is diverse, with manifestations prior to, concurrent with or subsequent to first onset of psychosis. Prospective studies have also reported a diverse course with persisting, remitting or fluctuating OCS over time (de Haan et al., 2012, Schirmbeck and Zink, 2013b). This phenotypic heterogeneity suggests that a variety of causal factors have to be considered. Accordingly, several explanations have been proposed, ranging from the assumption that the co-expression of symptoms might represent a random association of two disorders (Berman et al., 1998, Patel et al., 2010), the concept that patients with OCS may mark a unique subgroup within the schizophrenia spectrum (Poyurovsky et al., 2012), to the proposition that comorbid OCS are induced by antipsychotic treatment, in particular clozapine (de Haan et al., 1999, Mukhopadhyaya et al., 2009, Schirmbeck et al., 2013, Schirmbeck and Zink, 2013b). The diversity of concepts highlight that progress in understanding pathogenic mechanisms is needed.

As early as 1892, Osler proposed that 'knowing the person who has the disease is as important as knowing the disease the person has' (Osler, 1892). Accordingly, longstanding, the investigation of personality traits has been utilized as an approach for explaining mental health problems. With the replication of higher order personality traits such as the Five-Factor Model (FFM), attention to personality-psychopathology relationships has increased over the last decades. Accordingly, several theoretical models have conceptualized the FFM personality traits Neuroticism, Extraversion, Agreeableness, Conscientiousness and Openness as risk and resiliency factors for the development and maintenance of mental disorders (Andersen and Bienvenu, 2011, Clark, 2005, Krueger and Tackett, 2005). Although the main focus has laid on interrelations between FFM personality traits and mood disorders, associations

with primary OCD and schizophrenia are increasingly being investigated. Higher Neuroticism and to a lesser extent lower Extraversion have been linked to both OCD (Rosellini and Brown, 2011, Samuels et al., 2000, Sexton et al., 2003, Tackett et al., 2008) and schizophrenia (Lönqvist et al., 2009, van Os and Jones, 2001). Due to the strong relation between Neuroticism and Extraversion and psychopathology across mental disorders (Andersen and Bienvenu, 2011, Kotov et al., 2010), several authors proposed that common comorbidities may partly be explained by these personality traits (Bienvenu et al., 2001, Khan et al., 2005, Klein Hofmeijer-Sevink et al., 2013). To the best of our knowledge, so far no study directly investigated associations between FFM personality traits and comorbid OCS in patients with psychotic disorders.

When investigating personality in the context of psychopathology, one faces the challenge to distinguish between personality as a vulnerability factor for psychiatric illness and the potential reverse effect of illness on personality. A useful approach in this regard is the investigation of un-affected first-degree relatives, who display an increased familial risk for the co-occurrence of psychosis and OCD (Poyurovsky et al., 2005, Swets et al., 2013), but for whom potentially confounding disease and therapy related influences are absent. Using this approach and investigating associations with psychotic symptoms, Boyette et al. recently suggested that the levels of Neuroticism increase with the level of familial risk for psychosis (Boyette et al., 2013). Based on these findings, we suggest that by including un-affected siblings more can be learned about potential associations between personality traits and a dimensional liability for the co-occurrence of psychotic disorders and obsessive-compulsive symptoms.

The main aim of the present study was to investigate differences in FFM personality traits in schizophrenia patients with vs. without comorbid OCS. Based on the assumption that especially Neuroticism and to a lesser degree Extraversion might display common vulnerability factors for schizophrenia and OCD, we hypothesized to find increased levels of Neuroticism and decreased levels of Extraversion in the comorbid OCS group. We further aimed to evaluate the association between FFM traits and OCS severity in a dimensional approach. These analyses were conducted in both patients and their un-affected siblings. To control for the potential confounding effect of depression, which is associated with both comorbid OCS (de Haan et al., 2005, Lysaker and Whitney, 2009), and FFM personality traits (Ormel et al., 2004a), we excluded patients and siblings with current depressive episodes from analyses.

