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Research paper

Course and clinical correlates of obsessive-compulsive disorder with or without comorbid personality disorder

Gina M. Belli [a], Clara Law [a], Immanuela C. Obisie-Orlu [a], Jane L. Eisen [c], Steven A. Rasmussen [b], Christina L. Boisseau [a,*]

[a] Department of Psychiatry and Behavioral Sciences, Northwestern University Feinberg School of Medicine, Chicago, IL, USA
[b] Department of Psychiatry and Human Behavior, Brown University Medical School, Providence, RI, USA
[c] Division of Depression and Anxiety Disorders, McLean Hospital, Belmont, MA, USA

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ABSTRACT

Background: Personality disorders (PDs) are often comorbid with obsessive-compulsive disorder (OCD) which may influence symptom presentation and course. This investigation sought to examine the impact of comorbid PDs on clinical presentation and symptom chronicity in a large, prospective longitudinal OCD study.
Methods: Participants ($n = 263$) were treatment-seeking adults with a primary diagnosis of OCD separated into two groups: individuals with and without a co-occurring PD. We conducted two-tailed *t*-tests to compare symptom severity, functioning, and quality of life between the OCD + PD group ($n = 117$) and the OCD w/o PD group ($n = 146$). Chronicity analyses were conducted to compare the amount of time in-episode for OCD and major depressive disorder (MDD) between the two groups.
Results: The OCD + PD group reported greater OCD and depression severity, lower levels of psychosocial functioning and worse quality of life than the OCD w/o PD group. The OCD + PD group exhibited greater OCD and MDD symptom chronicity; over 5 years the OCD + PD group spent 16.2 % weeks longer at full criteria for OCD and three times as many weeks in episode for MDD than the OCD w/o PD group.
Limitations: Focusing on PDs as a group limited our ability to make observations about specific PDs. Further, the participants in our sample were predominantly White and all were treatment seeking which limits the generalizability of our findings.
Conclusions: Our results suggest that those with OCD and comorbid PDs present with greater overall impairment and may require additional considerations during treatment conceptualization and planning.

1. Introduction

Obsessive compulsive disorder (OCD) is a debilitating disorder characterized by intrusive thoughts (obsessions) and repetitive behaviors or mental acts performed to reduce distress (compulsions). OCD is known to have a chronic course; a large, prospective observational study showed that over the course of five years, only about 17 % of individuals with OCD will achieve full remission and those who do will often relapse (Eisen et al., 2013). Personality disorders (PDs) are highly prevalent among individuals with OCD, with estimates ranging from 20 % to 47 % (Sharma et al., 2021; Bulli et al., 2016; Starcevic et al., 2013). Despite high rates of co-occurrence, little empirical work has characterized the impact of comorbid PDs on the clinical presentation of OCD, existing studies focus on the impact on individual PDs (Thamby and Khanna, 2019), and few studies have examined the influence of PDs on course and outcome in OCD.

By definition, PDs are chronic and stable and share a number of negative outcomes. Individuals with PDs report impairment in psychosocial functioning (Nakao et al., 1992; Pinto et al., 2014; Skodol et al., 2005), reduced quality of life (Chen et al., 2006; Cramer et al., 2006), increased suicidal behavior and attempts (Yen et al., 2003), and physical health problems (Chen et al., 2006; Pietrzak et al., 2007). Research suggests that these impairments are even more pronounced in individuals with comorbid OCD. In a large study of 420 patients with OCD, those who met criteria for a PD scored significantly lower on measures of overall functioning (Denys et al., 2004). Furthermore, numerous studies

* Corresponding author at: Department of Psychiatry and Behavioral Sciences, Northwestern University Feinberg School of Medicine, 710 N. Lake Shore Drive Suite 1223, Chicago, IL, USA.
E-mail address: christina.boisseau@northwestern.edu (C.L. Boisseau).