2. MATERIAL AND METHODS

2.1 Study design and participants

Participants were included from the GROUP (Genetic Risk and Outcome of Psychosis) study, a Dutch longitudinal multi-center cohort study that was designed to examine vulnerability and resilience factors for variation in expression and course of non-affective psychotic disorders. Details of the GROUP study have been described elsewhere (Korver et al., 2012). A subsample of the patients and siblings, who participated in personality and OCS assessment, was included in the current study. Eligible patients fulfilled the following criteria: (1) age between 18 and 50, (2) meeting DSM-IV criteria (diagnostic and statistical manual version IV, American Psychiatric Association, 2000) for a non-affective psychotic disorder; schizophrenia, schizophreniform disorder, schizoaffective disorder, delusional disorder or psychotic disorder NOS, (3) maximum duration of illness of 10 years, (4) fluent in Dutch. Siblings were between 18 and 50 years of age and had no lifetime diagnosis of psychosis. Participants were excluded if DSM-IV criteria for a current major depressive episode were fulfilled (patients $N=51$, siblings $N=33$).

2.2 Instruments

DSM diagnoses were based on the Comprehensive Assessment of Symptoms and History (CASH) (Andreasen NC, 1992). The CASH is a widely-used semi-structured interview designed for research of the major psychoses and affective disorders.

The Yale Brown Obsessive Compulsive Scale (YBOCS) was used to assess OCS. This instrument allows the rating of compulsions and obsessions separately on a five-point Likert-scale (0-4) yielding subtotal scores ranging from 0 to 20. The YBOCS is able to reliably assess the severity of OCS in schizophrenia (Boyette et al., 2011, de Haan et al., 2006).

Current psychotic symptoms in patients with psychotic disorders were assessed with the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987). The PANSS is a widely used interview to assess the severity of symptoms of schizophrenia. Subscales measure severity of positive and negative symptoms as well as general psychopathology.

The Community Assessment of Psychic Experiences (CAPE; www.cape42.homestead.com) was used to rate self-reports of psychotic experiences in the preceding three years in siblings. The CAPE measures frequency as well as distress associated with subclinical positive, negative and depressive symptoms. In the present study we included frequency of subclinical positive and negative symptoms to analyses.

Studies using the CAPE in general population samples have shown good psychometric properties in terms of reliability and validity (Hanssen et al., 2006, Konings et al., 2006).

The Dutch version of the NEO-FFI (Costa P.T., 1992, Hoekstra, 1996) was used to rate self-reports of the FFM personality traits. Neuroticism encompasses the predisposition to experience negative affectivity and self-consciousness. Extraversion includes sociability, cheerfulness, and liveliness. Openness to experience consists of esthetic sensitivity, intellectual curiosity, and need for variety. Agreeableness incorporates trust, altruism, and sympathy, and Conscientiousness includes a strict adherence to principles and a desire to achieve goals (Costa P.T., 1992). These five traits are believed to represent basic dimensions of personality. The NEO-FFI has demonstrated satisfactory to excellent construct validity and moderate to good internal reliability in general population samples, with slightly lower Chronbach alpha's for Openness and Agreeableness (Costa P.T., 1992, Hoekstra, 1996). The factor structure and reliability of the FFM scales in patients with schizophrenia were found to be highly similar to a normative sample (Bagby et al., 1999).

2.3 Statistics

Analyses were conducted using the Statistical Package for Social Sciences (IBM SPSS version 20.0, Chicago, IL, US). Normal distribution was tested with the Kolmogorov-Smirnov-Test and not normally distributed parameters were analyzed with non-parametric tests.

Differences in sociodemographic and clinical variables between the groups with vs. without comorbid OCS (OCS+ vs. OCS-) in patients and in siblings were assessed using Chi-square tests, Mann-Whitney U tests and Student's t-tests. Furthermore, one-way between group multivariate analysis of variance (MANOVA) were performed to investigate differences in the levels of FFM traits. Partial eta-squares were calculated to indicate effect-size of group differences. To account for possible effects of subclinical and clinical psychotic symptoms, covariance analyses (MANCOVA) were performed. In a dimensional approach non-parametric Spearman's rho correlation analyses between FFM subscale scores and OCS severity were separately calculated for patients and for siblings. Again partial correlation analyses investigated potential confounding effects of subclinical and clinical psychotic symptoms. Logistic regression analyses were performed to investigate the predictive value of the five FFM traits, to OCS+ versus OCS- group assignment in patients and in siblings. Finally, within patients, an a posteriori logistic regression analysis was conducted to evaluate additive predictive values of the level of Neuroticism, severity of psychosis (PANSS positive score) and treatment with vs. without clozapine to group assignment.

3. RESULTS

3.1 Sample characteristics

The total sample consisted of 208 patients and 281 siblings. Herein, 52 (25%) patients and 32 (11.4%) siblings presented with OCS. Group comparisons between patients with (OCS+) and without OCS (OCS-) revealed no significant differences in terms of age, gender, ethnicity, duration of illness, education or estimated total IQ. Whereas the two patients groups did not differ on PANSS negative symptoms, OCS+ patients showed significantly more severe positive symptoms and higher scores on the general psychopathology (GPP) subscale (Table 1).

The OCS+ and OCS- sibling groups did also not significantly differ in age, gender, ethnicity, education or estimated total IQ, but OCS+ siblings reported more severe subclinical positive and negative symptoms according to the CAPE (Table 2).

Table 1. Between-group differences in socio-demographic and clinical characteristics in patients

	OCS+ (N = 52)	OCS- (N = 156)	Between-group differences
<i>Sociodemographics</i>			
Age	29.1 ± 6.5	31.3 ± 7.8	t = 1.85, n.s.
Male/female ratio	44 : 8	127 : 29	$\chi^2 = 0.28$, n.s.
Duration of illness (years)	7.2 ± 4.1	6.8 ± 4.9	t = -0.44, n.s.
Ethnicity (Caucasian yes/no)	37 : 15	127 : 29	$\chi^2 = 2.46$, n.s.
Estimated intelligence (IQ)	100.5 ± 16.2	98.6 ± 15.8	t = 0.75, n.s.
<i>Treatment with clozapine (yes/no)</i>	17/30	26/99	$\chi^2 = 4.30$, p = 0.038
<i>Y-BOCS</i>			
Obsessions subscale	5.1 ± 4.8	0 ± 0	Z = 6.106, p < 0.001
Compulsions subscale	4.1 ± 3.8	0 ± 0	Z = 3.938, p < 0.001
Total	9.6 ± 5.5	0 ± 0	Z = 4.112, p < 0.001
<i>PANSS</i>			
Positive Scale	13.1 ± 4.6	10.2 ± 3.4	t = -3.977, p < 0.001
Negative Scale	13.3 ± 5.6	12.3 ± 5.8	t = -1.042, n.s.
General Psychopathology	27.3 ± 6.6	22.8 ± 6.0	t = -4.337, p < 0.001

Abbreviations: OCS: obsessive-compulsive symptoms; PANSS: Positive and Negative Symptom Scale; YBOCS: Yale Brown Obsessive Compulsive Scale

Table 2. Between-group differences in socio-demographic and clinical characteristics in siblings