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similarly indicate impairments in global and psychosocial functioning and quality of life in individuals with OCD and a comorbid PD (Bejerot et al., 1998; Coles et al., 2008; Garyfallos et al., 2010; Lochner et al., 2011). Comorbid PDs in OCD have also been shown to negatively impact treatment outcomes, contributing to poorer responses to treatment (Keeley et al., 2008; Thiel et al., 2013) and higher dropout rates (Bulli et al., 2016; AuBuchon and Malatesta, 1994).

Unlike the clear evidence of impairment in overall functioning, findings on the effects of comorbid PDs on OCD symptom severity have been mixed. Matsunaga et al. (1998) found that OCD patients with a comorbid PD had lower levels of global functioning, but similar levels of OCD severity compared to those without a PD. Similarly, Denys et al. (2004) found no differences in OCD symptom severity between outpatients with and without a comorbid PD. In contrast, other studies have demonstrated that comorbidity between OCD and a range of PDs is associated with greater OCD severity (AuBuchon and Malatesta, 1994; Bulli et al., 2016; Lochner et al., 2011). These conflicting findings are representative of broader inconsistencies within the PD literature, which might exist because of methodological variation and constraints within the study of PDs (Dèttore and Pozza, 2014).

Although several studies have examined the relationship between co-occurring PDs and OCD severity, few have examined PDs in the prediction of OCD course. To date, course studies have focused examining specific PDs as predictors of remission or relapse. Of those studies, one investigated the role of obsessive-compulsive personality disorder (OCPD) on OCD course, finding that OCPD predicted relapse following remission (Eisen et al., 2013). A different study showed that, while trending toward significance, worsening borderline personality disorder was not significantly associated with a decreased likelihood of remission from OCD (Keuroghlian et al., 2015). Nevertheless, there has yet to be a comprehensive evaluation of PDs associated with the naturalistic course of OCD in a well characterized OCD sample.

Research examining OCD and comorbid PDs have also evaluated depression severity, finding higher depressive symptom severity in those with comorbid PDs compared to those without comorbid PDs (Matsunaga et al., 1998; Wheaton and Ward, 2020). However, few studies have examined depression and PDs together in OCD. It has been widely reported that major depressive disorder (MDD) frequently co-occurs with both OCD (Ruscio et al., 2010) and PDs (Friborg et al., 2014), which may have implications for the course of MDD in OCD with a comorbid PD. In a study investigating the course of MDD over 24 months, Grilo et al. (2004) found that the presence of comorbid PDs predicted longer times to remission when compared to depression without a PD. Similarly, Gunderson et al. (2014) found that borderline personality disorder and depression interacted to produce worsened effects on the other's time to remission and time to relapse over 10 years. As several studies indicate that individuals with comorbid depression and PDs have worse outcomes (Newton-Howes et al., 2006; Skodol et al., 2011; Zanarini et al., 2019) and that individuals with comorbid depression and OCD also have a more severe course (Marcks et al., 2011), it may be important to investigate whether comorbid PDs may exacerbate depressive course in OCD.

Few studies have examined OCD with comorbid PDs and the ones that have are often limited by unstandardized assessment materials (Fricke et al., 2006) and small sample size (Bulli et al., 2016). Additionally, whereas some studies have examined the effects of comorbid PDs on treatment outcomes of OCD (Keeley et al., 2008; Thiel et al., 2013) and impact of specific PDs on OCD course (Eisen et al., 2013; Keuroghlian et al., 2015) no recent studies have comprehensively investigated the impacts of PDs on the naturalistic course of OCD or MDD over time. The cross-sectional nature of existing studies in addition to the use of unstandardized assessment materials (Fricke et al., 2006) may contribute to the mixed findings regarding OCD symptom severity and comorbid PDs. Given that both PDs and OCD are chronic and often comorbid, it is important to examine them longitudinally in a clinical sample that addresses the limitations of previous studies.