	OCS+ (N = 32)	OCS- (N = 249)	Between-group differences
<i>Sociodemographics</i>			
Age	31.8 ±8.1	31.0 ±8.7	t = -0.489, n.s.
Male/female ratio	13 : 19	112 : 137	$\chi^2 = 0.218$, n.s.
Ethnicity (Caucasian y/n)	31 : 1	215 : 34	$\chi^2 = 2.883$, n.s.
Estimated intelligence (IQ)	107.4 ±17.2	107.4 ±16.2	t = -0.003, n.s.
<i>Y-BOCS</i>			
Obsessions subscale	1.7 ±3.3	0 ±0	Z = -16.666 p < 0.001
Compulsions subscale	4.0 ±2.4	0 ±0	Z = -8.118 p < 0.001
Total	5.7 ±3.7	0 ±0	Z = -15.123 p < 0.001
<i>CAPE</i>			
Positive Scale	0.2 ±0.2	0.1 ±0.1	t = -2.426 p = 0.021
Negative Scale	0.7 ±0.4	0.4 ±0.3	t = -3.813 p < 0.001
Depressive Scale	0.6 ±0.4	0.5 ±0.4	t = -1.757 n.s.

Abbreviations: CAPE: Community Assessment of Psychic Experiences; OCS: obsessive-compulsive symptoms; YBOCS: Yale Brown Obsessive Compulsive Scale

3.2 Group differences in FFM traits

Differences in FFM traits between participants with vs. without OCS were analyzed in patients and in siblings using MANOVAs. Analysis within patients revealed significant differences on three FFM personality traits with higher scores in the OCS+ group on Neuroticism ($p < 0.001$), and lower scores on Extraversion ($p = 0.005$), and Conscientiousness ($p = 0.001$) (see Table 3). Subsequent MANCOVAs, including PANSS positive symptoms as covariates were calculated. All group differences remained significant (Table 3).

Between group comparisons within siblings also revealed significant differences on three of the five personality traits with higher scores in the OCS+ group on Neuroticism ($p = 0.001$), and Openness ($p = 0.037$), and lower scores on Extraversion ($p = 0.005$) (Table 3). When including CAPE positive scores in a subsequent covariance analyses, only Neuroticism ($p = 0.046$) remained statistically significant, Extraversion was reduced to a trend ($p = 0.090$) (Table 3).

Table 3. Between group-differences in FFM traits

Group ¹	OCS+	OCS-	Between group		Between group	
			MANOVA	ηp^2	MANCOVA*	ηp^2
N	P 39.2 ±7.2	33.4 ±8.1	$F = 21.188, p < 0.001$	.093	$F = 14.622, p < 0.001$	.069
	S 32.1 ±9.6	27.5 ±7.4	$F = 10.448, p = 0.001$	.036	$F = 3.996, p = 0.046$	.018
E	P 35.4 ±6.8	38.4 ±6.7	$F = 8.189, p = 0.005$	.038	$F = 5.208, p = 0.024$	.026
	S 40.2 ±5.9	43.1 ±6.6	$F = 5.640, p = 0.018$	.020	$F = 2.898, p < 0.10$	.010
O	P 39.2 ±4.8	37.7 ±6.4	$F = 2.340, n.s.$	.011	$F = 1.720, n.s.$	.009
	S 40.1 ±5.8	37.9 ±5.6	$F = 4.389, p = 0.037$	.015	$F = 1.544, n.s.$	.006
A	P 41.8 ±5.6	43.2 ±5.4	$F = 2.455, n.s.$	.012	$F = 0.553, n.s.$	.003
	S 43.0 ±6.6	44.9 ±5.0	$F = 3.607, n.s.$	.013	$F = 1.092, n.s.$	.004
C	P 38.8 ±5.8	42.1 ±6.6	$F = 10.448, p = 0.001$	.047	$F = 6.463, p = 0.012$	.032
	S 44.0 ±5.5	45.0 ±5.9	$F = 0.854, n.s.$	.003	$F = 0.133, n.s.$	.000

*controlling for PANSS positive symptoms in patients and CAPE positive symptoms in siblings.

¹ P: patients, S: siblings

N: Neuroticism, E: Extraversion, O: Openness, A: Agreeableness, C: Conscientiousness

Effect size partial eta square. .01 small, .06 medium, .13 large

3.3 FFM traits and OCS severity

In a dimensional approach, Spearman's rho correlations between the FFM traits and OCS severity scores as measured with the YBOCS were calculated (Table 4). Neuroticism and Extraversion were correlated with OCS severity in both patients ($p < 0.001$; $p = 0.014$) and siblings ($p = 0.003$; $p = 0.009$), whereas Conscientiousness was only significantly associated with the YBOCS scales in patients ($p = 0.002$) and Openness ($p = 0.039$) and Agreeableness ($p = 0.030$) only in siblings.

When controlling for positive symptoms in patients, correlations between Neuroticism ($r = .20, p = 0.006$) and OCS severity remained significant. Correlations between the YBOCS total score and Extraversion ($r = -.13, p = 0.08$) as well as Conscientiousness ($r = -.13, p = 0.07$) were reduced to trends. Within siblings, only the association with Neuroticism ($r = .15, p = 0.012$) remained significant after correction for subclinical positive symptoms.

Table 4. Spearman rho correlations between the NEO-FFI and YBOCS scores in patients and siblings

	Group	N	E	O	A	C
Obsession	Patients	.231**	-.153*	.096	-.110	-.200**
	Siblings	.183**	-.161*	.123*	-.130*	-.072
Compulsion	Patients	.245***	-.124	.107	-.096	-.159*
	Siblings	.148*	-.135*	.100	-.104	-.062
Total	Patients	.303***	-.178*	.131	-.111	-.220**
	Siblings	.178**	-.156*	.123*	-.129*	-.070

N: Neuroticism, E: Extraversion, O: Openness, A: Agreeableness, and C: Conscientiousness.

* $p < 0.05$, ** $p < 0.005$, *** $p < 0.001$

Logistic regression analyses were calculated to explore the predictive values of the FFM traits on group categorization (OCS+/OCS-). Within patients and siblings Neuroticism significantly predicted group-assignment, but none of the other FFM traits significantly added to the prediction (Table 5). When adding PANSS positive symptoms to the equation in patients, the predictive value of Neuroticism ((Exp)B = 1.087, $p = 0.008$) was only slightly reduced. However, positive symptoms significantly added to the explained variance ($B = 1.180$, $p = 0.001$). In contrast, adding subclinical positive symptoms as measured with the CAPE in siblings, Neuroticism lost significance ($p > 0.05$).

3.4 A posteriori analyses

Finally, a posteriori logistic regression model within patients, with Neuroticism, severity of psychosis (PANSS positive score) and treatment with vs. without clozapine as predictors, revealed significant predictive value of all three variables on group assignment (Table 6). Goodness of fit: $\chi^2 = 36.228$, $p < 0.001$, $R^2 = .264$.

Table 5. Standard multiple regression analyses: FFM personality traits as predictors of group affiliation with vs. without OCS in patients and siblings

	Group	Unique contributors	(Exp) Beta	R^2	Test of model coefficients
OCS+/OCS-	Patients	Neuroticism	1.089, $p = 0.004$	.169	$\chi^2 = 24.176$, $p < 0.001$
	Siblings	Neuroticism	1.068, $p = 0.045$	.110	$\chi^2 = 16.041$, $p = 0.007$

Table 6. Logistic regression analysis with predictive values of Neuroticism, severity of positive symptoms and antipsychotic treatment on group assignment.

	<i>Unique contributors</i>	<i>(Exp) Beta</i>	<i>R²</i>	<i>Test of model coefficients</i>
OCS+/OCS-	Neuroticism	1.101, $p < 0.001$	.264	$\chi^2=36.228, p < 0.001$
	PANSS positive	1.174, $p = 0.001$		
	CLZ treatment	0.412, $p = 0.039$		

4. DISCUSSION

This is the first study examining associations between FFM personality traits and OCS in patients with psychotic disorders. As hypothesized, patients with co-occurring OCS showed significantly higher Neuroticism and lower Extraversion compared to patients without OCS. Accordingly, in a dimensional approach, we found higher Neuroticism to be associated with higher obsessive-compulsive severity, as well as an inverse trend for Extraversion. Thus, in line with findings in primary OCD, we found higher Neuroticism and to a lesser degree lower Extraversion to be associated with comorbid OCS in schizophrenia. In addition, we found lower Conscientiousness levels in patients with OCS compared to patients without OCS.