The present study aims to assess whether those with OCD and a co-occurring PD have worse OCD symptom severity, depressive symptom severity, psychosocial functioning, and quality of life than those without a co-occurring PD. Additionally, we sought to explore the impact of comorbid PDs on OCD and depression course in adults with primary OCD. We hypothesized that individuals with OCD and a comorbid PD would report more severe OCD and depressive symptoms and poorer psychosocial functioning and quality of life than those without a PD, as well as a more chronic course over time. This 5-year longitudinal study builds off previous cross-sectional literature in expanding the understanding impact of personality pathology on OCD and depression course.

2. Method

2.1. Participants

Our sample were a subset of adult participants from the Brown Longitudinal Obsessive Compulsive Study (BLOCS), a prospective, longitudinal study of OCD course. The primary outcomes of the study have been published previously (Eisen et al., 2010, 2013; Mancebo et al., 2014). Briefly, inclusion criteria were as follows: 1) primary diagnosis of DSM-IV OCD (defined as the disorder participants considered the biggest problem overall across their lifetime), 2) age 19 or older in the adult sample, and 3) having sought treatment within five years prior to study enrollment. Participants were recruited between July 2001 and February 2006 from multiple psychiatric treatment settings in Rhode Island and Massachusetts including a hospital-based OCD specialty clinic, a private psychiatric hospital inpatient unit, community mental health centers, general outpatient psychiatric practices, and private psychotherapy practices. The Butler Hospital and Brown University Institutional Review Boards approved the study. After providing a written informed consent to participate in annual interviews, participants were interviewed in person by trained clinical interviewers at baseline and were contacted annually for in-person or telephone follow-up interviews.

A total of 325 participants were enrolled in the BLOCS. For this study, participants were included if they had a current diagnosis of OCD at baseline, were evaluated for a PD, completed the measures of interest at intake. Thus, in this study, a total of 263 participants were included in analyses. Participants were separated into two groups: individuals with OCD and a co-occurring PD (OCD + PD, $n = 117$) and individuals with OCD without a co-occurring PD (OCD w/o PD, $n = 146$).

2.2. Measures

Intake diagnoses, demographic characteristics, clinical history, and psychosocial functioning were established at baseline interviews using the Structured Clinical Interview for DSM-IV Axis I Disorders-Patient Edition (SCID-IV; First et al., 1996) and the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First et al., 1997). Current OCD symptoms and severity was assessed using the Yale-Brown Obsessive-Compulsive Scale (YBOCS), a reliable and valid 10-item rater-administered scale (Goodman et al., 1989a, 1989b; Goodman et al., 1989b) and the YBOCS Symptom Checklist. Depression symptoms were measuring using the Modified Hamilton Rating Scale for Depression (MHRSD), a reliable and valid 25-item rater-administered measure (Miller et al., 1985). The MHRSD has specific probes and anchors and has been shown to have good validity in comparison to the original HRSD and the Beck Depression Inventory (Miller et al., 1985). In addition, general functioning was assessed using the Global Assessment of Functioning (GAF) (American Psychiatric Association, 2000) and social and occupational functioning was assessed using the Social and Occupational Functioning Assessment Scale (SOFAS). Quality of life was assessed using the Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q), a reliable and valid 91-item self-report measure (Endicott et al., 1993).

Follow-up interviews were conducted yearly using the Longitudinal Interval Follow-up Evaluation (LIFE), a semi-structured interview designed to assess the course of psychiatric disorders (Keller et al., 1987). Using information obtained through the LIFE, weekly Psychiatric Status Ratings (PSRs) are made to determine whether participants meet DSM-IV criteria for specific Axis I disorders. The six-point OCD and MDD PSR scales indicate whether participants meet full criteria for (at moderate (PSR4), severe (PSR5), or extreme (PSR6) levels of distress and impairment) or are in partial (PSR3) or full remission (PSR2, PSR1). Psychiatric Status Ratings provide a reliable and valid global rating of ongoing disorder severity (Warshaw et al., 1994). Good to excellent interrater and test–retest reliabilities have been established in this sample (Eisen et al., 2010) and in other prospective, longitudinal studies with similar assessment protocols (Warshaw et al., 1994).

2.3. Data analysis

Data analysis was performed using R version 4.0.5 (R Core Team, 2021). Descriptive statistics were used to characterize the sample. Chi-square and two-tailed *t*-tests were used to compare demographics between groups. Two-tailed t-tests were conducted to compare symptom severity, functioning, and quality of life between the OCD + PD group ($n = 117$) and the OCD w/o PD group ($n = 146$). Chronicity analyses were conducted by first summing the total number of weeks each participant met full criteria for OCD or MDD during the 5-year follow-up period and then comparing the mean number of weeks across OCD + PD and OCD w/o PD groups. These analyses required at least one year of follow up data and thus, OCD and MDD course was examined for a total of 177 participants. We ran a multivariate regression model to assess whether the presence of PD among individuals with OCD was a predictor of MDD chronicity when controlling for OCD symptom severity and age of onset. We also ran a multivariate regression model to assess whether the presence of PD among individuals with OCD was a predictor of OCD chronicity when controlling for depressive symptom severity and age of onset.

3. Results

3.1. Participant characteristics

Our sample consisted of a total of 263 participants. The average age of our participants was 39.5 years ($SD = 12.5$). Our participants were predominantly female (56.3 %, $n = 148$), White/Not Hispanic (95.0 %, $n = 250$), and well-educated (two-year college degree or higher) (52.9 %, $n = 139$). There was no significant difference between the OCD + PD and OCD w/o PD group in terms of age, gender, education, and employment ($ps > 0.05$). However, marital status was significantly different between the two groups; those in the OCD + PD group were less likely to be married or partnered than those in the OCD w/o PD group (35.0 % vs. 50.7 %; $X^2(1, n = 261) = 5.90, p < .05$). The OCD + PD group ($M = 16.7$, $SD = 8.1$) had a lower age of major OC symptom interference than the OCD w/o PD group ($M = 19.3$, $SD = 10.4$), $t(260) = 2.2$, $p < .05$. See Table 1 for Demographics.

3.2. Clinical characteristics

Overall, the OCD + PD group reported greater OCD symptom severity and depressive symptom severity compared to the OCD w/o PD group. The OCD + PD group also had lower levels of psychosocial functioning and worse quality of life than the OCD w/o PD group. See Table 2. In the OCD w/o PD group, 74 % were on a serotonin reuptake inhibitor (SRI) at intake and 84 % had received or were currently receiving cognitive-behavioral therapy (CBT). In the OCD w/ PD group, 81 % were on SRI at intake and 50 % had received or were currently receiving CBT.

Table 1
Demographics.

	OCD w/o PD ($n = 146$)	OCD + PD ($n = 117$)
Age in years, *M*(*SD*)	39.5 (13.1)	39.0 (11.8)
Gender, *n* (%)		
Female	84 (57.5 %)	64 (54.7 %)
Male	62 (42.5 %)	54 (45.3 %)
College educated, *n* (%)	79 (54.1 %)	60 (51.3 %)
Employed, *n* (%)	84 (57.5 %)	55 (47 %)
Married/Partnered, *n* (%)	74 (50.7 %)	41 (35.0 %)
Age in years of major OC symptom interference, *M*(*SD*)	19.3 (10.4)	16.7 (8.0)
Comorbid Personality Disorder, *n* (%)		
Obsessive-Compulsive Personality Disorder		79 (67.5 %)
Avoidant Personality Disorder		46 (39.3 %)
Borderline Personality Disorder		21 (17.9 %)
Paranoid Personality Disorder		5 (4.3 %)
Antisocial Personality Disorder		4 (3.4 %)
Schizotypal Personality Disorder		4 (3.4 %)
Dependent Personality Disorder		3 (2.6 %)
Histrionic Personality Disorder		3 (2.6 %)
Schizoid Personality Disorder		2 (1.7 %)
Narcissistic Personality Disorder		1 (0.9 %)

Table 2
Clinical characteristics of OCD participants with and without personality disorders.