Several causal interpretations have been proposed to explain personality-psychopathology associations (Andersen and Bienvenu, 2011, Kotov et al., 2010). The so-called vulnerability hypothesis suggests that personality traits represent a general vulnerability factor, predisposing individuals to develop psychopathology. In line with this hypothesis, we found similar personality-psychopathology associations in the siblings of patients with psychotic disorders, who display an increased familial risk for the co-occurrence of psychotic disorders and OCD (Poyurovsky et al., 2005, Swets et al., 2013). In accordance with the patient group, siblings with OCS showed significantly higher scores on Neuroticism. Also, they showed a trend for lower Extraversion. Similarly, previous studies in un-affected family members, have demonstrated higher levels of Neuroticism with an increasing level of familial risk for OCD (Samuels et al., 2000) and for psychosis (Boyette et al., 2013). In the latter study, siblings also presented with lower Extraversion on a trend level.

A postulate for the vulnerability hypothesis is that risk constellations of personality traits exist prior to onset of illness, and are not caused by illness itself. This would entail that personality traits remain stable independent of changes in psychopathology.

So far only few prospective studies have been performed to investigate this aspect. For one, there is indication for short-time stability of the FFM traits in patients with psychotic disorders irrespective of fluctuations in positive symptoms (Beauchamp et al., 2006, Kentros et al., 1997). Another study evaluated the stability of FFM personality traits in patients with anxiety disorders and revealed relative stability of Neuroticism, Extraversion and Conscientiousness, independent of changes in symptomatology (Karsten et al., 2012). However, no study specifically focused on the associations with primary OCD, let alone with comorbid OCS in patients with psychotic disorders. Therefore, further prospective studies examining higher levels of Neuroticism and lower levels of Extraversion as possible shared risk factors for the co-occurrence of OCS and psychosis are required.

As mentioned, in addition to higher Neuroticism and lower Extraversion, we found significantly lower Conscientiousness in our patient group with co-occurring OCS, and associations with higher OCS severity on a trend level. In accordance, independent from Neuroticism, lower Conscientiousness scores have been described in primary OCD patients and across studies of anxiety disorders (Kotov et al., 2010, Rector et al., 2002, Rector et al., 2005, Samuels et al., 2000, Tackett et al., 2008). These findings led some authors to propose Conscientiousness as an additional contributor to internalizing disorders (Kotov et al., 2010, Tackett et al., 2008). In line with the vulnerability hypothesis, low levels of Conscientiousness have been associated with the inability to modulate impulsive expression, lack of persistence, and sensitivity to challenge, thereby contributing to the development of pathological forms of anxiety (Lonigan et al., 2004). The interpretation of Conscientiousness as an additional contributing factor to the development of psychopathology in general or as a more specific trait–disorder link with internalizing disorders needs further longitudinal investigation.

If we acknowledge that comorbid OCS in patients with psychotic disorders may occur in the context of their premorbid personality, the question of mediating pathways arises. With regard to possible psychological mechanisms, Neuroticism has consistently been linked to both a higher emotional reactivity to stress (Jacobs et al., 2011, Mroczek and Almeida, 2004, Norris et al., 2007, Suls and Martin, 2005) and a tendency for avoidant coping strategies (Carver and Connor-Smith, 2009, Lysaker and Taylor, 2007). In their study on the relationship between FFM personality traits and acute psychopathology, Mirnic et al. found a strong mediating effect of coping strategies on the association between Extraversion and Conscientiousness and psychopathology, while for Neuroticism both direct and indirect relations were found (Mirnic et al.,

2013). Findings of significantly higher levels of avoidant focused coping strategies in schizophrenia patients with comorbid OCS (Lysaker et al., 2006), and associations between avoidant focused coping and high levels of Neuroticism (Lysaker et al., 2003), suggest that a similar pathway may exist in patients with psychotic disorders. Higher Neuroticism and lower Extraversion and Conscientiousness scores might reinforce inadequate coping strategies which in turn facilitate the development and maintenance of comorbid obsessive thinking and compulsive behavior.

In addition, the influence of environmental factors on symptom development and maintenance certainly needs to be acknowledged. Keeping the assumption of possible antipsychotic induced OCS (Mukhopadhyaya et al., 2009, Schirmbeck et al., 2013) in patients with comorbid symptoms in mind, we conducted an exploratory regression analysis including antipsychotic treatment as an additional factor. Results revealed, that apart from Neuroticism, both treatment with clozapine and psychotic symptom severity significantly contributed to the prediction of OCS+ vs. OCS- group affiliation. These findings not only emphasize the need to acknowledge the effect of environmental factors, but also point to possible interrelations between comorbid OCS and psychotic symptoms, as has been reported in cross-sectional designs (Cunill et al., 2009). Although we accounted for the effect of clinical and subclinical positive symptoms by including these variables as covariates, interactions and possible hierarchical patterns (Sturt, 1981) of symptom groups have to be acknowledged and further investigated. Prospective studies are needed to determine the course of co-occurring symptoms and the influential effects of individual and environmental factors. Here, one possible approach could be experience sampling. This approach captures changes in symptoms on a day to day basis, in real life situations. It thereby enables to find explanations for symptom variability and interaction.

Regarding methodological limitations, the rather small group of siblings with co-occurring OCS may have caused a lack of statistical power. Second, we included participants who reported subclinical levels of comorbid obsessive-compulsive severity. In line with studies comparing patient groups with acute, clinically significant OCD to those with subclinical OCS (de Bruijn et al., 2010, Rector et al., 2002), our results might underestimate associations between FFM personality traits and clinical relevant symptom severity. On the other hand focusing on subclinical symptom severity reduces the probability of strong reverse effects of symptom state on the reported FFM levels, strengthening proposed causal pathways.

Because Neuroticism, psychotic symptom severity and treatment with clozapine together only explained 26% of the likelihood to belong to the OCS+ group, further variables, such as stressful life events should be investigated. Furthermore, research should focus on possible mediating factors such as coping mechanisms in order to enhance knowledge on specific pathways between FFM traits and comorbid OCS in patients with psychotic disorders.

4.2

5. CONCLUSION

In line with findings in primary OCD, our results show that personality traits, in particularly Neuroticism and to a lesser degree Extraversion and Conscientiousness are associated with comorbid OCS in patients with psychotic disorders. Findings in siblings support the hypothesis of Neuroticism as a shared vulnerability factor for the co-occurrence of OCS. However, we emphasize that found effects were small to moderate and that the cross-sectional designs precludes causal interpretations. Some critics have also generally questioned the validity of FFM personality traits in studying etiological factors of psychopathology. They urge to clarify the nature of the association between personality and psychopathology in identifying underlying biological mechanisms, such as genetic factors (Ormel et al., 2004b). Recent progress is being made in this direction (Hur, 2009, Ormel et al., 2013). Further studies are certainly needed to clarify shared mechanisms and possible causal contribution of FFM personality traits to psychopathology in general and more specifically to comorbid OCS in psychotic disorders.

Regarding clinical implications, so far the development and investigation of treatment approaches for the often highly impaired comorbid group is insufficient (Schirmbeck and Zink, 2013a). Being aware of patients' basic personality traits and coping styles could facilitate the choice of more adequate therapy strategies and may provide better prediction of treatment outcomes (Bagby et al., 2008).

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