	OCD w/o PD (n = 146)		OCD + PD (n = 117)				
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
YBOCS	22.4	5.7	25.0	5.6	−3.8	261	<0.001
MHRSD	9.1	7.5	16.1	10.3	−6.2	256	<0.001
GAF	50.8	9.3	45.0	8.7	5.1	260	<0.001
SOFAS	54.2	11.8	47.0	10.5	4.9	235	<0.001
Q-LES-Q	62.8	15.8	51.4	18.1	5.1	229	<0.001

Note: GAF = Global Assessment of Functioning, MHRSD = Modified Hamilton Rating Scale for Depression, Q-LES-Q = Quality of Life Enjoyment and Satisfaction Questionnaire; SOFAS = Social and Occupational Functioning Assessment Scale, YBOCS = Yale Brown Obsessive Compulsive Scale.

3.3. Symptom chronicity

The OCD + PD group exhibited greater OCD symptom chronicity. Over a 5-year follow-up period, the OCD + PD group spent 16.2 % weeks longer at full criteria for OCD than the OCD w/o PD group (227.5 weeks vs. 185.2 weeks, $t(175) = -3.4$, $p < .001$). Over a 5-year follow up period, the OCD + PD group spent 3 times as many weeks in episode for MDD than the OCD w/o PD group (89.7 weeks vs. 33.1 weeks, $t(175) =$

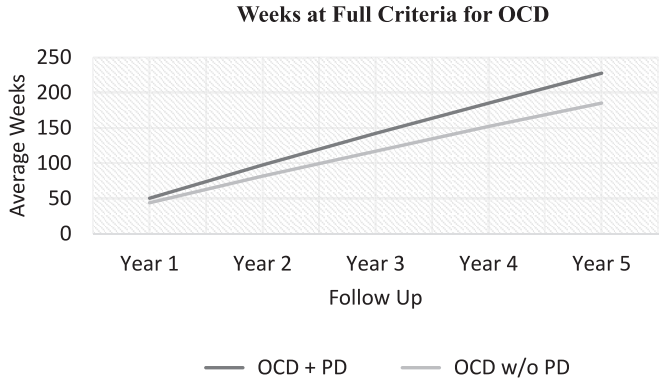

Fig. 1. Group differences in number of cumulative weeks as full criteria for OCD over 5 years of follow-up.

−5.0, $p < .001$). See Figs. 1 and 2. Results from the multivariate regression model predicting MDD chronicity ($F[3, 173] = 10.44$, $p < .001$) suggest that even after controlling for OCD symptom severity and age of onset, the presence of PD among individuals with OCD remained a significant predictor ($\beta = 51.39$, $SE = 11.46$, $p < .0001$). Results from multivariate regression model predicting OCD chronicity ($F[4, 168] = 10.19$, $p < .001$) suggests that even after controlling for depressive symptom severity and age of onset, the presence of PD among individuals with OCD remained a significant predictor ($\beta = 35.37$, $SE = 12.67$, $p < .001$). See Table 3 and Table 4.

4. Discussion

The present study examined differences in clinical presentation and course of individuals with and without comorbid PDs in a prospective, longitudinal OCD study. Our hypothesis that individuals with OCD and PDs would exhibit worse psychological well-being than those without PDs was supported. Consistent with prior studies (AuBuchon and Malatesta, 1994; Cain et al., 2015), our results indicate that individuals with OCD and a co-morbid PD have greater OCD and depression severity, lower psychosocial functioning, and worse quality of life. The core features of PDs (i.e., rigid and maladaptive pervasive patterns of thinking, functioning, and behavior) may exacerbate symptoms, impede global and social functioning, and decrease quality of life in those with OCD. The majority of our participants with comorbid PDs had OCPD or AVPD which are both characterized by restrictive, avoidant behaviors (APA, 2013; Lochner et al., 2011; Marques et al., 2012). Theoretical and empirical work in OCD (Craske et al., 2014; Gruner and Pittenger, 2017; Catapano et al., 2010) and depression (Lewinsohn et al., 1974; Lewinsohn et al., 1986), respectively, have suggested that cognitive and behavioral inflexibility characteristic of these PDs serve to maintain OCD and depressive symptoms.

Our results also indicated that those with comorbid PD and OCD reported greater OCD and depression chronicity. Over the 5-year follow-up period, those with a comorbid PD spent 16.2 % weeks longer at full criteria for OCD and three times as many weeks in episode for MDD than those without a comorbid PD. Coupled with lower functioning and quality of life, this paints a less optimistic picture for those with PDs compared to those without. Although our study design precludes causal interpretations, previous research may provide insight into potential factors underlying these findings. First, several studies have highlighted the role of marital status and quality of social relationships in OCD and depression course. In a 15-year longitudinal study, Marcks et al. (2011) reported that marriage at the time of intake predicted OCD remission, with those who are married being more likely to remit from OCD even when controlling for OCD symptom severity. Similarly, in a study examining MDD over the course of 15 years, never marrying was also a predictor of depression recurrence (Mueller et al., 1999). Marital dysfunction and reduced occurrence of social interactions have also been previous found to predict depression chronicity (Maj, 1994).

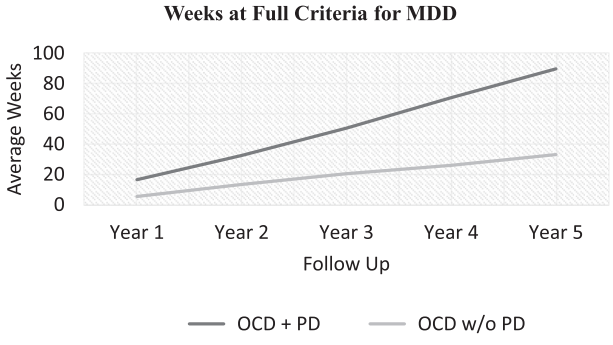

Fig. 2. Group differences in number of cumulative weeks as full criteria for MDD over 5 years of follow-up.

Table 3
Multivariate Model Examining PDs as a Predictor of MDD Chronicity.

Predictors	β	SE	95 % CI[1]	*p*-Value
OCD Symptom Severity	2.13	0.97	0.21–4.06	<0.05
OCD Age of Onset	−0.49	0.61	−1.69–0.71	0.42
Presence of PD	51.39	11.46	28.78–73.01	<0.001

Table 4
Multivariate Model Examining PDs as a Predictor of OCD Chronicity.

Predictors	β	SE	95 % CI[1]	p-Value
OCD Symptom Severity	4.77	1.10	2.60–6.94	<0.001
OCD Age of Onset	−1.60	0.64	−2.86 – −0.34	<0.05
Depressive Severity	−0.79	0.71	−2.20–0.62	0.27
Presence of PD	35.37	12.67	10.34–60.39	<0.01

Moreover, prior research has demonstrated that for those with OCD and MDD, respectively, social support is associated with greater maintenance of treatment gains (Steketee et al., 1999) and remission (Marcks et al., 2011). Thus, it is notable that in this investigation, we found that those with OCD + PDs significantly less to be married or partnered than those in the OCD w/o PDs group and reported lower levels of social functioning. Due to the interpersonal dysfunction prevalent across PDs, a comorbid PD could interfere with these individuals' ability to form stable social relationships or partnerships and increase feelings of disconnection from others. Ultimately, without the protective buffer provided by supportive relationships, individuals with OCD and co-morbid PDs may have increased vulnerability to experiencing the risk factors that contribute to longer OCD and MDD course. This is an important area for future research.

Second, we found that the OCD + PD group reported earlier symptom onset than those without PD. Indeed, those with comorbid PDs reported the presence of clinically impairing symptoms onsetting approximately 2.5 years earlier than those without. Previous research has associated early age of onset with decreased likelihood of OCD remission and a more protracted treatment course (Eisen et al., 2010; Catapano et al., 2006; Sharma et al., 2014). Taken together, these results indicate that the presence of co-morbid PDs may be associated with a more insidious course of OCD, as individuals with co-occurring PDs become impaired earlier, and experience a more chronic course over time. These results highlight the critical importance of early recognition and intervention in individuals with comorbid OCD and PDs to attenuate potentially poorer clinical outcomes.

There are clinical implications for our findings that those with OCD and co-occurring PDs have greater impairments overall and worse diagnostic course. Because of the poorer outcomes associated with OCD and PDs, further research is needed to determine if patients with OCD with comorbid PDs would obtain comparable levels of symptom improvement through OCD treatment or if it is necessary to tailor existing interventions to explicitly address PD symptoms. There is no clear consensus from previous research on the impact of comorbid PDs on OCD treatment outcome (Thiel et al., 2013; Kart and Yucens, 2020). Some studies have found that specific comorbid PDs predict worse treatment outcomes (Ansell et al., 2011; Hansen et al., 2007; Melca et al., 2015; Keeley et al., 2008), whereas others have not supported this finding (Olatunji et al., 2010; Dreessen et al., 1997). Several potential treatment options exist. Cain et al. (2015) suggested augmenting interventions to target the interpersonal profile of specific PDs through a skills-based approach such as increasing perspective taking and capacity to respond to emotion. Another approach could be to utilize existing PD interventions such as Dialectic Behavior Therapy or Radically-Open Dialectic Behavior Therapy to address maladaptive behaviors (O'Connell and Dowling, 2014; Hempel et al., 2018; Lynch et al., 2016). This transdiagnostic approach could be utilized regardless of specific diagnosis and may increase cognitive flexibility, decrease maladaptive

perfectionism, improve emotion regulation, increase distress tolerance, and increase feelings of social connectedness. Improved understanding of the relationship between OCD and PDs would allow treatment to be tailored to the individualized needs of a patient which would maximize the likelihood of symptom improvement.

The limitations of our study should be noted. First, we focused on personality disorders as whole which maximized our ability to investigate the impact of a co-occurring PD more broadly but limited our ability to make any observations about specific PDs. Future research could separate comorbidity by type of PD to investigate any individual differences between diagnoses, which has most recently been explored in Thamby and Khanna, 2019. Additionally, the participants in our sample are predominantly White and all were treatment seeking which limits the generalizability of our findings. Furthermore, because a primary diagnosis of OCD was required for inclusion in our study, our results may not generalize to the larger population with OCD as part of their symptom picture. Our study also has several strengths. As this was a naturalistic study, we were able to capture OCD and PD symptoms over time, enhancing our understanding of the relationship between OCD and PDs beyond prevalence rates. Another major strength is that we had a large sample size with recruitment spanning many settings and levels of care. Our study had participants with varying levels of OCD symptom severity and utilized less stringent exclusion criteria than randomized control trials, making our sample representative of a wider patient population. Our study aimed to accurately capture how OCD, functioning, quality of life, depression, and PD symptoms interact in a real-world clinical sample to lessen the gap between research finding and clinical application.

In summary, this study establishes that individuals with OCD and a co-occurring PD have a more chronic OCD and depression course than those without a co-occurring PD. Additionally, those with OCD and a PD reported worse psychosocial functioning and quality of life, suggesting that individuals with this diagnostic presentation may be at increased risk for higher degrees of impairment and poorer treatment outcomes. These findings contribute to our understanding of specific factors that can complicate the clinical presentation of individuals with OCD and co-occurring PDs. The current findings support the need to prioritize treatment that can help reduce both OCD symptoms and personality disturbances to not only reduce symptom severity but also to improve overall quality of life and psychosocial functioning.

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CRediT authorship contribution statement

Gina M. Belli: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Clara Law:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Immanuela C. Obisie-Orlu:** Conceptualization, Writing – original draft, Writing – review & editing. **Jane L. Eisen:** Investigation, Supervision, Writing – review & editing. **Steven A. Rasmussen:** Funding acquisition, Investigation, Supervision, Writing – review & editing. **Christina L. Boisseau:** Conceptualization, Investigation, Writing – review & editing.

Declaration of competing interest

None.

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